WATER MANAGEMENT PLAN, REVISION 2

Manchester Environmental Laboratory, Port Orchard, Washington

OARM Sustainable and Transportation Solutions Branch (STSB) **January 2016**

Overview

This report summarizes the findings and recommendations associated with a water use and conservation assessment conducted at the U.S. Environmental Protection Agency's (EPA's) Region 10 Manchester Environmental Laboratory (MEL) in Port Orchard, Washington. Under this Water Management Plan, MEL will consider implementing the potential water conservation opportunities identified during the water assessment, which are summarized in Table 1.

The remainder of this Water Management Plan describes the facility's water reduction goals, water use trends, end uses of water, and drought management plans.

Background

Executive Order (EO) 13653, *Preparing the United States for the Impacts of Climate Change*, signed in November 2013, requires agencies to reduce potable water consumption intensity, measured in gallons per gross square foot (gsf), by 36 percent by fiscal year (FY) 2025. Reductions will be measured relative to the agency's baseline water consumption in FY 2007, through reductions of 2 percent annually. In addition to the potable water use reduction requirements in EO 13693, the order requires that agencies reduce industrial, landscaping, and agricultural (ILA) water consumption by 2 percent annually or 30 percent by the end of FY 2025 relative to a FY 2010 baseline (including nonpotable sources). Agencies also should install water meters and utilize building and facility water balance data to improve water conservation and management.

The implementing instructions of EO 13693 require that, where applicable, agencies should purchase WaterSense® labeled products and choose irrigation contractors who are certified through a WaterSense labeled program.

The Energy Independence and Security Act (EISA) of 2007 directs agencies to complete comprehensive energy and water evaluations for 25 percent of covered facilities (i.e., those accounting for 75 percent of total agency energy use) each year, resulting in each covered facility being assessed once every four years. It also directs agencies to implement cost-effective measures identified through life cycle analyses, and measure and verify water savings.

To achieve greater agency-wide water efficiency and to meet EISA requirements, a water assessment was conducted at MEL on December 2, 2015.

Figure 1: View of Manchester Environmental Laboratory.

Table 1. Potential Water Conservation Opportunities at MEL

Suggested Priority	Project Description	Project Cost	Potential Water Savings (Gallons)	Potential Energy Savings (Million Btu)	Potential Utility Cost Savings*	Potential Payback (Years)	Notes
1a	Install WaterSense labeled 1.5 gallons per minute (gpm) aerators on eight faucets with flow rates currently exceeding 1.5 gpm.	$80	23,000	11	$580	0.1	Facility will pursue installation of 1.0 gpm faucet aerators if building occupants are satisfied with 1.5 gpm aerators. Previous attempts at installing low-flow aerators were not received well.
1b	Assuming user satisfaction, replace 1.5 gpm aerators with 1.0 gpm aerators on 12 faucets with flow rates exceeding 1.0 gpm.	$120	14,000	7	$350	0.3	
2	Replace four existing showerheads with WaterSense labeled models flowing at 1.75 gpm or less.	$160	3,000	1	$60	2.7	None.
3	Replace urinals with 0.25 gallons per flush (gpf) WaterSense labeled models.	$4,000	33,000	0	$580	6.9	None.
4	Read existing reverse osmosis (RO) permeate meter and permeate and reject ratio once per month.	$0	0	0	$0	Not quantified	Reading the permeate water meter and monitoring the ratio between permeate and reject will help the facility track the RO system water use and will ensure leaks or other problems are quickly identified.
5	Install and read meters on steam boiler make-up water lines.	$2,000	0	0	Not quantified	Not quantified	Installing water meters on the steam boiler system make-up water lines will improve system monitoring and will ensure leaks or other problems are quickly identified.
NA	Replace 13 existing flushometer-valve toilets with 1.28 gpf, WaterSense labeled models.	$12,000	68,000	0	$1,200	10	MEL does not intend to pursue this project because facility staff are concerned that high-efficiency fixtures will cause drainline issues.

*Utility cost savings are calculated using the most current water, sewer, and fuel oil costs available. As of 2015, the Manchester Environmental Laboratory's water rate is approximately $0.031 per cubic foot and the sewer rate is $0.093 per cubic foot. Combined, this rate is equal to $16.63 per 1,000 gallons. Fuel oil cost is $2.585 per gallon.

Facility Information

MEL, occupied in 1979 and expanded in 2002, is a 68,222 square-foot facility located in Port Orchard, Washington. The building is owned and operated by EPA, and EPA is responsible for all water, sewer, and other utility bills.

Water Management Goals

MEL achieves its resource conservation goals by implementing a facility-specific Environmental Management System (EMS) program. MEL made significant progress in reducing water use prior to 2007 by reducing eyewash rinse times, shortening dishwasher and autoclave run-times and frequency of use, and minimizing landscape watering. In addition, water-using analytical equipment and facility processes were reviewed and replaced where appropriate. The facility was able to eliminate the need for a cooling tower by replacing it with standard refrigeration cooling. Because of all of its prior work in reducing water use to the extent practical, MEL's EMS focuses on continuous improvement and not backsliding into water intensive practices. Within the EMS and otherwise, MEL's water management goals include:

- Achieving a 36 percent potable water reduction by the end of FY 2025, compared to a FY 2007 baseline of 9.49 gallons per gsf, as required by EO 13693.
- Implementing site-specific water conservation projects to achieve the facility's ConservW target (set annually by EPA's Sustainable and Transportation Solutions Branch).

Water Supply, Measurement, and Historical Use

MEL's water use has increased since the last water use assessment in 2012. While the facility has implemented many effective changes, a water leak occurred in FY 2015, resulting in a one-time loss of approximately 136,000 gallons of water. Prior to FY 2015, MEL's water use was trending downwards.

MEL uses water for the following: research and mission-related functions; steam boilers, which provide building and hot water heating; and sanitary needs. The following sections provide additional details on the facility's water use.

Water Supply

MEL's potable water is supplied by the Manchester Water District. Sewer service is provided by Kitsap County Public Works. MEL does not have nonpotable water sources; therefore all discussion of water use in this plan refers to potable water use.

Meters and Submeters

Incoming city water is supplied through five separate meters that service different buildings on the facility campus. Building-level meters are read weekly and data is evaluated to identify potential leaks or equipment malfunctions.

Laboratory water that is discharged to the acid neutralization system is metered before discharging to the sewer system.

The facility submeters RO permeate, although the meter is not read regularly. MEL's operation and maintenance contractor will add the RO system water meter to its weekly report under this Water Management Plan. In addition, MEL will consider installing submeters on the steam boiler make-up lines.

Table 2 lists the meters and submeters located at MEL and the associated Manchester Water District account numbers, where applicable.

Table 2. MEL Water Meters and Submeters

Description	Meter Number	Account Number
Main Laboratory City Water Meter	#1647	001477-000
West Annex City Water Meter	#1478	001478-000
Warehouse City Water Meter	#191	005066-000
Wet Lab City Water Meter	#680	003315-000
North Office Building City Water Meter	#614	003311-000
RO System Permeate Meter	N/A	N/A
Acid Neutralization Flow Meter	N/A	N/A

Historical Water Use

In response to EO 13693 and the executive orders that preceded it, MEL established a FY 2007 water use intensity baseline of 9.49 gallons per gsf. In FY 2015, water use intensity was up to 10.42 gallons per gsf—an increase of 9.8 percent compared to the FY 2007 baseline. This increase was a result of a water leak that occurred between December 2014 and February 2015. In FY 2014, MEL's water use intensity was down to 8.04 gallons per gsf—a decrease of 15.3 percent. In FY 2016, water use is anticipated to be consistent with FY 2014 levels, below the facility's baseline. Figure 2 provides a graph of MEL's water use from FY 2007 through FY 2015.

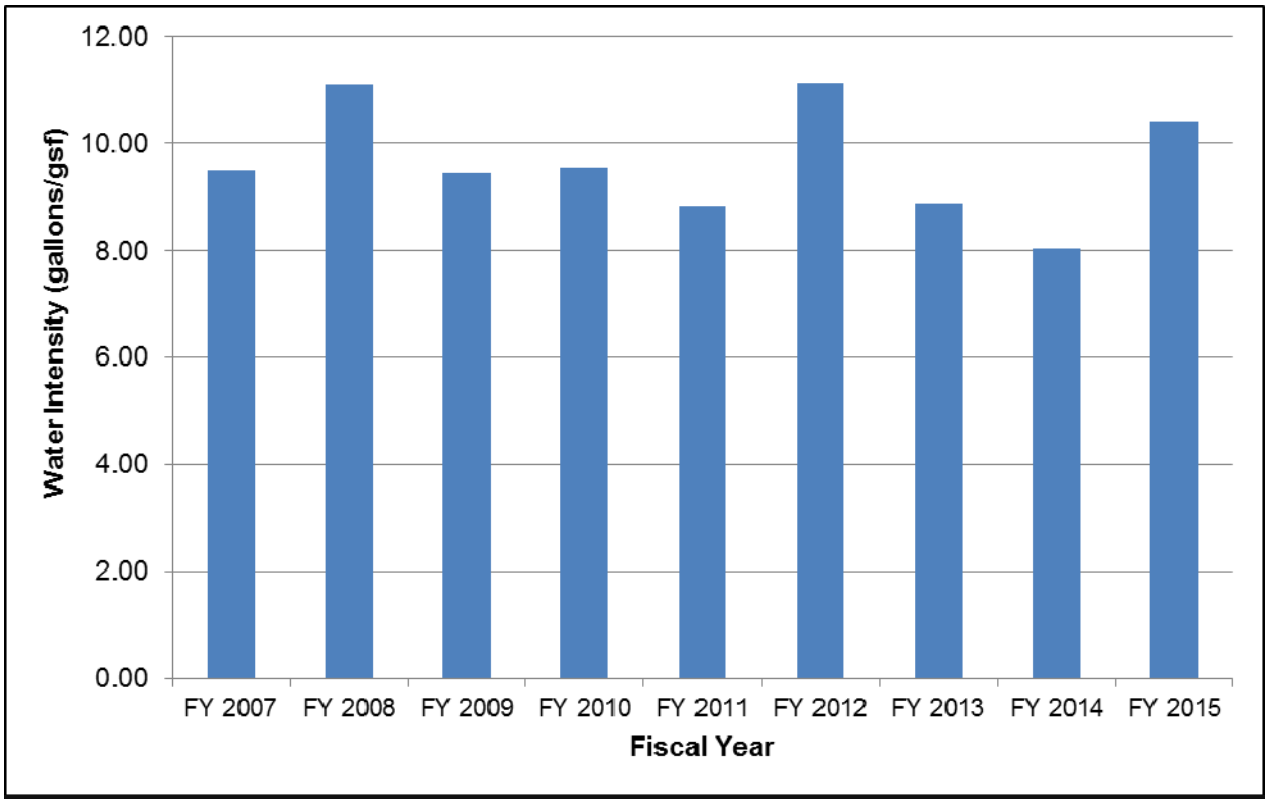

Figure 2: Manchester Environmental Laboratory's Water Use, FY 2007 to FY 2015.

End Uses of Water

Table 3 and Figure 3 illustrate the end uses of water at MEL. The uses are described in more detail below.

Table 3. Major Potable Water Uses at MEL, Fiscal Year 2015

Major Process	FY 2015 Annual Water Use (gallons)	Total Water Use (%)	Basis of Estimate
Laboratory water use, process water use, boat washing, steam boilers, and other miscellaneous uses	280,934	39.5	Calculated by subtracting all other estimated water uses from the metered total.
Restroom and other sanitary fixtures	242,000	34.1	Engineering estimate based on sanitary fixtures installed, occupancy, and daily usage factors.
Leak from North Office Building	136,000	19.1	Based on difference between weekly meter readings when leak occurred (December 2014 to February 2015) and average weekly consumption at the North Office Building.
Autoclave tempering water	20,000	2.8	Based on laboratory autoclave study, which noted 665 operating hours/year x 0.5 gallons/minute discharge during operation x 60 minutes/hour = 19,950 gallons/year.
RO system product water	15,600	2.2	Engineering estimated based on meter readings of RO product between February and December 2015, extrapolated for full fiscal year.
RO system reject water	10,900	1.5	Engineering estimated based on observed ratio of permeate to reject water for the RO system.
Eyewash flushing	5,200	0.7	Estimated based on and eyewash flushing study and operational changes made in 2005.
Total Water Use	**710,634**	**100.0**	**Sum of all building metered totals. Data provided by the facility.**

Research and Other Laboratory Use

MEL has a water purification system to provide purified water for laboratory use. The water purification system consists of a mixed bed sand filter, activated carbon, cartridge filter, RO membrane filters, deionized resin beads, and ultraviolet light disinfection.

With the RO membranes, specifically, water efficiency is an important consideration. The building engineer changes the RO membranes and filters as needed, at the recommendation of the system's service contractor, to ensure optimal efficiency. In addition, water entering the purification system is tempered to the optimal temperature for membrane pass through. There is a meter on the RO permeate line, which was previously read regularly but that had not been read in a few months. MEL's operations and maintenance (O&M) contractor will add this meter to their weekly report to ensure the meter is being read and tracked regularly. The O&M contractor was also encouraged to read and track the ratio of permeate to reject water to ensure ongoing efficiency of the system. During the assessment, the observed ratio was 5 gpm of permeate to 3.5 gpm of reject water, which is efficient for such systems.

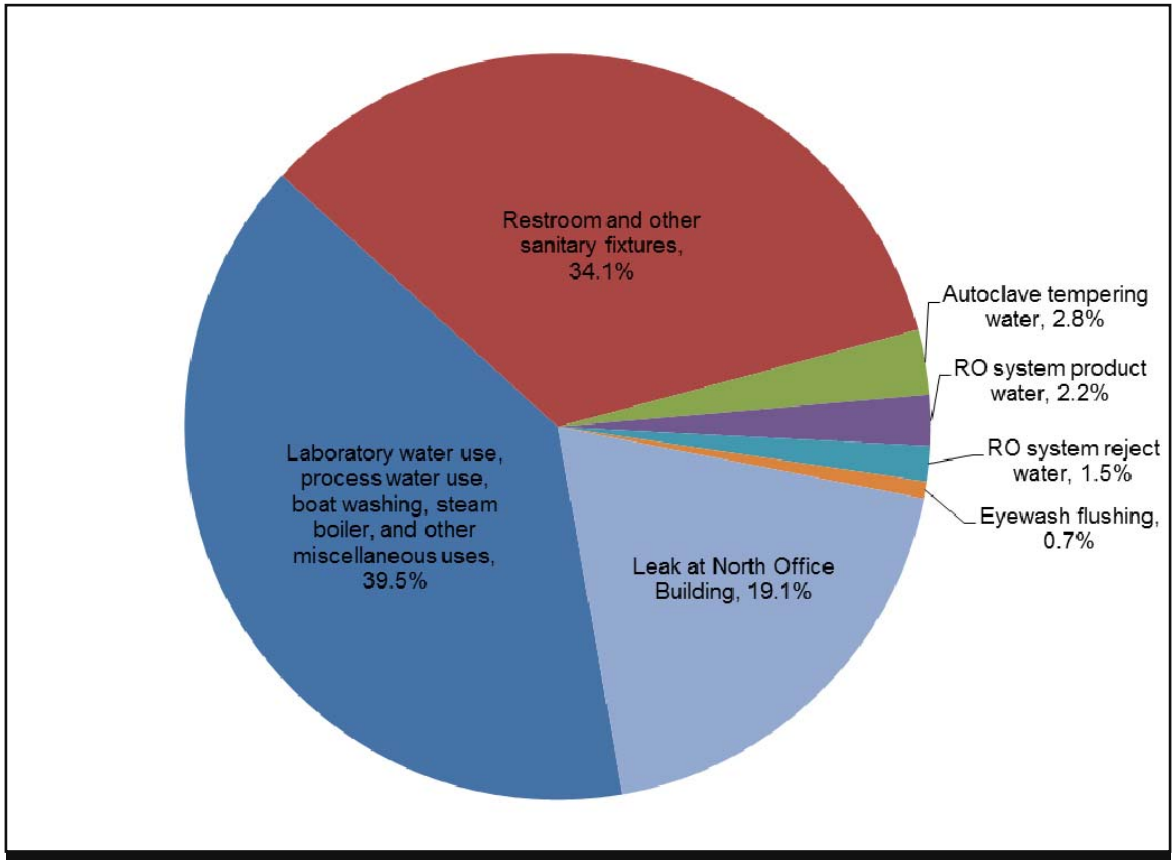

Figure 3: Water End Uses at MEL, FY 2015.

MEL also operates three autoclaves. Tempering water flow is manually controlled to ensure that flow is not continuous. The facility also optimizes five laboratory glassware washers to ensure that full loads are run and water use is as low as possible for proper cleaning.

In 2005, the facility initiated a study to determine how frequently eyewashes need to be flushed to meet safety requirements. The study showed that the facility could reduce flushing from once per week to once per month to reduce water uses. Emergency showers are flushed quarterly.

The facility has two pre-rinse spray valves for field preparation and clean-up. The pre-rinse spray valves flow at or above the federal maximum of 1.6 gpm. When these spray valves are past their useful life, MEL will consider replacing them with more efficient, WaterSense labeled models, which flow at 1.28 gpm or less.

Figure 4: MEL's three autoclaves are manually controlled to ensure that water flow is not continuous.

Steam Boilers

MEL has four steam boilers that use fuel oil to generate steam. Steam is supplied for building heat, domestic hot water production, and direct steam humidification. The boiler system is equipped with a condensate collection and recovery system, which returns approximately 90 percent of condensate to the boilers. A small quantity of steam is blown down from the boilers as a preventative maintenance measure and tempered with cold water. Blow down is performed manually for about 30 seconds per boiler per day. Make-up water to the system passes through a water softener first. The boiler water systems are monitored and maintained once per month under a service contract to prevent scale and corrosion and optimize condensate reuse. Boiler water parameters such as phosphorous, chloride, and conductivity are monitored and controlled through periodic testing and chemical treatment.

Figure 5: Four steam boilers provide building heat and domestic hot water to MEL.

MEL will consider installing water meters on boiler make-up water lines to better monitor potable water usage. MEL is also in the process of installing natural gas lines to the facility to replace fuel oil with natural gas to reduce greenhouse gases and costs associated with operating the steam boilers.

Restroom and Other Sanitary Fixtures

Many of MEL's restroom fixtures are not compliant with 1992 Energy Policy Act (EPAct 1992) water efficiency requirements (1.6 gpf toilets, 1.0 gpf urinals, and 2.5 gpm or less showerheads). All flushometer-valve toilets flush at 3.5 gpf, while the four urinals flush at 1.5 gpf. MEL does, however, have five tank-type toilet fixtures flushing at 1.6 gpf, which are EPAct-compliant. There are four showerheads at MEL, which flow at 2.5 gpm or 3.5 gpm.

Faucet fixtures are generally not considered water efficiency best practice, flowing between 1.5 and 2.2 gpm in most cases. There are also two faucets that have unrestricted flow, with a measured maximum flow rate of 4.25 gpm. Faucets that flow at 0.5 gpm are sufficient for hand washing and considered a best practice for lavatory sinks in public settings.

Table 4 provides an inventory of sanitary fixtures.

Table 4. Sanitary Fixtures Inventory, Manchester Environmental Laboratory

Fixture Type	Flow Rate	Total Number
Toilets	3.5 gpf flushometer-valve	12
	1.6 gpf tank-type	5
Urinals	1.5 gpf	4
Lavatory faucets	4.25 gpm (measured)	2
	2.2 gpm	6
	1.5 gpm	4
	0.5 gpm	3
Showerheads	3.5 gpm (measured)	2
	2.5 gpm	2

MEL previously installed 0.5 gpm aerators on faucets, but as a result of occupant complaints and user dissatisfaction, the lower flow aerators were removed in many places throughout the laboratory. The facility will continue to seek an acceptable solution that lowers flow rates and satisfies users. WaterSense labeled aerators flowing at 1.5 gpm will be installed on all faucets that currently exceed that flow rate. If user complaints are not received, the facility will further reduce faucet flow rates to 1.0 gpm.

To further reduce water use in the restrooms, MEL will also consider replacing the four existing showerheads with WaterSense labeled models flowing at 1.75 gpm or less and all urinals with 0.25 gpf, WaterSense labeled models.

MEL will not pursue a project to replace existing 3.5-gpf flushometer-valve toilets with 1.28 gpf, WaterSense labeled models. Facility staff indicated that the laboratory sits at the end of a sewer drainline provided by Kitsap County. Therefore, they fear installing low-flow toilets will result in drainline backups at the facility.

Miscellaneous Use

Occasionally, MEL washes boats on site, but this is not a significant water use.

Drought Contingency Plan

Drought Risk

MEL is located in an area that periodically experiences drought and, at times, can experience extreme drought. In 2015, the State of Washington's Department of Ecology declared a statewide drought.

MEL's water is supplied by the Manchester Water District, which obtains water from underground wells located within the service territory. If imposed, information on drought restrictions can be found on the Manchester Water District's website at: www.manchesterwater.org/. Statewide resources for responding to drought are provided by the Department of Ecology at: www.ecy.wa.gov/drought/.

Recent Contributions to Drought Contingency

MEL set a FY 2007 potable water use intensity baseline of 9.49 gallons per gsf. As of FY 2014, the laboratory had reduced its water use intensity to 8.04 gallons per gsf—a 15.3 percent reduction compared to the FY 2007 baseline. Despite a setback in FY 2015 where a facility water leak resulted in higher annual water use, MEL plans to pursue projects to continue to reduce water use. MEL staff records and monitors water meters and submeters so that leaks or other malfunctions resulting in increased water use can be identified and resolved.

Potential Capital Improvement Projects to Reduce Water Use

Potential capital improvement projects are identified in Table 1. These projects represent MEL's plan to further reduce facility water use, particularly if faced with water supply limitations. If necessary, all of the projects could be implemented relatively quickly, although some do not have short-term payback periods. If fully implemented, these projects are estimated to reduce facility water use by up to ten percent.

Opportunities for Short-Term Response to Local Drought

In the event of a drought or other water supply shortage, MEL will follow the water use recommendations and restrictions of the Manchester Water District. As required, the facilities manager, in consultation with the laboratory director and building engineer, will implement the facility response to water use restrictions. Because the majority of the laboratory's water usage is for sanitary, building and water heating, and laboratory functions which are critical to the facility, there is not much opportunity for short-term response to local drought. However, the facility will cease non-essential water using activities, such as boat washing, as necessary.

Considerations for New Construction

MEL's current facility includes many aspects that are considered water efficiency best practices. However, if EPA had the opportunity to construct a new facility, the design choices listed below could be considered to further reduce water use.

1) MEL could consider restroom fixtures with maximum flow rate and performance requirements provided in Table 5.

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Table 5. Requirements for Restroom Fixtures in New Laboratory Construction

Fixture Type	Maximum Flow Rate	Performance Requirement
Toilets	1.28 gpf	WaterSense labeled
Urinals	0.125 gpf	WaterSense labeled
Lavatory faucets	0.5 gpm	None
Showerheads	1.75 gpm	WaterSense labeled

2) When evaluating laboratory-wide DI/RO requirements, MEL could consider whether point-of-use systems in individual laboratories would offer more efficient operation than central laboratory systems sized for maximum concurrent needs in multiple laboratories.