Water Management Plan

Revision 2

United States Environmental Protection Agency
Andrew W. Breidenbach Environmental Research Center and Child Development Center
26 West Martin Luther King Drive
Cincinnati, Ohio 45268

November 14, 2013

Point of Contact:
Andy Franke
513-569-7924

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
ANDREW W. BREIDENBACH ENVIRONMENTAL RESEARCH CENTER AND CHILD DEVELOPMENT CENTER
CINCINNATI, OHIO

WATER MANAGEMENT PLAN, REVISION 2

Approved by:

Richard D. Koch, Director, Facilities Management and Services Division 11/19/13 Date

TABLE OF CONTENTS

Page

1.0 IDENTIFIED WATER CONSERVATION OPPORTUNITIES

A water use and conservation assessment was conducted at the U.S. Environmental Protection Agency's (EPA's) Andrew W. Breidenbach Environmental Research Center (AWBERC) and Child Development Center (CDC) in Cincinnati, Ohio, in May 2013. Under this Water Management Plan, AWBERC and CDC will consider implementing the potential water conservation opportunities identified during the water assessment, which are summarized in Table 1.

The rest of this Water Management Plan describes the facilities' water reduction goals, water use trends, end uses of water, 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 consumption 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® labeled products.

In addition to the potable water use reduction requirements, EO 13514 requires agencies to reduce industrial, landscaping, and agricultural (ILA) water consumption 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 consumption.

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 AWBERC and CDC, so that the facilities can contribute to meeting these Agency-wide objectives.

Table 1. Potential Water Conservation Opportunities, AWBERC and CDC

Suggested Priority	Project Description	Project Cost	Potential Water Savings (gallons)	Potential Energy Savings (MMBtus)	Potential Utility Cost Savings	Potential Payback (years)
AWBERC [a]						
1	Fix steam sterilizer tempering valve for the autoclave in Bay 8. Tempering valve is in place but not working properly. (Completed)	$0	500,000	0	$3,900	Immediate
2	Replace existing 2.5 gallons per minute (gpm) showerheads with 1.5 gpm WaterSense labeled models.	$330	100,000	66	$1,300	<1
3	Replace pre-rinse spray valve in the cafeteria with a 1.0 gpm model.	$80	9,000	8	$100	<1
4	Control flash tank tempering water flow in boiler room by replacing the tempering water sensor so that it only allows tempering water to flow when flash tank is discharging (instead of allowing tempering water to flow continuously). (Completed)	$5,000	800,000	0	$6,200	<1
5	Replace urinals on floors 1 through 4 with 0.125 gallons per flush (gpf) WaterSense labeled models.	$8,000	110,000	0	$900	9
6	Replace toilets on floors 1 through 4, full containment building, and health center with 1.28 gpf models.	$38,000	470,000	0	$3,600	11
7	Recover air handler condensate and use it for cooling tower make-up water.	$75,000	1,000,000	-3.2	$2,100	35
8	Recover used aquatic culture water and use it for green roof irrigation.	$35,000	75,000	-0.2	$700	51
CDC [b]						
1	Replace toilets with 1.28 gpf models.	$7,000	90,000	0	$900	8

[a] Utility cost savings are calculated using the most current water and sewer rates available. Water and sewer service is provided by Greater Cincinnati Water Works. Beginning in January 2013, the incremental water rate applicable to the main building is $2.15 per 1,000 gallons. The incremental water rate applicable to Annex 2 is $2.42 per 1,000 gallons. The incremental sewer rate applicable to the main building is $5.59 per 1,000 gallons. The incremental sewer rate applicable to Annex 2 is $6.99 per 1,000 gallons. For projects with potential increased or decreased energy use, current energy rates of $7.09 per thousand cubic feet (Mcf) and $0.080 per kilowatt-hour (kWh) were used depending upon the resource involved.

[b] Beginning January 2013, the incremental water rate applicable to CDC is $3.05 per 1,000 gallons. The incremental sewer rate applicable to CDC is $6.99 per 1,000 gallons.

3.0 FACILITY INFORMATION

AWBERC is located on 22 acres donated by the City of Cincinnati, adjacent to the University of Cincinnati's main campus and near a major hospital and medical research complex. The 10-story facility opened in 1976 and is owned and operated by EPA.

Internationally recognized for water research, AWBERC has also become a leader in bioremediation, pollution prevention, and superfund research. At AWBERC, EPA also provides public education and training on the environment and emergency response. AWBERC is one of two major EPA research centers in the United States, and houses state-of-the-art research laboratories, training facilities, and administrative offices.

AWBERC contains laboratory spaces equipped for chemistry and biology research, including animal containment rooms and an aquatic culture unit. Laboratory spaces are interspersed with office and general use space throughout the building. A one-story full containment laboratory is located adjacent to the main building, on the north side. A three-story research support annex (i.e., Annex 1) was added to the northwest corner of the main building and occupied in September 2004. Annex 1 was built to provide additional office space and allowed some of the space in the main building to be converted from offices to research laboratories.

EPA added another research support annex (i.e., Annex 2). The north wing of Annex 2 was completed and occupied in September 2007, and the west wing was completed and occupied in January 2008. Annex 2 has received the U.S. Green Building Council's Leadership in Energy and Environmental Design (LEED®) Gold-level certification for new construction. At the time of the water assessment, half of Annex 2 was being used as permanent office space for AWBERC staff, and the other half was serving as temporary "swing space" during a major Infrastructure Replacement Project (IRP). The IRP is a multi-year, multi-phase, multi-million-dollar project that will replace all of the air handling units, vertical and horizontal supply ductwork, control systems, exhaust systems, and associated equipment at AWBERC.

Also located on the AWBERC campus is CDC, built in the late 1980s to provide childcare and education for young children of EPA employees at the AWBERC facility. CDC has several classrooms and an outdoor playground.

The main building, containment laboratory, and annex buildings contain 430,447 square feet of conditioned space. The CDC contains 5,904 square feet of conditioned space.

AWBERC's main building and Annex 1 are occupied by 668 employees, while 126 employees work in Annex 2. CDC is occupied by 16 adults and 47 children. The facility operates on a flex time schedule and is typically occupied Monday through Friday between the hours of 6 a.m. and 6 p.m.

4.0 WATER MANAGEMENT GOALS

AWBERC and CDC achieve its resource conservation goals by implementing a facility-specific Environmental Management System (EMS) program. Within the EMS and otherwise, AWBERC and CDC'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 SPFB).

- Work with SFPB to implement water efficiency and water conservation projects in Phase 5 of the IRP.

5.0 WATER USE INFORMATION

AWBERC and CDC's water use has decreased since the last water assessment in 2009. Both facilities have implemented suggested water-saving projects from the last Water Management Plan. AWBERC's IRP has also helped decrease facility water use.

AWBERC uses city-supplied potable water for cooling tower make-up, research, sanitary needs, boiler make-up and tempering, and other uses. CDC uses city-supplied potable water for sanitary uses and light dishwashing. The following sections provide additional details on these facilities' water use.

5.1 Water Supply

AWBERC and CDC's potable water and sewer service is provided by Greater Cincinnati Water Works. AWBERC and CDC do not use any sources of non-potable water. All discussion of water use in this Plan refers to potable, city-supplied use.

5.2 Meters and Submeters

Incoming city water supply is metered. Flow totalizing meters are also installed on many of the major subsystem flows. An inventory of metered flows is provided below:

- City water supply to main AWBERC building
- City water supply to Annex 2
- City water supply to CDC
- Cooling tower make-up
- Boiler make-up
- Emergency generator cooling

Flow totalizer readings are recorded monthly and reported to the facilities management staff. 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, AWBERC set a FY 2007 potable water use intensity baseline of 61.76 gallons per gsf. In FY 2012, water use intensity had decreased to 54.94 gallons per gsf—an 11.0 percent reduction compared to the FY 2007 baseline. Since the last water assessment conducted at AWBERC in 2009, AWBERC completed several projects to contribute to this reduction, including:

- Installing water conservation kits on steam sterilizers to ensure tempering water is only flowing when condensate is being discharged

- Replacing a potable-water-cooled ice machine with a model that uses process water for cooling
- Replacing a wet vacuum pump system with a dry system
- Replacing approximately half of the facility's inefficient toilets and urinals with high-efficiency models

CDC also significantly reduced its water use. Its FY 2007 potable water use intensity baseline was 31.49 gallons per gsf. By the end of FY 2012, its water use intensity had decreased by 41.9 percent to 18.31 gallons per gsf. CDC replaced its inefficient clothes washer with an ENERGY STAR® qualified model and installed 0.5 gpm faucet aerators throughout the facility to contribute to this savings.

Figure 1 illustrates AWBERC's potable water use intensity from FY 2007 to FY 2012. Figure 2 provides a graph of AWBERC's monthly water use in FY 2012, which illustrates AWBERC's seasonal water use pattern that can be attributed to high cooling tower make-up water use in the summer months. Figure 3 illustrates CDC's potable water use intensity from FY 2007 to FY 2012. A monthly water use graph is not provided because CDC's water use is billed quarterly instead of monthly.

Figure 1. Annual Water Use Intensity, AWBERC, FY 2007–FY 2012

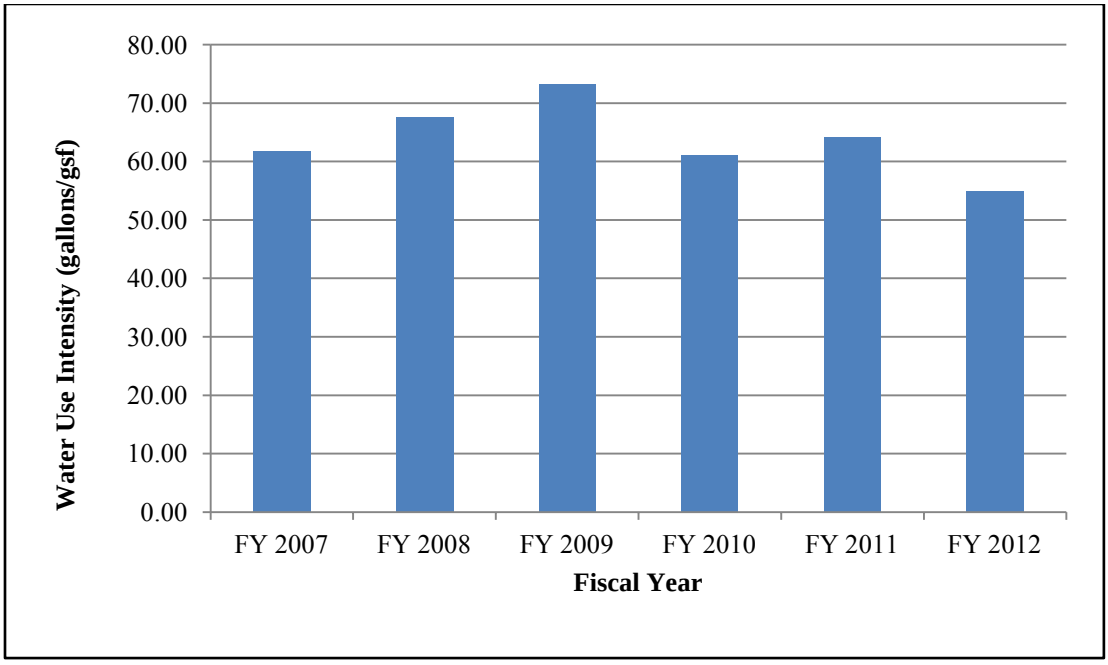


Figure 2. Monthly Water Use, AWBERC, FY 2012

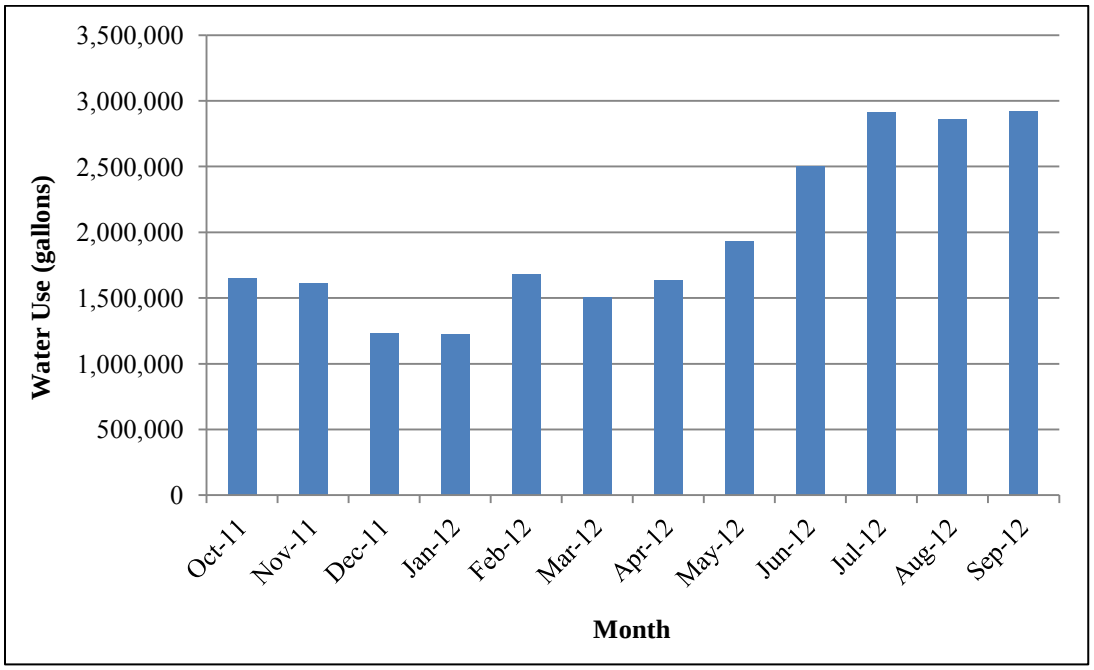
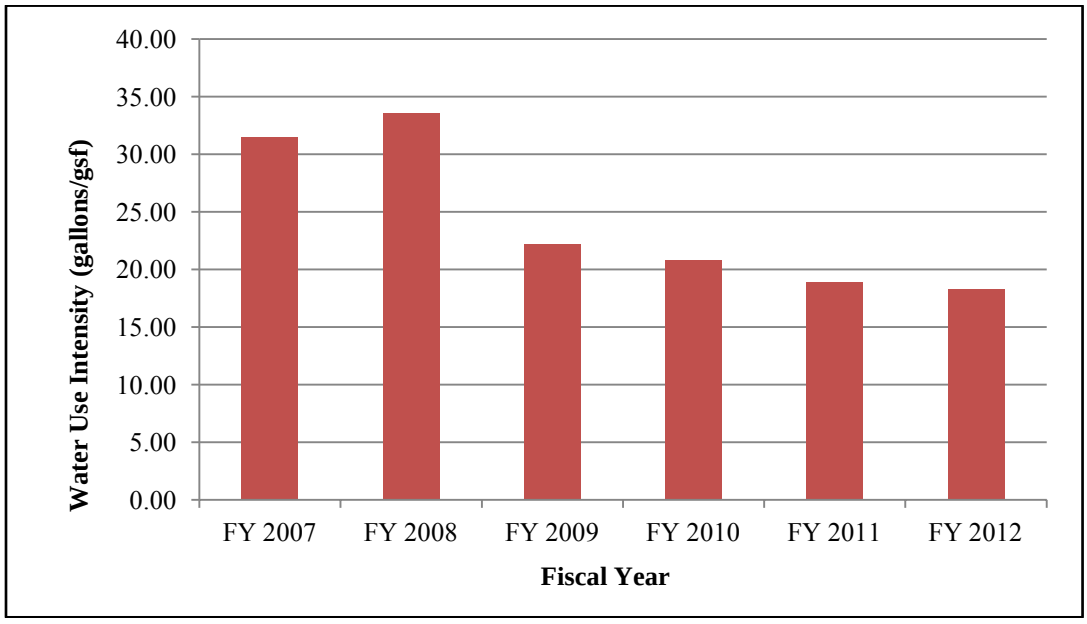


Figure 3. Annual Water Use Intensity, CDC, FY 2007–FY 2012



5.4 End Uses of Water

Table 2 and Figure 4 provide the end uses of water at AWBERC. Table 3 and Figure 5 provide the end uses of water at CDC. The uses are described in more detail below. Potential projects discussed in this section are summarized in Table 1.

Table 2. Major Water Uses, AWBERC, FY 2012

Major Process	FY 2012 Annual Consumption (gallons)	Percent of Total Water Use (%)	Estimated Utility Costs[a]	Supporting Calculations and Source Documentation
Cooling Tower	10,929,103	46.2	$23,500	Determined from FY 2012 monthly meter readings.
Aquatic Culture Water	2,938,983	12.4	$22,700	Determined from December 2007 and December 2008 meter readings.
Miscellaneous Laboratory and Other Uses	2,775,500	11.7	$21,500	Calculated by difference from the FY 2012 total water use and the other estimated uses.
Main Building and Annex 1 Sanitary	2,000,000	8.5	$15,500	Engineering estimate assuming sanitary fixture use is approximately 12 gallons per person per day based on fixture types installed in the main building. There are approximately 668 employees working in the main building and Annex 1 and 250 working days per year. = 12 gallons/person/day x 668 people x 250 days/year = 2,004,000 gallons/year
Boiler Make-Up	1,840,985	7.8	$14,200	Determined based on meter readings taken from FY 2012 logbooks.
Boiler Flash Tank Tempering	1,600,000	6.8	$12,400	Engineering estimate based on visual assessment that approximately 3 gpm was flowing to drain continuously. = 3 gpm x 60 minutes/day x 24 hours/day x 365 days/year = 1,576,800 gallons/year
Steam Sterilizer Tempering	500,000	2.1	$3,900	Engineering estimate based on visual assessment that one sterilizer had constant tempering water flow of 1 gpm. = 1 gpm/sterilizer x 1 sterilizer x 60 minutes/hour x 24 hours/day x 365 days/year = 525,600 gallons/year
Domestic Cold Water Booster Pump Cooling	260,000	1.1	$2,000	Engineering estimate that assumes 0.5 gpm of cooling water was flowing continuously. Although this is included in the FY 2012 water balance, the water-cooled pumps were removed in June 2013. = 0.5 gpm x 60 minutes/hour x 24 hours/day x 365 days/year = 262,800 gallons/year

Table 2. Major Water Uses, AWBERC, FY 2012

Major Process	FY 2012 Annual Consumption (gallons)	Percent of Total Water Use (%)	Estimated Utility Costs[a]	Supporting Calculations and Source Documentation
Annex 2 Sanitary	206,051	0.9	$1,900	Determined from FY 2012 meter readings for Annex 2. It is assumed all water consumption in Annex 2 is from sanitary use. Annex 2's water use is expected to increase in FY 2013 due to the addition of a green roof irrigation system.
Cafeteria Pre-Rinse Spray Valve (PRSV) and Dishwashing	170,000	0.7	$1,300	Engineering estimate based on equipment information and assumptions. In the cafeteria, there is one 1.6 gpm PRSV used for dishwashing. Cafeteria employees estimated that the PRSV is used for approximately 1.0 hour per day. This is confirmed by an estimate from EPA's WaterSense program, which states PRSVs used for dishwashing are used for 64 minutes/day. 250 working days per year are assumed. PRSV water use= 1.6 gpm x 60 minutes/hour x 1 hour/day x 250 days/year = 24,000 gallons/year In addition, there was a single-tank, conveyor-type dishwasher in the cafeteria (Hobart Model# CLPS66e), which uses about 126 gallons per hour based on product information from the manufacturer. The cafeteria staff estimated that the dishwasher is run for 4.5 hours per day (2.0 hours after breakfast and 2.5 hours after lunch). Dishwasher water use = 126 gallons/hour x 4.5 hours/day x 250 days/year = 141,750 gallons/year Therefore, the total water use for dishwashing = 24,000 gallons/year + 141,750 gallons/year = 165,750 gallons/year

Table 2. Major Water Uses, AWBERC, FY 2012

Major Process	FY 2012 Annual Consumption (gallons)	Percent of Total Water Use (%)	Estimated Utility Costs[a]	Supporting Calculations and Source Documentation
Reverse Osmosis (RO) Permeate Water	130,000	0.5	$1,000	Engineering estimate based on a tracking sheet located at the RO system. The RO system had run for 32 hours in May 2013, with permeate water flowing at 5.5 gpm. = 5.5 gpm x 60 minutes/hour x 32 hours/month x 12 months/year = 126,720 gallons/year
Laboratory Wastewater Kill Tank Discharge Tempering	120,000	0.5	$900	Engineering estimate based on discussions with the mechanic that runs the kill tank. The kill tank is run two to three times per week for 1.5 hours. It flows at 10 gpm. = 10 gpm x 60 minutes/hour x 1.5 hours/run x 2.5 runs/week x 52 weeks/year = 117,000 gallons/year
Vivarium Operations: Rack Washer	57,000	0.2	$400	Engineering estimate based on data from scientists; the rack washer uses approximately 1,100 gallons per week and is used for 52 weeks per year. = 1,100 gallons/week x 52 weeks/year = 57,200 gallons/year
RO Reject Water	48,000	0.2	$400	Engineering estimate based on a tracking sheet located at the RO system. The RO system had run for 32 hours in May 2013, with reject water flowing at 2.1gpm. = 2.1 gpm x 60 minutes/hour x 32 hours/month x 12 months/year = 48,384 gallons/year
Emergency Generator Cooling	27,087	0.1	$200	Determined from February 2008 and December 2008 meter readings and projected out to annual use.
Vivarium Operations: Room Wash Down	20,000	0.1	$200	Engineering estimate assuming animal wash down occurs for 1 hour every other work day. The spray flows at 2 gpm, and there are 250 working days per year. = 2 gpm x 60 minutes/hour x 1 hour/day x 130 days/year = 15,600 gallons/year

Table 2. Major Water Uses, AWBERC, FY 2012

Major Process	FY 2012 Annual Consumption (gallons)	Percent of Total Water Use (%)	Estimated Utility Costs[a]	Supporting Calculations and Source Documentation
Vivarium Operations: Bottle Washer	19,000	0.1	$100	Engineering estimate based on data from scientists; the bottle washer uses approximately 360 gallons per week and is used for 52 weeks per year. = 360 gallons/week x 52 weeks/year = 18,720 gallons/year
Vivarium Operations: Tunnel Washer	5,000	0.0	$40	Engineering estimate based on data from scientists; the tunnel washer uses approximately 100 gallons per week and is used for 52 weeks per year. = 100 gallons/week x 52 weeks/year = 5,200 gallons/year
Total Water Use	**23,646,709**	**100.0**		**FY 2012 total water use**

[a] Utility costs are calculated using the most current water and sewer rates available. Water and sewer service is provided by Greater Cincinnati Water Works. Beginning January 2013, the incremental water rate applicable to the main building is $2.15 per 1,000 gallons. The incremental water rate applicable to Annex 2 is $2.42 per 1,000 gallons. The incremental sewer rate applicable to the main building is $5.59 per 1,000 gallons. The incremental sewer rate applicable to Annex 2 is $6.99 per 1,000 gallons.

Figure 4. Percentage of Water End Uses, AWBERC, FY 2012

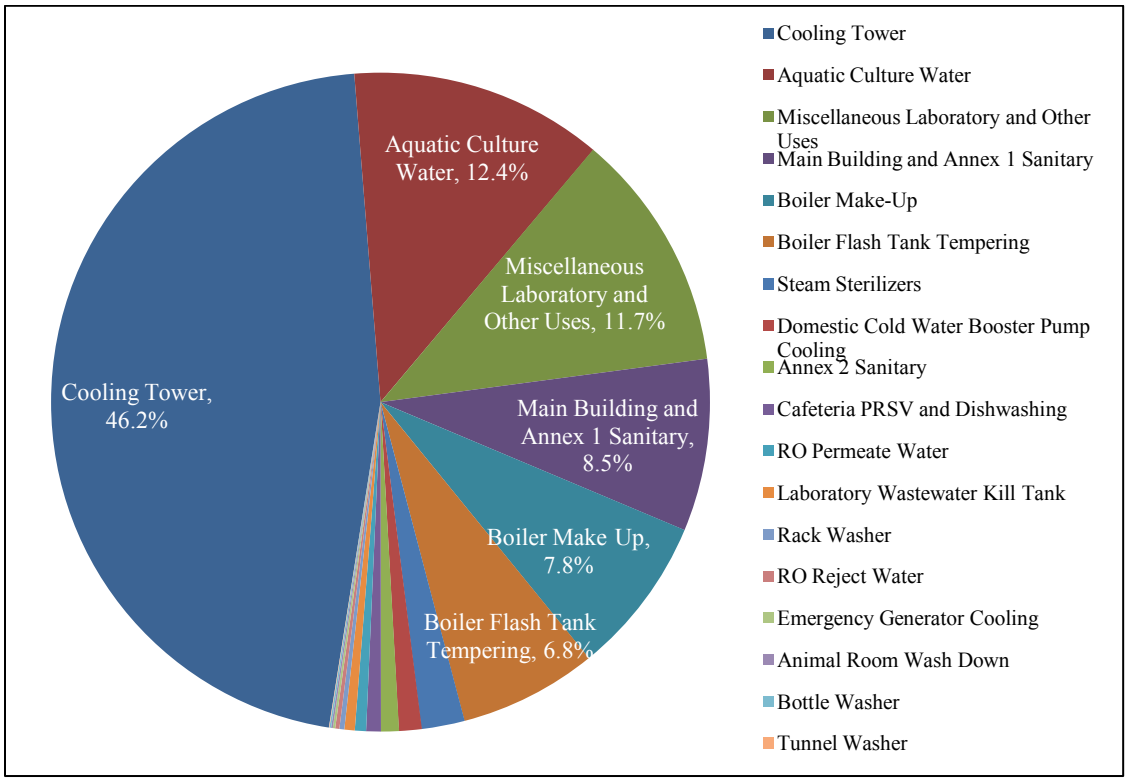
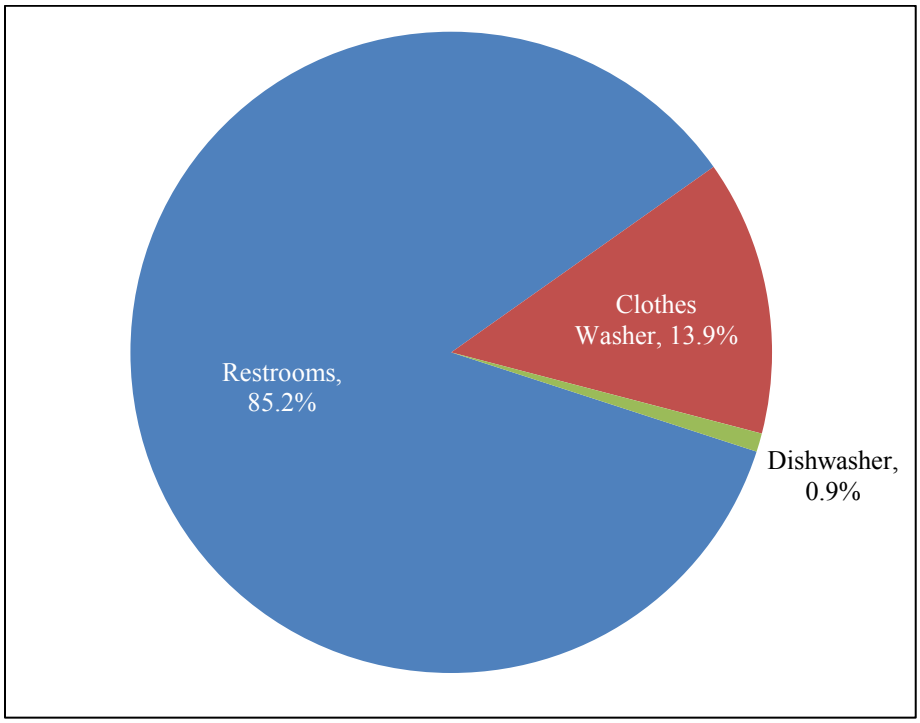


Table 3. Major Water Uses, CDC, FY 2012

Major Process	FY 2012 Annual Consumption (gallons)	Percent of Total Water Use (%)	Estimated Utility Costs [a]	Supporting Calculations and Source Documentation
Restrooms	92,094	85.2	$900	Calculated by difference from the FY 2012 total water use and the other estimated uses.
Clothes Washer	15,000	13.9	$200	Engineering estimate based on 12 gallons per load (estimated from specific model information), 5 loads/day (estimated by CDC staff members), and 250 working days per year. = 12 gallons/load x 5 loads/day x 250 days/year = 15,000 gallons/year
Dishwasher	1,000	0.9	$10	Engineering estimate based on 4 gallons per cycle (estimated from ENERGY STAR), 1 cycle per day (assumed), and 250 working days per year. = 4 gallons/cycle x 1 cycle/day x 250 days/year = 1,000 gallons/year
Total Water Use	**108,094**	**100.0**		**FY 2012 total water use**

[a] Utility costs are calculated using the most current water and sewer rates available. Water and sewer service is provided by Greater Cincinnati Water Works. Beginning January 2013, the incremental water rate applicable to CDC is $3.05 per 1,000 gallons. The incremental sewer rate applicable to CDC is $6.99 per 1,000 gallons.

Figure 5. Percentage of Water End Uses, CDC, FY 2012



Cooling Tower

The largest end use of water at AWBERC is its cooling tower, which uses 46.2 percent of its annual total. The 5,000-ton unit provides condenser water cooling for the building chillers and some ancillary equipment. The tower remains in service all year; however, there is only a very limited cooling load in the winter months.

A cooling tower system quality and performance review is conducted every two weeks by a service contractor. A conductivity meter is used to automatically control cooling tower blowdown. The blowdown controller is set to achieve approximately four to five cycles of concentration within the cooling tower, maintaining a set point of 1,550 microSiemens per centimeter (µS/cm). Chemical treatment is provided to control scale and corrosion.

To reduce potable make-up water to the cooling tower, AWBERC could consider capturing air handler condensate from its air handling units and using it as make-up water to the cooling tower. Air handler condensate is generated in the hot, humid months when the cooling tower has the highest demand, so the project has a matched source and end use. Implementing this project could save AWBERC more than 1 million gallons in potable water use per year. However, considering the layout and configuration of the potential condensate capture equipment and piping, this project does not appear to be cost effective at this time.

Aquatic Culture Water and Miscellaneous Laboratory Use

The second and third largest water uses at AWBERC are for aquatic culturing and other laboratory and research uses. These water uses are critical to AWBERC's mission.

Approximately 4 to 5 gallons per minute of city water is conditioned and used as water supply an aquatic culture system. The water flow rate to each tank is calibrated monthly and controlled to minimize water use, while maintaining the required level of water exchanges per hour and dissolved oxygen in each tank. Water is also used as necessary in individual laboratories for bench scale experimentation and glassware preparation.

Sanitary Fixtures

Sanitary fixtures are a major water end use at AWBERC and CDC. Since about half of AWBERC's restrooms have been upgraded as a result of the IRP, about half of its restroom fixtures exceed the water efficiency requirements in the Energy Policy Act (EPAct) of 1992, which requires that facilities install 1.6 gallons per flush (gpf) toilets and 1.0 gpf urinals. Toilets and urinals in the basement, on the ground floor, and on floors 5, 6, and 7 have been replaced with dual-flush toilets offering 1.1 and 1.6 gpf flushing options and 0.125 gpf urinals. Fixtures in Annex 2 are also water-efficient. AWBERC should continue upgrading the remaining restrooms on floors 1 through 4 so that all fixtures are efficient. CDC should also consider upgrading its toilets which are not EPAct-complaint.

AWBERC and CDC's faucet fixtures are water-efficient, flowing at 0.5 gpm. 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.

AWBERC's showerheads are compliant with the EPAct requirement of 2.5 gpm. To reduce water use in the restrooms, AWBERC could replace its existing showerheads with 1.5 gpm WaterSense labeled showerheads. Table 4 provides an inventory of sanitary fixtures.

Table 4. Sanitary Fixtures Inventory, AWBERC and CDC

Fixture	Flow Rate	Main Lab and Annex 1	Annex 2	CDC
Toilets	3.5 gpf	38	0	7
	Dual flush: 1.6/1.1 gpf	37	11	0
Urinals	1.5 gpf	8	0	0
	0.125 gpf	13	0	0
Lavatory Faucets	0.5 gpm	73	11	5
Showerheads	2.5 gpm	11	0	0

In addition to the restroom fixtures located throughout AWBERC and CDC, CDC has one clothes washer used to clean approximately five loads of laundry a day, five days per week. In September 2011, CDC replaced its old, inefficient clothes washer with an ENERGY STAR qualified model (Electrolux model E1FLW55H1W0). The new clothes washer uses approximately 12 gallons of water per load (instead of 40 gallons of water per load used by its previous clothes washer).

Steam Boiler

Two main steam boilers [45,000 pounds per hour (lbs/hr) each] and one summer boiler (8,700 lbs/hr) are used to generate steam for building heating hot water and domestic hot water. The boiler water system is monitored and maintained every two weeks under a service contract to prevent system scale and corrosion and to optimize condensate reuse. Boiler water quality parameters such as sulfite, hardness, conductivity, alkalinity, pH, and iron are monitored and controlled though periodic testing and chemical treatment provided by the service contractor. System components are visually inspected, and water chemistry is read several times each day by the boiler operator. Approximately 80 to 85 percent of steam condensate is sent to a condensate receiver and pumped to a surge tank. Make-up water is softened and then blended with the recovered condensate. The blended water is returned to the boiler system.

Tempering Water

AWBERC has several uses of tempering water—water used to reduce the temperature of hot water discharge which must go to drain. Some tempering water systems, when not controlled, flow continuously, sending cool water to drain regardless of whether there is hot discharge. To save water, tempering water systems can be controlled with a thermostatically-actuated solenoid valve that only allows tempering water to flow when hot water is being discharged.

At AWBERC, hot boiler blowdown is sent to a flash tank prior to discharge to the sewer. Tempering water is introduced into the flash tank to cool the discharge. The tempering water is controlled with a temperature sensor, which should sense when hot discharge is passing to the drain and turn on the tempering water as needed. During the May 2013 water assessment, it was observed that the tempering water was flowing all the time at approximately 3 gpm. To save water, AWBERC will repair or replace the temperature sensor and/or control valve so that the tempering water only flows when blowdown is occurring. Following the replacement, AWBERC will implement routine inspection and maintenance of the temperature-activated tempering water flow to ensure that the tempering water only flows when necessary.

Laboratory wastewater that has the potential to be biologically active is collected and treated in a 500-gallon kill tank prior to discharge. The temperature in the kill tank is raised to 270°F to treat the wastewater. After treatment, the tank contents are cooled to 160°F with potable water prior to discharge. Tempering water doesn't flow continuously; it only runs when the kill tank is in use. The kill tank is operated manually as needed.

In addition, AWBERC is equipped with eight steam sterilizers, listed in Table 5. In FY 2009, AWBERC installed water conservation retrofit kits on the steam sterilizers so that tempering water would only flow when needed. One unit's kit on the steam sterilizer in Bay 8 may have malfunctioned, because it still has a continuous flow of tempering water to drain, estimated to be 1 gpm. To save water, AWBERC should fix the tempering valve on the unit in Bay 8 so that tempering water only flows when needed.

Table 5. AWBERC Steam Sterilizers

Location	Model	Continuous Tempering Water Flow?
3rd Floor, Equipment Bay 1	Amsco 3041	No, only when needed
3rd Floor, Equipment Bay 7	Amsco 3021	No, only when needed
3rd Floor, Equipment Bay 8	Amsco 3021	Yes, at 1.0 gpm
3rd Floor, Equipment Bay 9	Steris/Amsco Century SV-120	No, only when needed
3rd Floor, Equipment Bay 10	Amsco Stage 2	No, only when needed
7th Floor Prep Room	Amsco Eagle SV-3043	Out of service during IRP construction
7th Floor Prep Room	Amsco 3021	Out of service during IRP construction

Single-Pass Cooling

Single-pass cooling is used to cool the emergency generator. Cooling water is only applied when the generator is in use. Since it is used infrequently, this water use makes up less than 1 percent of AWBERC's total.

In FY 2012, single-pass cooling was still used to cool the cold water booster pump, which maintained pressure on the domestic cold water supply system. In June 2013, the water-cooled pumps were replaced with pumps that do not require supplemental cooling. This project should reduce AWBERC's water use by approximately 1 percent.

Kitchen Equipment

A full-service cafeteria in the main building serves approximately 400 to 450 meals per day. Tableware is washed in a tunnel washer that is not ENERGY STAR qualified. Prior to placing dishes in the tunnel washer, they are rinsed with a PRSV that complies with EPAct 2005 requirements, flowing at 1.6 gpm or less. Pots and other large items are washed in three large pot washing sinks. The kitchen is also equipped with a food preparation sink and two dishwashing sinks. An ENERGY STAR qualified steam cooker is used for food preparation. A water-cooled ice machine is cooled using process chilled water instead of potable water.

To save water in the kitchen, AWBERC could replace its PRSV with a model rated at 1.0 gpm. In September 2013, WaterSense is issuing a specification to label high-efficiency PRSVs, so AWBERC could consider purchasing a WaterSense labeled model after that time.

CDC is equipped with a kitchen used to prepare snacks. Water-using equipment includes an automatic ENERGY STAR qualified dishwasher and pot-washing sinks.

Reverse Osmosis

Purified water is generated for laboratory research by reverse osmosis (RO). The RO reject water is discharged to the drain. The RO system is equipped with instantaneous flow meters. The system run time is recorded periodically by the system operator. Feed water to the system is tempered to 88°F because this is the optimal temperature for the membranes to produce water most efficiently. For each gallon of permeate water that is produced, 0.38 gallons of reject water

is sent to drain. Since more permeate is produced than water is rejected, the RO system is considered to be efficient.

Vivarium Equipment

AWBERC is equipped with a rack, bottle, and tunnel washer used to clean vivarium equipme The bottle and rack washers operate in batch mode and have wash, rinse, and final rinse cycle They are set up to reuse final rinse water as wash water for the next batch, saving approximat 38,000 gallons of water annually.

In addition, the animal containment room is equipped with a wash-down system to clean the room as needed. Wash down occurs for about one hour every other work day.

Irrigation

In FY 2012, AWBERC didn't use any water for irrigation. However, an irrigation system was installed in FY 2013 to water plants on the green roof on Annex 2. Although not accounted fo the water balance in Table 2, in FY 2013, irrigation could account for 75,000 gallons of water more. Multi-spray, multi-trajectory sprinkler heads that can uniformly distribute water were installed to irrigate the green roof. The irrigation controller is equipped with a rain sensor to ensure that irrigation isn't occurring during rain events. The irrigation system is programmed run two or three days a week during the summer months only (e.g., mid-April through mid-September). Although the irrigation system was installed and programmed appropriately with water conservation in mind, AWBERC could consider reusing using aquatic culture water as green roof irrigation water to eliminate the need for potable water use. Installing a system is costly, though, and may not be cost effective considering that the system accounts for less tha percent of AWBERC's total water use.

6.0 DROUGHT CONTINGENCY PLAN

The City of Cincinnati does not have a water management plan specifically for droughts. However, as conditions warrant, AWBERC and CDC are prepared to follow the water use recommendations and restrictions outlined under the State of Ohio Emergency Operations Pla (EOP), updated in May 2013. Within the EOP, the Drought Incident Annex provides a systematic means for the State of Ohio to assess and respond to a drought. The EOP and the Drought Incident Annex can be found at: http://ema.ohio.gov/EOP_Detail.aspx.