

# Water Management Plan

Revision 1

U.S. Environmental Protection Agency  
National Health and Environmental Effects Research Laboratory  
Atlantic Ecology Division  
27 Tarzwell Drive  
Narragansett, Rhode Island 02882



June 9, 2010

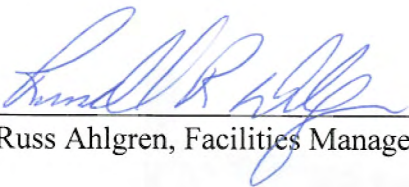
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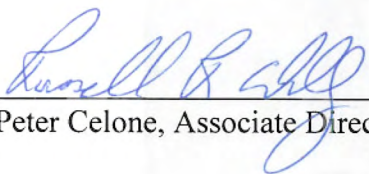


U.S. ENVIRONMENTAL PROTECTION AGENCY  
NATIONAL HEALTH AND ENVIRONMENTAL RESEARCH LABORATORY  
ATLANTIC ECOLOGY DIVISION

WATER MANAGEMENT PLAN

Approved by:

 6/9/2010  
\_\_\_\_\_  
Russ Ahlgren, Facilities Manager Date

 ACTING 6/9/2010  
\_\_\_\_\_  
Peter Celone, Associate Director for Program Operations Date

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## **1.0 EPA'S STATEMENT OF PRINCIPLES ON EFFICIENT WATER USE**

To meet the needs of existing and future populations and ensure that habitats and ecosystems are protected, the nation's water resources must be sustainable and renewable. Sound water resource management, which emphasizes wise, efficient use of water, is essential to achieve these objectives.

Efficient water use can have major environmental, public health, and economic benefits by helping to improve water quality, maintain aquatic ecosystems, and protect drinking water resources. As the country faces increasing risks to ecosystems and their biological integrity, the inextricable link between water quality and water quantity becomes more important. Water efficiency is one way of addressing water quality and quantity goals. The efficient use of water can prevent pollution by reducing wastewater flows, recycling process water, reclaiming wastewater, and using less energy. As municipalities and regions deal with chronic drinking water shortages due to drought and changes in climate patterns, water conservation becomes even more important to EPA's mission.

EPA recognizes that regional, state, and local differences exist regarding water quality, quantity, and use. Differences in climate, geography, and local requirements influence the water efficiency programs applicable to specific facilities. Therefore, EPA is establishing facility-specific Water Management Plans to promote the efficient use of water and meet the water conservation requirements under Executive Order (EO) 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, and EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*.

This Water Management Plan has been established to document and promote the efficient use of water at the National Health and Environmental Effects Research Laboratory, Atlantic Ecology Division (AED) Facility in Narragansett, Rhode Island. The plan is organized according to the Federal Energy Management Program (FEMP) Facility Water Management Planning Guidelines.

## **2.0 FACILITY DESCRIPTION**

AED is a state-of-the-art aquatic research facility under EPA's Office of Research and Development (ORD). The mission of AED is to develop and evaluate theory, methods, and data to better understand and quantify the environmental effects of stressors on the coastal waters and watershed of the Atlantic Seaboard.

AED is located approximately 30 miles south of Providence, Rhode Island, on an 11-acre site overlooking the West Passage of Narragansett Bay. The surrounding area is predominantly rural or residential in character. Adjacent to AED is the 165-acre Narragansett Bay Campus housing the University of Rhode Island's (URI's) Graduate School of Oceanography, the Coastal Institute, the Marine Resources Center, the Rhode Island Nuclear Science Center; and the National Oceanic and Atmospheric Administration's (NOAA's) National Marine Fisheries Service's Narragansett Laboratory. AED's 13 buildings provide 89,922 square feet for research and research support activities.

The AED facility is owned and operated by EPA. The majority of the space (approximately 66,000 square feet) is contained in a main laboratory/office building complex that houses the

reception area, administrative support and scientific staff office space, conference rooms, dry and wet-laboratory space, sea water tempering equipment, and space for the storage of scientific samples. Other structures include the support services building, containing various workshops, field operations spaces, and boat storage; a pier and associated pump house that provides sea water to the laboratory; and the hazardous materials building containing segregated waste and chemical supplies. Additional activities take place in various small external structures such as the pollutant abatement building, walk-in cold storage, and a greenhouse.

The Laboratory provides research support to EPA program offices and regions in areas related to the protection of coastal marine ecosystems. Areas of research specialization include: understanding, quantifying, and modeling the cumulative effects of multiple anthropogenic stressors on coastal ecosystems; development of methods for assessing the ecological effects of contaminated marine sediments; development of species, population, and community-level indicators of ecological impacts resulting from anthropogenic activities; and place-based integrated ecological assessments for the Atlantic Coast.

AED has two marine wet laboratory facilities. The original wet laboratory, which is the smaller of the two, contains two microcosm rooms, one marine algae culture chamber, 10 wet tables, and office space for scientific staff. The main wet laboratory, constructed in the mid-1970's, contains the following areas: a high hazard testing area, a low hazard testing/holding area, a marine algae/plant laboratory, a general purpose and glass fabrication shop, a sea water filtration system room, and an electronic control room. Sea water can be supplied to laboratory spaces either unfiltered (i.e., directly from Narragansett Bay), or filtered before use. Both types of water can be temperature controlled by heating and cooling.

AED houses two microcosm facilities containing 10 and 20 separate chambers, respectively, each with the capability to support individual microcosms. Each microcosm is an independent 140 liter containerized system composed of intact benthic and pelagic communities. Within each, pumps, paddles, and fluorescent lights model the effects of tide, current, and the solar cycle to directly assess the effects of various contaminants on model ecosystems.

AED also has nine laboratory rooms devoted to chemical, biological, and geological sample preparation and analyses. An information technology center, conference center, and library facilities are also contained within the main building.

### **3.0 FACILITY WATER MANAGEMENT GOALS**

The resource conservation goals of AED are achieved through the implementation of an Environmental Management System (EMS). The EMS is consistent with the laboratory environmental policy. AED's environmental policy, as written by the facility, and AED's water conservation goals are provided below:

#### **Environmental Policy**

*The Atlantic Ecology Division (AED) conducts research to enhance the understanding of the effects of human activity on the land and waters of the Atlantic seaboard. Researchers collect and analyze data to provide tools for diagnosing and predicting the effects of anthropogenic*

*activity on aquatic resources and wildlife. AED provides research support to EPA Program & Regional Offices and state & local governments.*

*The Atlantic Ecology Division commits to reducing the environmental impacts and consumption of natural resources by our facility operations and comply with legal and applicable requirements by implementing an appropriate, yet practical, environmental management system. The AED Environmental Management System will be designed to meet the following goals:*

- *Insure compliance by meeting applicable environmental regulatory requirements while conducting research activities;*
- *Strive to continuously improve environmental performance;*
- *Integrate source reduction, waste diversion and other pollution prevention approaches into day to day research activities;*
- *Consider the environmental impact in planning, purchasing and operating decisions;*
- *Establish, track and review specific environmental performance goals and employee awareness; and*
- *Share performance information with our research partners and other parties.*

### **Environmental Management System Aspects, Objectives and Targets**

As a part of its EMS, AED has identified energy management and water consumption-related energy use as a significant environmental aspect. Through the June 2008 *AED Environmental Management Plans, Energy Management and Sub-Aspect Water Consumption-Related Energy Use*, AED has established water management and conservation as a significant sub-aspect.

Specific objectives under this sub-aspect are:

- Reduce total water use 16 percent by FY 2015 (from an FY 2007 baseline).

Provide awareness training (and posters) to result in an informed and knowledgeable staff regarding water conservation issues and progress.

- Install low-flow devices on 100 percent of the fixtures in laboratories and lavatories.
- Eliminate single-pass cooling water lines by installing recirculating water loops for chillers and compressors.

To meet the objectives under this sub-aspect, AED has established specific actions, which include:

- Implement this Water Management Plan.
- Install low-flow devices in lavatories and laboratories.

- Reduce non-contact single pass cooling.
- Develop xeriscape landscaping as part of the sustainable landscape master plan.
- Upgrade the chiller system.
- Conduct facility-wide training and education programs and address awareness at All Hands meetings and via strategically placed posters.

### **EO 13514 Goals and ConservW Targets**

AED strives to achieve the water use intensity reduction goal set forth in EO 13514. Therefore, AED has set a goal of reducing its water use intensity (in gallons per gross square foot [gal/GSF]) by 2 percent per year from an FY 2007 baseline through FY 2020, for a total reduction in water use intensity of 26 percent. This goal will be incorporated into the facility EMS when it is next revised. AED's FY 2007 baseline is 29.28 gal/GSF.

To continue progress toward meeting EO requirements, AED will strive to meet annual facility-specific goals set by EPA's Sustainable Facilities Practices Branch under its ConservW program. These ConservW goals are calculated for each EPA facility based on the facility's previous water use reduction and its potential identified projects.

## **4.0 UTILITY INFORMATION**

### **Contact Information**

Potable water supply is provided by:

United Water Rhode Island  
 17 Arnold Street  
 P.O. Box 429  
 Wakefield, RI 02880-0429  
 401-789-0271

Sewer service is provided by:

University of Rhode Island  
 Facility Management Division  
 Old Plains Road  
 Kingston, RI 02881  
 Attn: Dave Lamb  
 401-874-7896

### **Rate Schedule**

Water supply is billed at the following rates:

- 1) A base water rate of \$1.415 per 100 cubic feet.
- 2) A drinking water protection fee of \$0.218 per 100 cubic feet.

The combined rate is \$1.633 per 100 cubic feet.

In addition, AED is charged a service fee quarterly for each account, shown below in Table 1.

**Table 1. AED Metered Water Service**

Meter Number	Meter Location	Quarterly Facility Charge
51211228	Support services building	\$26.63
51211231	Hazardous materials building	\$26.63
60499954	Main laboratory (standby)	\$53.58
60499955	Main laboratory (active)	\$53.58

A 4-inch water main enters the main laboratory building in the boiler room, then immediately splits into two 2-inch metered services that join again after metering to feed a common header. One meter is active, while the other is closed but available for standby use. Separate metered water supply is also provided to the support services and the hazardous materials buildings. Typically, no flow is registered on the meter installed at the hazardous materials building, as this metered supply is required only during unusual circumstances.

URI bills AED a flat annual fee of \$1,274.51 for sewer service. This fee, provided at a discount to prevailing commercial rates, reflects URI's 46 percent ownership in the combined Narragansett/South Kingston Waste Water Treatment Plant.

**Payment Office**

U.S. Environmental Protection Agency  
 Account Operations Office  
 26 West Martin Luther King Drive  
 Cincinnati, OH 45268

**5.0 FACILITY WATER USE INFORMATION**

The predominant features of AED are the wet laboratory and microcosm facilities where research is conducted on aquatic species and systems. These facilities are supplied with either filtered or unfiltered sea water from Narragansett Bay. The laboratory is equipped to temper the incoming sea water by either heating or cooling to provide for a wide range of experimental conditions.

Sea water is obtained directly from the bay via a pump house mounted on a pier at approximately 400 gallons per minute (gpm). The flow is split at the main laboratory building, where 300 gpm are routed to the wet labs and microcosm facilities to support the laboratory science program. The remaining 100 gpm are routed to an adjacent research facility operated by NOAA. After

flowing through the various supply headers, wet labs, and microcosms, the sea water is collected and returned to the bay.

This Water Management Plan focuses on potable water, which is obtained from the local water utility and used as process water in some of the laboratories (e.g., as source water for deionized water supply, glassware washing, or sterilization), cooling tower make-up, boiler make-up, equipment cooling, and sanitary supply. The facility is not equipped with an irrigation system; therefore, virtually no water is used for landscape irrigation.

In September 2009, AED installed a 200,000 gallon aboveground storage tank to provide consistent water pressure for the fire suppression system. Potable water to service the fire suppression system is provided by the local water utility but is not metered.

The remainder of this plan discusses potable water use throughout the facility.

### Major Water Using Processes

Estimates of potable water consumption by major use area are provided in Table 2. These data reflect average facility water use in FY 2009.

**Table 2. Major Water Using Processes, AED**

Major Process	FY 2009 Annual Consumption (gallons)	Percent of Total Water Use	Comments
Cooling tower make-up	386,700	32.0	Based on average daily meter readings during 2009 cooling season
Continuous flow equipment cooling	285,000	23.6	Projected from instantaneous measurements
Boiler make-up	12,000	1.0	Metered data from calendar year 2007
Support services building (sanitary, boat washing, dive locker)	59,844	5.0	FY 2009 metered total for support services building
Deionized water	1,250	0.10	Average daily meter readings
Sanitary	258,000	21.4	Engineering estimate
Laboratory process water and other miscellaneous uses	203,814	16.9	Calculated as remaining difference from metered total
<b>TOTAL</b>	<b>1,206,608</b>	<b>100.0</b>	<b>FY 2009 total reported water use</b>

Because cooling tower water consumption occurs primarily between April and October, water use varies seasonally. Additional details on assumptions and calculations supporting these water use estimates are provided in Appendix A. Monthly total water use in FY 2009 is provided in Appendix B.

The fire suppression system is not currently metered; however, the system is tested for approximately one hour once per week. The diesel engine pump is water cooled, and the cooling

water is discharged to the storm drain. At an assumed average flow rate of 20 gpm, this discharge accounts for approximately 62,400 gallons per year.

### **Measurement Devices**

Incoming water is supplied by United Water of Rhode Island through four metered service lines as indicated in Table 1.

The cooling tower make-up and blow down lines are equipped with meters. Water use is recorded daily by the facility operations and maintenance (O&M) contractor.

### **Shut-off Valves**

City water shut-off valves are located at each main water supply meter location.

### **Occupancy and Operating Schedules**

Approximately 126 employees work at AED year-round, with an additional 20 personnel on site during the summer season. The laboratory operates on a flex time schedule and is typically occupied between 5:30 a.m. and 7 p.m., Monday through Friday.

## **6.0 BEST MANAGEMENT PRACTICE SUMMARY AND STATUS**

EO 13423, *Strengthening Federal Environmental, Energy, and Transportation Management*, signed in January 2007, calls for federal agencies to reduce water use intensity by 2 percent per year between FY 2007 and FY 2015, for a total reduction of 16 percent. This goal was extended by EO 13514, *Federal Leadership in Environmental, Energy, and Economic Performance*, signed in October 2009. EO 13514 calls for reducing potable water consumption intensity by 2 percent annually through the end of FY 2020, for a total reduction of 26 percent. Facilities should implement best management practices (BMPs) related to water use, considering life-cycle cost effectiveness, to achieve this water reduction goal. FEMP has identified BMPs in 14 areas to help facilities identify and target water use reductions. AED has adopted BMPs in 11 of the areas, designated by checkmarks in the list below. One other area is deemed inapplicable for AED, designated by “NA” in the list below. The status of each BMP at AED is as follows:

- Water Management Planning
- Information and Education Programs
- Distribution System Audits, Leak Detection and Repair
- Water-Efficient Landscaping
- Water-Efficient Irrigation
- Toilets and Urinals
- Faucets and Showerheads
- Boiler/Steam Systems
- Single-Pass Cooling Equipment
- Cooling Tower Management
- NA Commercial Kitchen Equipment
- Laboratory/Medical Equipment
- Other Water Use
- Alternate Water Sources

A description of the laboratory's approach under each of the 14 areas is described below.

### **Information and Education Programs**

AED conducts facility-wide training and education programs and addresses awareness at All Hands meetings. In addition AED maintains a website dashboard where it publicizes utility usage and progress towards goals. AED also promotes water conservation and awareness using the EPA laboratory "Every Drop Counts" water conservation poster series. Conservation posters are displayed in prominent locations within the building. AED maintains information about its water consumption objectives and targets on EPA's website about AED under the heading "Greening Our Lab", <http://www.epa.gov/aed/html/ems/watercon.html>.

The onsite O&M contractor has been made aware of AED's water conservation goals and of the importance of water and energy conservation as key operating principles for the laboratory. These practices are integrated into building system O&M practices wherever practical. Internal and external awareness of water conservation issues are also promoted through the activities associated with the Sustainable Site Master Plan.

BMP status is achieved in this area.

### **Distribution System Audits, Leak Detection, and Repair**

A screening-level system review was conducted in March 2010 to develop this plan. Known water uses account for greater than 90 percent of water consumption.

Facility staff are trained to report leaks and malfunctioning water-using equipment to a facility maintenance help line. Reported problems are assigned a work order, which is completed by the facility O&M contractor. Work orders are tracked in an electronic database through completion and close out. A plumber on the O&M contractor staff makes a daily walk-through inspection of all water-using processes. Any problems or leaks identified are addressed immediately.

BMP status is achieved in this area.

### **Water-Efficient Landscaping**

Much of the 11-acre AED compound is wooded and has been returned to a natural setting. AED is in the process of implementing a sustainable landscape plan and has reduced its mowable grass areas as much as possible.

BMP status is achieved in this area.

### **Water-Efficient Irrigation**

No irrigation is used to maintain the grassy areas immediately surrounding the building; they are allowed to brown out during dry periods and are naturally restored when precipitation occurs. AED currently only irrigates to establish plantings, including the new green roof that was installed in September 2009.

BMP status is achieved in this area.

### **Toilets and Urinals**

Table 4, on page 15, provides an inventory of current sanitary fixtures. Where feasible, all restrooms have been renovated to include high-efficiency fixtures (dual flush 1.1/1.6 gallons per flush [gpf] toilets and 1-pint or non-water urinals).

Janitorial staff and employees are trained to report leaks or other maintenance problems to the facilities maintenance help line. Reported problems are assigned a work order, which is completed by the facility O&M contractor. Work orders are tracked in an electronic database through completion and close out.

BMP status is achieved in this area.

### **Faucets and Showerheads**

Table 4, on page 15, provides an inventory of faucets and showerheads and their associated design flow rates. Where feasible, all restrooms have been renovated to include high-efficiency faucets/aerators and showerheads (0.375, 0.5, or 0.895 gpm faucets and 1.25 gpm showerheads).

Janitorial staff and employees are trained to report leaks or other maintenance problems to the facilities maintenance help line. Reported problems are assigned a work order, which is completed by the facility O&M contractor. Work orders are tracked in an electronic database through completion and close out.

BMP status is achieved in this area.

### **Boiler/Steam Systems**

The laboratory is equipped with two steam boilers that each produce low-pressure steam at approximately 10.4 million Btu/hour. The steam is delivered to shell and tube heat exchangers to produce hot water that is circulated through preheat coils, reheat coils, perimeter radiation, and sea water processing heat exchangers. Steam is also used to produce domestic hot water in a steam heat exchanger. Steam condensate is captured and returned to the boilers. A small quantity of steam is blown down from the boilers each morning as a preventive maintenance measure. Chemical treatment is provided by a water treatment contractor to prevent scale formation and corrosion.

AED plans to upgrade the boiler system as part of future renovation projects. The new system will generate recirculated hot water rather than steam. In addition, a solar hot water heating system will be evaluated as part of the Sustainable Master Plan.

BMP status has been achieved in this area.

### **Single Pass-Cooling Equipment**

AED has eliminated all sources of single-pass cooling water and has achieved BMP status in this area.

## **Cooling Tower System Management**

A new cooling tower system was installed in 2001. Cooling tower system performance is monitored and maintained regularly by the building O&M contractor. The cooling tower make-up water flow rate is metered and recorded daily by the O&M contractor. A conductivity meter is used to automatically control cooling tower blow down; the conductivity meter is regularly maintained by the O&M contractor. The conductivity target for the system is 900 to 1,100 microSiemens per centimeter ( $\mu\text{S}/\text{cm}$ ). This conductivity control point provides for approximately five to seven cycles of concentration and efficient cooling tower water use.

Chemical treatment is provided by a cooling tower maintenance contractor to control scale and corrosion. The contractor routinely monitors the cooling system water quality for optimum performance and is informed that water conservation is an operational goal of the facility.

BMP status is achieved in this area.

## **Commercial Kitchen Equipment**

AED does not operate commercial kitchen equipment. BMP status is not applicable in this area.

## **Laboratory/Medical Equipment**

AED operates some laboratory equipment including a steam sterilizer and glassware washers. This equipment is used intermittently. The steam sterilizer is a standalone system that utilizes high pressure steam generated from a built-in boiler. It is used approximately once per month. No tempering water flows when the sterilizer is not in use.

AED operates a liquid ring vacuum pump to maintain vacuum on an experimental apparatus to strip gas from seawater for dissolved oxygen analysis. The water used to maintain the liquid ring is recirculated through a reservoir, and when the pump is operating, water is allowed to continuously overflow the reservoir to remove excess heat generated by the pump. AED is considering adding a small intake chiller unit to the reservoir to eliminate the need for the continuous overflow.

BMP credit in will be achieved in this area pending the installation of the chiller unit on the vacuum pump reservoir and subsequent elimination of continuous overflow.

## **Other Water Use**

Deionized water is generated through cartridge resin beds. Deionized water is blended with sea water to reduce the salinity of water supplied to the wet laboratory areas where estuary research is conducted. AED is planning to replace these centralized deionization units with point of use systems. Deionized water use is carefully monitored and controlled and BMP status is achieved in this area.

## **Alternate Water Sources**

AED will explore the feasibility of capturing rainwater collected from roof drains into two existing 600-gallon tanks for use to irrigate the new green roof or other plants.

In addition, as part of Phase I of the Master Plan, AED is planning to route air handler condensate to the cooling tower to serve as make-up water.

BMP status will be achieved in this area upon implementation of the rain water collection and reuse or the capture of air handler condensate for use as cooling tower make-up.

## **7.0 DROUGHT CONTINGENCY PLAN**

AED will follow the water use recommendations and restrictions of United Water of Rhode Island, which typically establishes its drought response actions in coordination with the towns of Narragansett and Kingston. The overall drought management approach in Rhode Island is coordinated under the Rhode Island Drought Management Plan, which is available online at: <http://www.planning.ri.gov/landuse/dmp.htm>.

As a matter of general operating practice, AED already follows most of the water conservation approaches that are recommended or could be required under drought conditions. Water is not used for decorative fountains, maintenance of paved surfaces, or landscape irrigation, and motor vehicles are washed at commercial car washes.

When voluntary or mandatory water use restrictions are instituted by United Water of Rhode Island, the requirements are communicated to the Facilities Manager. The Facilities Manager assembles a task force of facility and operating personnel to identify and implement modifications to facility operations to achieve additional specified reductions in water consumption.

## **8.0 COMPREHENSIVE PLANNING**

Consistent with AED's environmental management policy and EMS direction to consider the environment when making all planning, purchasing, and operating decisions, the Facilities Manager will ensure that water supply, wastewater generation, and water efficiency BMPs are taken into account during the initial stages of planning and design for any facility renovations or new construction. These factors will also be considered prior to the purchase and installation of any equipment that would measurably change facility water consumption. Where available, WaterSense® labeled products (see <[www.epa.gov/watersense](http://www.epa.gov/watersense)> for more information about WaterSense) will be purchased or specified.

## **9.0 STATUS UNDER GUIDING PRINCIPLES FOR HIGH PERFORMANCE AND SUSTAINABLE BUILDINGS**

The Interagency Sustainability Working Group (ISWG), formed as a subcommittee of the EO 13423 Steering Committee, has established guiding principles to assist agencies in meeting the high performance and sustainable buildings goals of EO 13423, section 2(f). The December 1, 2008, version of the ISWG's *Guiding Principles for Sustainable Existing Buildings* established six supporting principles for protecting and conserving water. AED's status toward achieving the supporting principles for protecting and conserving water at existing buildings is documented in Table 3.

**Table 3. Status of Guiding Principle to Protect and Conserve Water**

Topic	Status
Indoor Water	Annual water tracking data (water consumption in gal/gsf) shows that AED decreased water use intensity by 60.3 percent between FY 2003 and FY 2009. AED has performed multiple water conservation projects since 2003, including upgrading to high-efficiency sanitary fixtures and replacing an air compressor that used single-pass cooling. The Energy Management Sub-Aspect Water Consumption-Related Energy Use EMP contains an objective to reduce water use by 16 percent by FY 2015. A water assessment was performed in FY 2010.
Outdoor Water	No irrigation is used at AED. Grassy areas are allowed to brown out during dry periods and are naturally restored when precipitation occurs. AED is in the process of implementing a Master Plan which incorporates sustainable site concepts from a 2004 Sustainable Site Master Plan, such as eliminating all mowable grass areas and replacing with native, non-invasive plant species. Several projects that reduced mowable grass areas were completed from 2004 to 2009. AED is installing a rainwater collection cistern in FY 2010, which will be used to irrigate the green roof installed in September 2009.
Water Metering	Incoming city water supply is metered. Flow totalizing meters are also installed on the cooling tower make-up water line, the cooling tower blow down water line, the boiler make-up water line, and the distilled water system. Under EPA's National Advanced Metering System, water utility meters will be tied into the advanced metering system.
Stormwater Management	Stormwater runoff from AED's impervious surfaces flows into storm drains where it is treated by silt traps then routed through stormwater collection pipes to the Narragansett Bay. AED is in the process of implementing a Master Plan which addresses stormwater management concepts that were developed in the 2004 Sustainable Site Master Plan. During Phase 3 of the Master Plan AED intends to implement projects from the 2004 Sustainable Site Master Plan, including repaving parking areas using porous pavement, evaluating the feasibility of bioswales, and installing a designed wetland. In 2007, AED replaced mowable grass area near the break room with a garden courtyard which has porous pavers and sustainable plantings. In September 2009, AED installed a green roof on 3,369 square feet of roof area to manage stormwater and AED is in the process of installing a system that will collect runoff from the roof area serving the green roof in cisterns and using it to irrigate the newly established green roof plantings.
Process Water	AED does not use potable water to improve its energy efficiency at the expense of water efficiency.
Water-Efficient Products	The Affirmative Procurement EMP promotes the purchases of water efficient products and services as required by the Energy Policy Act of 2005 (EPAct 2005). Toilets, urinals, and faucets were upgraded at AED to maximize water efficiency. The O&M contract SOW does not specify the purchase of WaterSense labeled or other water efficient products, although bank card holders and acquisition personnel are trained on the procurement of these products. The facility manager and procurement staff review all purchases for sustainability; however, the process and review procedure are not documented.

## 10.0 OPPORTUNITIES FOR FURTHER WATER CONSERVATION

AED is pursuing the following projects to achieve additional reductions in water use:

- 1) **Rainwater Harvesting** – AED is evaluating the feasibility of collecting rainwater from roof drains into two existing 600-gallon tanks. This water will be reused to irrigate the green roof during dry periods as necessary. Assuming AED irrigates the green roof with approximately ¼ inch of water once per week from April to September, the cisterns could potentially offset the need for approximately 2,400 gallons of potable water per year. AED is investigating the use of a solar powered pump to transfer water from the tanks to the point of use. This project is estimated to cost \$5,000. While it would not offer a life cycle cost-effective payback, this could serve as an innovative demonstration project using renewable energy and existing materials.
- 2) **Capture and Reuse Air Handler Condensate** – As a part of Phase I of the Master Plan, AED will capture air handler condensate from the rooftop air handler and route it to the cooling tower. Initial engineering evaluation indicates that it may be possible to capture up to 170,000 gallons of condensate per year from the air handler. This water will offset the consumption of potable water for cooling tower make-up and result in savings of approximately \$360 per year. This project is estimated to cost \$5,000 and result in a payback period of approximately 14 years.
- 3) **Eliminate Continuous Flow from Liquid Ring Pump Reservoir Used in Dissolved Oxygen Experimental Set-Up** – The water used to maintain the liquid ring on an experimental apparatus to strip gas from seawater for dissolved oxygen analysis is recirculated through a reservoir, and water is allowed to continuously overflow the reservoir when the pump is operating to remove excess heat generated by the pump. AED is considering adding a small intake chiller unit to the reservoir to eliminate the need for the continuous overflow. Initial engineering evaluation indicates it may be possible to reduce potable water consumption by 257,000 gallons per year, resulting in a cost savings of approximately \$560 per year. This savings will be offset by approximately \$460 per year in increased energy costs required to operate the small intake chiller unit. This project is estimated to cost \$3,000 and, assuming net costs, will result in a payback period of approximately 30 years.
- 4) **Reduce Duration of Fire Suppression System Testing** – Currently AED tests its fire suppression system for approximately one hour once per week. National Fire Protection Association (NFPA) 25, Section 8.3, however, only requires the system to be tested for a minimum of 30 minutes once per week. AED will consider reducing the fire suppression system testing time from one hour to 30 minutes in order to reduce the discharge of potable water that is used to water cool the diesel engine pump. Although this water is not metered, this project could result in a savings of approximately 31,200 gallons of potable water per year.

**Table 4. Inventory of Sanitary Fixtures, AED, Narragansett, Rhode Island**

Building	Sub-Location	Fixture	Quantity	Flow Rating
Support Services	T103	Toilet	1	Briggs 1.5
		Sink	1	0.5 gpm
	T101	Toilet	1	Sloan Dual Flush 1.1/1.6
		Sink	1	Bricor 0.375 gpm
	Dive Locker	Toilet	1	Sloan Dual Flush 1.1/1.6
		Sink	1	Bricor 0.375 gpm
Shower		2	Bricor 1.25 gpm	
Field Operations	Bathroom	Toilet	1	Briggs 1.5
		Sink	1	0.5 gpm
New Wing 1st Floor	Men's	Toilet	1	Sloan Dual Flush 1.1/1.6
		Urinal	1	Zurn 0.125 gpf
		Sink	1	Bricor 0.895 gpm
	Women's	Toilet	2	Sloan Dual Flush 1.1/1.6
		Sink	1	Bricor 0.896 gpm
New Wing 2nd Floor	Men's	Toilet	1	Sloan Dual Flush 1.1/1.6
		Urinal	1	Waterless
		Sink	1	Bricor 0.895 gpm
	Women's	Toilet	2	Sloan Dual Flush 1.1/1.6
		Sink	1	Bricor 0.895 gpm
Admin Intermediate Floor	Conference Room C	Sink	1	Chicago 2.2 gpm
Admin 1st Floor	Men's	Toilet	1	Sloan Dual Flush 1.1/1.6
		Urinal	2	Waterless
		Sink	2	Chicago 2.2 gpm
		Shower	1	Bricor 1.375 gpm
	Women's	Toilet	1	Sloan Dual Flush 1.1/1.6
		Sink	2	Chicago 2.2 gpm
		Shower	1	Bricor 1.375 gpm
Admin 2nd Floor	Men's	Toilet	2	Sloan Dual Flush 1.1/1.6
		Urinal	2	Waterless
		Sink	2	Chicago 2.2 gpm
	Women's	Toilet	2	Sloan Dual Flush 1.1/1.6
		Sink	2	Chicago 2.2 gpm
Laboratory	Men's	Toilet	2	Sloan Dual Flush 1.1/1.6
		Urinal	2	Waterless
		Sink	2	Bricor 0.375/0.875
	Women's	Toilet	2	Sloan Dual Flush 1.1/1.6
		Sink	2	Bricor 0.375/0.875
Mezzanine	Men's	Toilet	1	Sloan Dual Flush 1.1/1.6
		Urinal	1	Waterless
		Sink	1	Bricor 0.375/0.875

**Table 4. Inventory of Sanitary Fixtures, AED, Narragansett, Rhode Island**

<b>Building</b>	<b>Sub-Location</b>	<b>Fixture</b>	<b>Quantity</b>	<b>Flow Rating</b>
	Women's	Toilet	1	Sloan Dual Flush 1.1/1.6
		Sink	1	Bricor 0.375/0.875
Pollution Abatement	T101	Toilet	1	Sloan Dual Flush 1.1/1.6
		Sink	1	Bricor 0.895 gpm
		Shower	1	Bricor 1.25 gpm
		Total	61	

**Appendix A**

**WATER BALANCE SUPPORTING CALCULATIONS**

**Table A-1. Water Balance Supporting Calculations – FY 2009, AED Laboratory,  
Narragansett, Rhode Island**

<b>Major Process</b>	<b>Annual Consumption(gallons)</b>	<b>Comments</b>
Cooling tower make-up	386,700	Based on average daily meter readings during 2009 cooling season.
Continuous flow for equipment cooling	285,000	Projected from instantaneous measurements, assuming 180 days/year operation. $(1.1 \text{ gpm} * 60 \text{ min} / \text{hour} * 24 \text{ hours} / \text{day} * 180 \text{ days} / \text{year}) = 285,120 \text{ gallons} / \text{year}$ .
Boiler make-up	12,000	Metered data from 2007.
Support services building (sanitary, boat washing, dive locker)	59,844	FY 2009 metered total for support services building.
Deionized water	1,250	Based on average daily meter readings. Assume 7 units, 5 of which are operational, consume 1 gallon per day, and operate 250 days per year. $(1 \text{ gallon} / \text{day} / \text{unit} * 5 \text{ units} * 250 \text{ days} / \text{year}) = 1,250 \text{ gallons} / \text{year}$ .
Sanitary	258,000	Engineering estimate. Calculated assuming 8 gallons per person per day, 116 employees work in the main laboratory year round 250 days per year (assume 10 employees work solely out of the support services building, which is metered separately), and 20 employees work during the summer 160 days per year. $((126 - 10 \text{ employees}) * 8 \text{ gallons} / \text{person} / \text{day} * 250 \text{ days} / \text{year}) + (20 \text{ employees} * 8 \text{ gallons} / \text{person} / \text{day} * 160 \text{ days} / \text{year}) = 257,600 \text{ gallons} / \text{year}$ .
Laboratory process water and other miscellaneous uses	203,814	Calculated as remaining difference from metered total. $1,206,608 \text{ gallons} / \text{year} - 386,700 \text{ gallons} / \text{year} - 285,000 \text{ gallons} / \text{year} - 12,000 \text{ gallons} / \text{year} - 59,844 \text{ gallon} / \text{year} - 1,250 \text{ gallons} / \text{year} - 258,000 \text{ gallons} / \text{year} = 203,814 \text{ gallons} / \text{year}$ .
<b>TOTAL</b>	<b>1,206,608</b>	<b>FY 2009 total reported water use</b>
Fire Suppression System <sup>a</sup>	62,400	Engineering estimate. Assume discharge of 20 gpm once per week for one hour. $(20 \text{ gallons} / \text{minute} * 60 \text{ minutes} / \text{run} * 52 \text{ runs} / \text{year}) = 62,400 \text{ gallons/year}$ .

<sup>a</sup> Fire suppression system is not included in the metered potable water total.

**Appendix B**

**MONTHLY WATER USE IN FY 2009**

**Table B-1. Monthly Water Use in FY 2009 in Gallons, AED, Narragansett, Rhode Island**

<b>Quarter Year</b>	<b>Support Services</b>	<b>Main Laboratory</b>	<b>Total AED</b>
1st Quarter (Sep – Dec 2008)	11,221	225,164	236,384
2nd Quarter (Dec 2008 – Mar 2009)	8,229	193,745	201,974
3rd Quarter (Mar – Jun 2009)	16,457	175,044	191,501
4th Quarter (Jun – Sep 2009)	23,938	552,810	576,748
<b>Total water use</b>	<b>59,844</b>	<b>1,146,764</b>	<b>1,206,608</b>

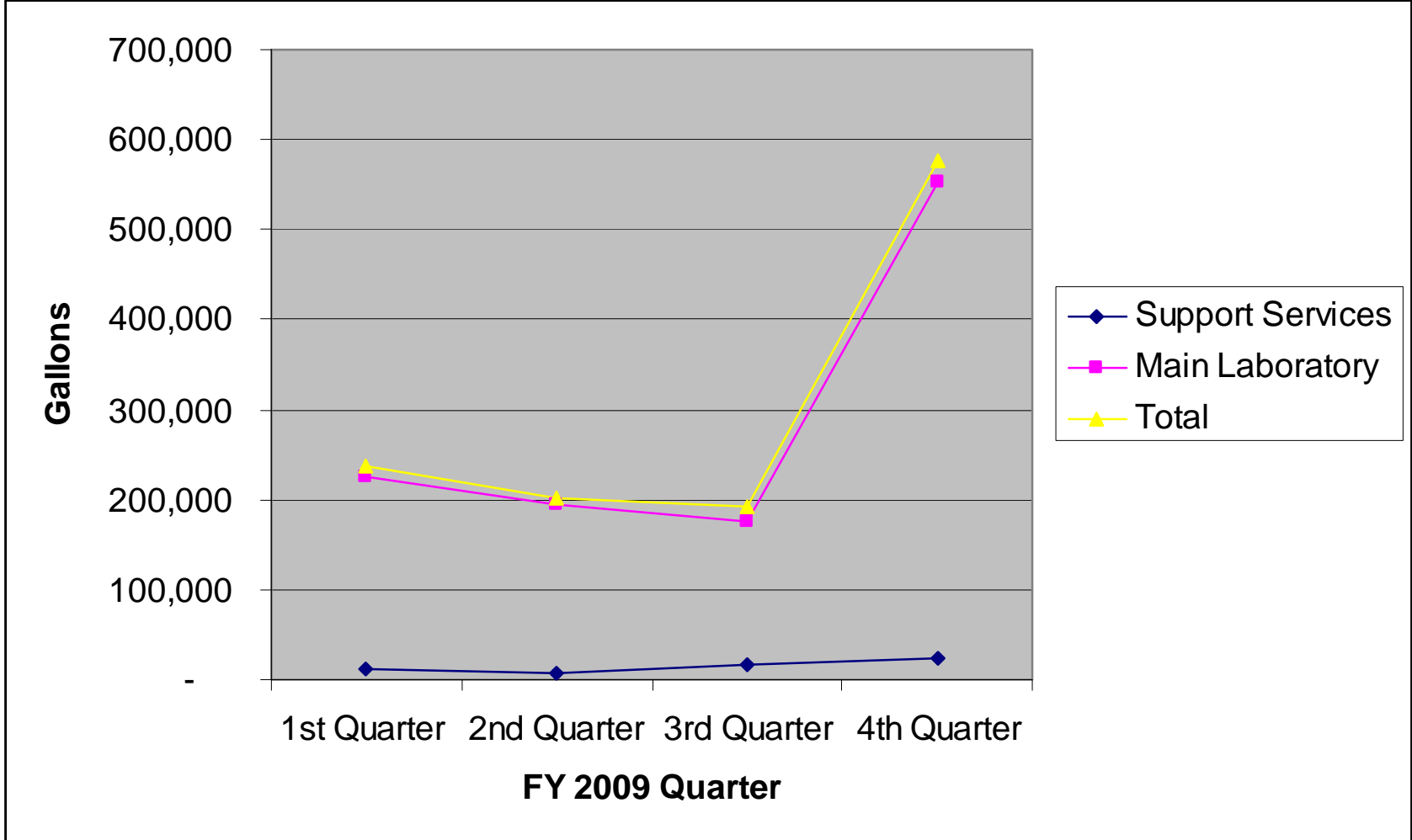


Figure B-1. Monthly Water Use in FY 2009, AED, Narragansett, Rhode Island