



WATER MANAGEMENT PLAN, REVISION 3

Office of Research and Development, Center for Environmental Measurement and Modeling, Gulf Ecosystem Measurement and Modeling Division, Gulf Breeze, Florida

Office of Mission Support, Safety and Sustainability Division

September 2019

Overview

This plan summarizes the findings and recommendations associated with a water use and conservation assessment conducted at the U.S. Environmental Protection Agency's (EPA's) Office of Research and Development (ORD), Center for Environmental Measurement and Modeling (CEMM), Gulf Ecosystem Measurement and Modeling Division (hereafter referred to as the GEMMD) located in Gulf Breeze, Florida. Under this Water Management Plan revision, the GEMMD will consider implementing the potential water conservation opportunities identified during the water assessment, which are summarized in Table 1. The Water Management Plan also describes the facility's water reduction goals, water use trends, end uses of water, drought management plans and stormwater management efforts.

Background

Executive Order (EO) 13834, *Efficient Federal Operations*, Section 2(c) requires agencies to reduce potable and non-potable water consumption in federal facilities and comply with stormwater management requirements. In addition, 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.



Figure 1. Aerial photo of the Center for Environmental Measurement and Modeling, GEMMD, Gulf Breeze, Florida

To achieve greater facility and agency-wide water efficiency and to meet EISA requirements, a water assessment was conducted by the Office of Mission Support, Safety and Sustainability Division (SSD) at the GEMMD July 8 and 9, 2019. Since 2002, the SSD's Sustainable and Transportation Solutions Branch (STSB) has conducted water assessments at EPA-owned and operated laboratories to improve water efficiency and comply with EISA 2007. The assessment team (Rafael Hernandez and Praveen KC of the STSB, and Robert Pickering of contractor Eastern Research Group, Inc. [ERG]) conducted the water assessment at the GEMMD to review existing conditions and update the facility's 2014 Water Management Plan.

Table 1. Potential Water Conservation Opportunities at the GEMMD

Suggested Priority	Project Description	Number of Fixtures	Initial Project Cost	Potential Annual Water Savings (Gallons)	Potential Annual Energy Savings (Million Btu)	Potential Annual Utility Cost Savings ¹	Potential Payback (Years)	Notes
Low and No-Cost Maintenance Activities								
1	Monitor water meters and submeters on a monthly basis and record meter readings.	N/A	N/A	Tracking water use regularly can help establish water use trends and identify potential leaks or malfunctions.				
2	Evaluate and resolve condensate accumulating on air handler duct in Building 65.	N/A	N/A	Maintenance activity to ensure proper operation of equipment.				
3	Coordinate with cooling tower treatment vendor to increase the cycles of concentration on the Buildings 20 and 47/49 cooling towers from four to six.	N/A	N/A	176,000	N/A	\$2,080	Immediate	None
4	Install 0.5 gallon per minute (gpm) faucet aerators on all faucets currently flowing at 1.2 gpm or greater.	27	\$270	28,500	12	\$670	0.4	None
5	Install WaterSense labeled showerheads rated at 1.75 gpm or less in shower areas that are used regularly.	6	\$180	3,900	2	\$80	2.3	None.

¹ Estimated water cost savings are based on the Emerald Coast Utility Authority's (ECUA's) water rate of \$4.51 per thousand gallons (Kgal) and sewer rate of \$7.30 per Kgal. Estimated energy cost savings are based on an electricity rate of \$0.0965 per kilowatt-hour (kWh), estimated based on the average costs from the GEMMD's fiscal year (FY) 2019 utility bills.

Suggested Priority	Project Description	Number of Fixtures	Initial Project Cost	Potential Annual Water Savings (Gallons)	Potential Annual Energy Savings (Million Btu)	Potential Annual Utility Cost Savings ¹	Potential Payback (Years)	Notes
Capital Improvements								
6	Capture condensate from two of six air handlers in Building 65 and route to the cooling tower.	N/A	\$1,000	22,000	-0.1	\$260	3.8	None.
7a	Install a system to collect rainwater from the Building 20 roof. The system would include a 10,000-gallon aboveground storage tank, a pump to route the water to the Building 20 cooling tower, and the necessary controls to operate the system.	N/A	\$35,000 ²	325,000	-1.2	\$3,600 ³	9.7	If the GEMMD moves forward with a project to replace the Building 20 cooling tower with a heat exchanger that uses seawater for cooling, this project would no longer be recommended.

² Represents rough order of magnitude (ROM) cost based on material cost estimate of approximately \$12,000 from RS Means and Rainharvest.com. Additional costs will be required for modifications to the Building 20 roof drain, as well as: design; controls; and supervision, inspection, and overhead (SIOH). Significant contingency has been applied to account for other, unexpected design and construction costs.

³ Takes into account annual operations and maintenance (O&M) costs related to changing sediment filters (conservatively assumed to occur four times annually).

Suggested Priority	Project Description	Number of Fixtures	Initial Project Cost	Potential Annual Water Savings (Gallons)	Potential Annual Energy Savings (Million Btu)	Potential Annual Utility Cost Savings ¹	Potential Payback (Years)	Notes
7b	Install a system to collect rainwater from the Building 52 roof (directly adjacent to the Building 20 cooling tower). The system would include a 500-gallon aboveground storage tank, a pump to route the water to the Building 20 cooling tower, and the necessary controls to operate the system.	N/A	\$4,000 ⁴	20,000	-0.1	\$330 ⁵	21.3	If the GEMMD moves forward with a project to replace the Building 20 cooling tower with a heat exchanger that uses seawater for cooling, this project would no longer be recommended.
8	Replace/upgrade the fire pump and sprinkler system in Building 39.	N/A	Not quantified	31,500	N/A	\$320	Not quantified	This project is not recommended solely for water efficiency purposes; however, water and water cost savings can be used as additional justification for replacing the fire pump and sprinkler system in Building 39.

⁴ Represents ROM cost based on material cost estimate of approximately \$2,000 from RS Means and Rainharvest.com. Additional costs will be required for design; controls; and SIOH. Significant contingency has been applied to account for other, unexpected design and construction costs.

⁵ Takes into account annual O&M costs related to changing sediment filters (assumed to occur once annually).

Suggested Priority	Project Description	Number of Fixtures	Initial Project Cost	Potential Annual Water Savings (Gallons)	Potential Annual Energy Savings (Million Btu)	Potential Annual Utility Cost Savings ¹	Potential Payback (Years)	Notes
9	Install make-up meters on the cooling towers serving Buildings 20 and 65.	N/A	\$1,000					Although this project will not result in direct water or utility cost savings, installing and reading meters on cooling tower make-up lines is a best practice that could improve cooling tower management and result in early leak detection, therefore reducing potential water use.

Facility Information

The GEMMD is located on Sabine Island in Gulf Breeze, Florida, eight miles southeast of Pensacola, Florida. The GEMMD campus is owned and managed by the EPA and has 34 buildings with 78,006 gross square feet (GSF) of conditioned space. The 34 buildings include three laboratory buildings, eight office buildings, a library, a wellness center, a shop facility, a security building, and several small storage and utility buildings. In addition, the campus has four seawater piers, a boathouse, and a seawater delivery system. One of the GEMMD's newest buildings, the computational and geospatial sciences building (Building 67), received the U.S Green Building Council's (USGBC's) LEED® for New Construction Silver-level certification in April 2009. Table 2 provides a list of major buildings located at the GEMMD.

Table 2. Major GEMMD Buildings

Building Number	Function	Year Built
1	Ecosystem Assessment Branch offices	1902
10	Shop facility	1997
20	Marine toxicology and chemistry laboratory	1979
34	Biological Effects and Population Response Branch offices	1908
38	Ecosystem Dynamics and Effects Branch offices	1908
42	Library	1908
44	Security Building	2016
45	National Oceanic and Atmospheric Administration (NOAA) Offices	1980
47/49	Marine ecology laboratory	1986/1992
65	Research and administration support center and conference center	2002
67	Computational and geospatial sciences building	2008

The GEMMD is occupied by approximately 115 employees; however, the facility is typically occupied by approximately 80 percent of employees at any given time, based on telework policies and fieldwork. The facility operates on a flex time schedule between 6:00 a.m. and 6:00 p.m., Monday through Friday.

Water Management

The GEMMD works to achieve its resource conservation goals by implementing the EPA’s Office of Research and Development (ORD) Multi-Site Laboratory Environmental Management System (EMS). As part of the EMS and otherwise, the ORD’s collective water management goals include:

- Annually, achieve the agency ConservW targets (set annually by the STSB) as a cumulative total of all seven ORD locations.
- Identify a potential water conservation or stormwater management project that will be started by one of the six ORD locations in FY 2020.

Water Supply, Measurement and Historical Use

The GEMMD uses water for cooling tower make-up, marine culture and toxicity testing research, sanitary needs, fire control system testing, seawater system washdown, and miscellaneous laboratory and research purposes. The following sections provide additional details on the facility’s water use.

Water Supply

Emerald Coast Utility Authority (ECUA) provides the GEMMD’s potable water and sewer service.

The GEMMD does not use any sources of non-potable fresh water, but it does use onsite alternative water sources. The GEMMD collects air handler condensate from Buildings 20 and 47/49 and routes the water to those buildings’ respective cooling towers to serve as make-up water. Building 67 is equipped with a system to collect rainwater from the building’s roof and use it for toilet and urinal flushing. The collection system is not fully functional as currently designed, as the system regularly clogs with debris. Instead, the GEMMD uses collected rainwater for plant watering.

Meters and Submeters

Incoming potable water supply is metered. Flow-totalizing meters are also installed on many of the major subsystem flows. Table 3 provides a summary of the meters and submeters installed at the GEMMD, the area or subsystem each meter serves, and the meter reading collected at the time of the assessment. All meters are owned by the GEMMD, unless otherwise indicated.



Figure 2: The GEMMD has high flow and low flow meters that totalize all potable water supplied by the ECUA. The meter is located below grade prior to going over the causeway to the GEMMD.

Table 3. List of Meters and Submeters at the GEMMD, July 2019

Area/System Served by Meter	Meter Location	Meter Number	Utility Account Number	Water Source	Meter Reading from Assessment
GEMMD campus	Below grade, at the entrance gate prior to going over the causeway to the GEMMD	N/A	#137837-857744	City potable water	High flow: 16,100 cubic feet (CF) Low Flow: 348,860 CF

Area/System Served by Meter	Meter Location	Meter Number	Utility Account Number	Water Source	Meter Reading from Assessment
Building 47/49 cooling tower #1 make-up	North wall of Building 49 mechanical room	2245907	N/A	City potable water	604,800 gallons
Building 47/49 cooling tower #2 make-up	North wall of Building 49 mechanical room	2245921	N/A	City potable water	9,770,660 gallons
Building 47/49 recovered air handler #1 condensate to cooling tower make-up	Building 49 mechanical room, adjacent to air handler #1	90171313	N/A	Air handler condensate	1,675,670 gallons
Building 47/49 recovered air handler #2 condensate to cooling tower make-up	Building 49 mechanical room, adjacent to air handler #2	90560061	N/A	Air handler condensate	1,508,410 gallons
Building 47/49 use from deionized (DI) water system	Building 49 mechanical room, above DI water system	52836819	N/A	DI water	128,780 gallons
Building 47/49 use from DI water system (contractor-owned)	Building 49 mechanical room, above DI water system	032094	N/A	DI water	37,400 gallons
Building 20 recovered air handler condensate to cooling tower make-up	Building 20 exterior on north wall	94942747	N/A	Air handler condensate	282,400 gallons
Building 20 chemistry laboratory use from DI water system	Building 20 chemistry laboratory (Room 14), above DI water system	032096	N/A	DI water	2,200 gallons
Building 20 wet laboratory use from DI water system	Building 20 wet laboratory, above DI water system	032095	N/A	DI water	25,900 gallons

Since the GEMMD's FY 2014 water assessment, system submeters have not been regularly monitored nor recorded by facility management or O&M staff. However, prior to the FY 2019 assessment, the facility manager directed onsite staff to begin recording meter readings for various submetered systems. Regular monitoring of meters can ensure irregular use, leaks or other malfunctions can be quickly identified. Under this Water Management Plan, facilities management and O&M staff should continue to record readings from all submeters at least monthly and report values to the facilities manager, so that water use trends can be monitored on an ongoing basis. Any unexpected changes in water use should be investigated and resolved immediately.

Historical Water Use

In response to various executive orders and laws addressing federal sustainability, the GEMMD established an FY 2007 water use intensity baseline of 85.87 gallons per gross square foot (gsf) based on 6,822,061 gallons of water used that fiscal year. In FY 2018, water use intensity had decreased to 54.36 gallons per gsf, or 4,240,464 gallons of water—a decrease of 37 percent compared to the FY 2007 baseline. The GEMMD further reduced water use over the most recent 12-month period for which water use data was available during the water assessment (April 2018 through March 2019) to 46.57 gallons per square foot based on 3,633,049 gallons of water used—a decrease of 46 percent compared to the FY 2007. This reduction could have been influenced by the federal government shutdown that occurred throughout most of January 2019, as well as renovations to the Building 47/49 mechanical equipment, resulting in the cooling towers and many laboratory operations being down for a number of months. Figure 4 provides a graph of the GEMMD's water use from FY 2007 through FY 2018.⁶

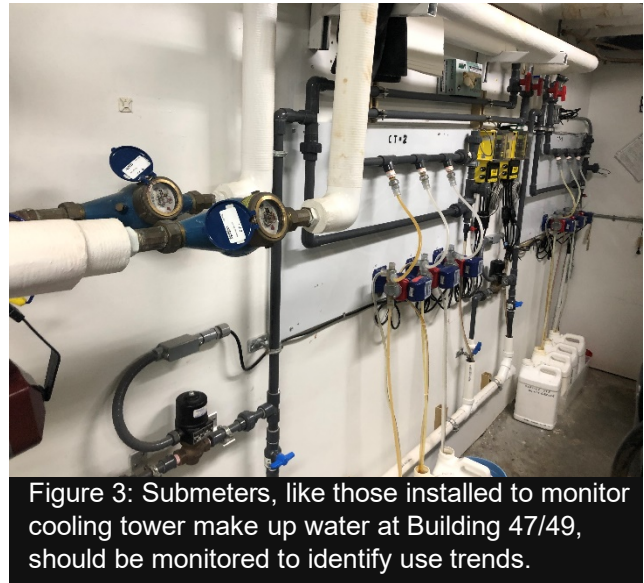
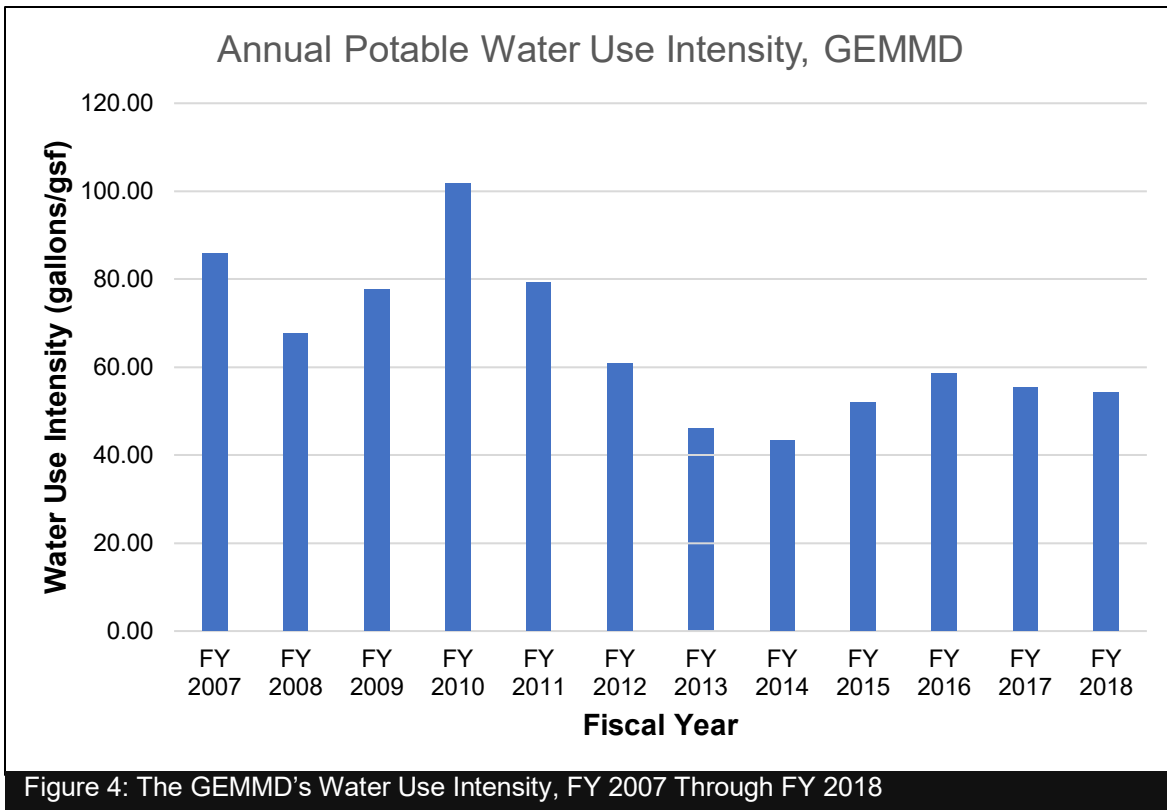


Figure 3: Submeters, like those installed to monitor cooling tower make up water at Building 47/49, should be monitored to identify use trends.

⁶ In FY 2010, the GEMMD experienced a water leak caused by a contractor working on a city construction site adjacent to the property line, causing an increase in the facility's reportable water consumption.



The GEMMD achieved its lowest annual water use intensity (43.26 gallons per gsf) in FY 2014. Because the majority of the GEMMD's water use is related to the operation of cooling towers, moderate increases and fluctuations in the GEMMD's annual water use intensity since FY 2014 are likely a result of changes in the number of annual cooling degree days (CDD) experienced by the facility.⁷

End Uses of Water

Table 4 and Figure 5 identify the end uses of water at the GEMMD based on the facility's water use from April 2018 through March 2019. The uses are described in more detail below.

⁷ Per the ENERGY STAR Degree Day Calculator, the cooling degree days (relative to 65°F) for the GEMMD over the past six fiscal years are as follow: FY 2013: 2,249 °F; FY 2014: 2,349 °F; FY 2015: 2,715 °F; FY 2016: 3,156 °F; FY 2017: 2,755 °F; FY 2018: 3,049 °F.

Table 4. Major Potable Water Uses at the GEMMD, April 2018 Through March 2019

Major Process	Annual Water Use (gallons)	Total Water Use (percent)	Basis of Estimate
Potable Water Use			
Cooling tower make-up (potable water)	2,056,230	56.6	Engineering estimate based on metered water use from the two cooling towers at Building 47/49. The water use from these cooling towers was extrapolated to the cooling towers at Buildings 20 and 65 using the tonnage ratios.
Wet lab (marine culture and marine toxicology testing water)	1,230,000	33.9	Engineering estimate based on discussions with the Wet Lab Coordinator and onsite plumber. Seawater system controls the freshwater tank such that it refills when water level reaches 65 percent capacity, up to 90 percent capacity. The tank capacity is 9,000 gallons. Assumes 1.5 freshwater tank fills per day.
Restroom fixtures	167,000	4.6	Engineering estimate based on fixtures installed, occupancy, and daily usage factors.
Research and other miscellaneous water uses	84,019	2.3	Calculated by difference from known total water use and all other calculated water uses.
Fire control system testing	49,000	1.3	Engineering estimate based on annual fire hydrant testing, annual fire booster pump testing, and annual sprinkler system testing.
Seawater system washdown	46,800	1.3	Engineering estimate based on a 1.5-inch fire hose using 45 gpm, 20 minutes per week, 52 weeks per year.
Total Potable Water Use	3,633,049	100	Metered total.
Onsite Alternative Water Use			
Recovered air handler condensate (used as cooling tower make-up)	456,272	-	Estimate based on metered total air handler condensate collected from April 2014 to July 2019 from the Building 47/49 air handling units and from July 2014 to July 2019 from the Building 20 air handling units. This amount was extrapolated to determine an estimate for 12 months.
Total Water Use	4,089,321	-	Sum of metered totals.

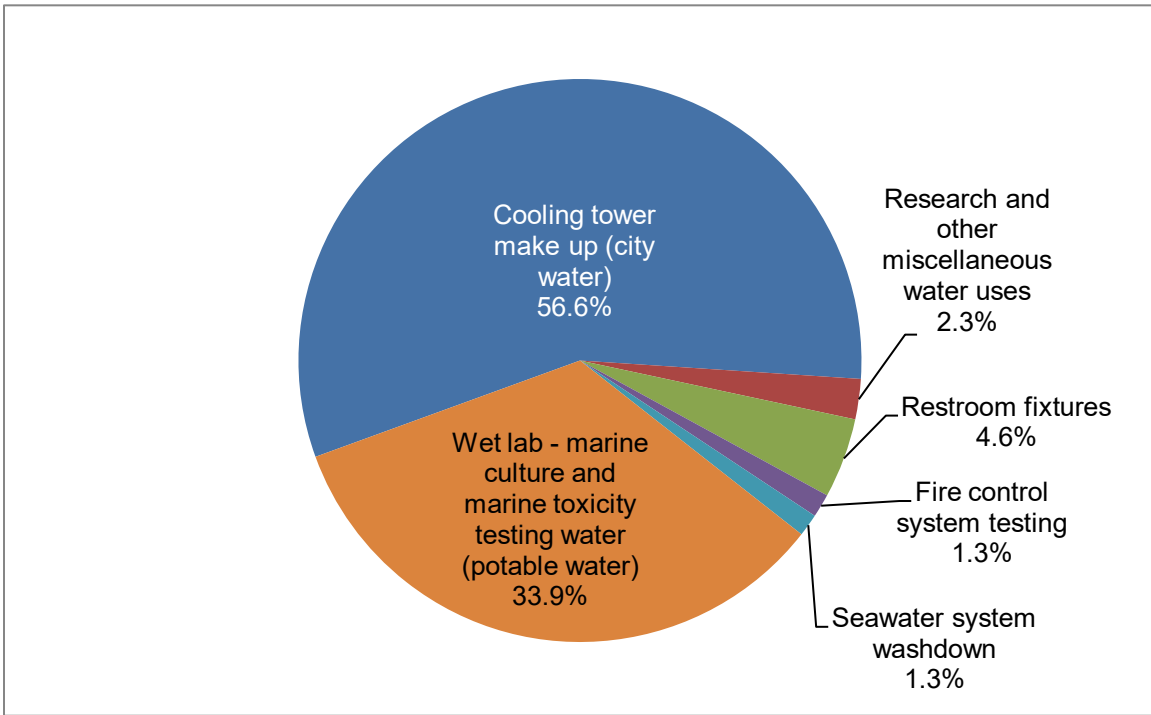


Figure 5: The GEMMD's Water End Uses, April 2018 Through March 2019

Cooling Towers

The largest end use of water at the GEMMD is the cooling tower system, which accounts for approximately 57 percent of its total potable water use annually. The GEMMD is equipped with four cooling towers, listed in Table 5, with a total cooling capacity of 510 tons. A cooling tower maintenance contractor performs a monthly quality, performance, and water chemistry review of each cooling tower operation. Chemical treatment is provided to control scale and corrosion. Treatment chemical addition rates are controlled to be proportional to the quantity of water blown down. Incoming potable water has a conductivity of approximately 200 microSiemens per centimeter (uS/cm). Conductivity meters for the Building 20 and Building 47/49 cooling towers are set to maintain the towers between 800 and 1000 uS/cm, which provides approximately four cycles of concentration. The Building 65 cooling tower is maintained between 400 and 500 uS/cm, achieving approximately two cycles of concentration. As part of this Water Management Plan, the GEMMD should coordinate with its cooling tower treatment vendor to assess opportunities to increase cycles of concentration, while still protecting the towers against scale and corrosion. If possible, the GEMMD should target improving the cycles of concentration to six cycles.



Figure 6: Two 100 ton cooling towers provide space and equipment cooling for Building 47/49.

The cooling towers for Building 47/49 were rebuilt in 2019 as part of heating, ventilation, and air-conditioning (HVAC) upgrades that occurred throughout the building. New cooling tower fill material and high-efficiency drift eliminators were installed. These improvements, along with other HVAC upgrades, are anticipated to significantly reduce the building’s energy use, and could also have an impact on reducing the water use of the cooling towers.

Two of the four cooling towers are equipped with make-up water meters. Under this plan, the GEMMD should consider installing make-up water meters on the cooling towers at Building 20 and Building 65. The GEMMD should also monitor and record cooling tower make-up meter readings at least monthly. The O&M contractor and facilities manager should evaluate water use trends in the cooling towers and should investigate unexpected trends to resolve issues identified as soon as possible.



Figure 7: A 250 ton cooling tower serves Building 20.

Table 5. GEMMD Cooling Towers

Tower Location	Rating (tons)	Makeup Water Meter	Air Handler Condensate Used for Make-Up Water
Building 20	250	No	Yes
Building 47/49 #1	100	Yes	Yes
Building 47/49 #2	100	Yes	Yes
Building 65	60	No	No

The GEMMD collects condensate from air handling units in Building 20 and Building 49 and routes it to the Building 20 and Building 47/49 cooling towers, respectively, as make-up water. The collected condensate is metered. The GEMMD should also monitor and record recovered air handler condensate meter readings monthly. The GEMMD collects approximately 450,000 gallons of air handler condensate annually and uses it as cooling tower make-up water, reducing the GED’s need for potable make-up water by approximately 18 percent.

The GEMMD is currently in the process of assessing a project to collect air handler condensate from the air handling units in Building 65 to use as make-up water for the building’s cooling tower. Collection is feasible for two of the six air handling units. As part of this Water Management Plan, the GEMMD should consider implementing an air handler condensate recovery system in the future.

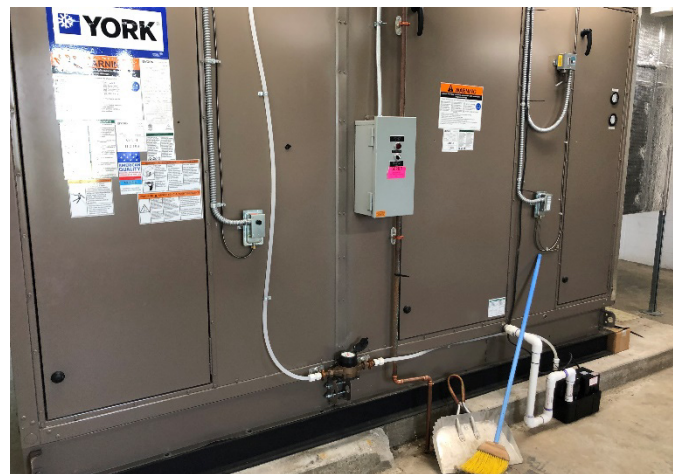


Figure 8: Condensate from air handlers in Building 20 and Building 47/49 (pictured here) is directed to cooling towers as make up water.

For another opportunity to reduce potable water used in the cooling towers, the GEMMD could pursue rainwater collection from Building 20 or Building 52. The collected rainwater could serve as make-up water for the Building 20 cooling tower. Rainwater from the Building 20 roof, which has a collection area of approximately 10,000 square feet, currently collects in roof drains. The flows from the roof drains combine into a large PVC storm pipe before exiting the building and discharging into the bay. Providing storage for a 1.5" storm event would require a 10,000-gallon storage tank and associated pumps and controls. If the GEMMD is interested in this project, it would need to identify the best location for the storage tank, considering the current configuration of the storm pipe, the seawater system, and other infrastructure surrounding Building 20. Such a system could save approximately 325,000 gallons of water per year, with a payback estimated to be approximately 8 years. Alternatively, rainwater could be collected from Building 52, which currently houses the Building 20 chillers and is directly adjacent to the Building 20 cooling tower. The collection area is approximately 600 square feet, and a 1.5" storm event would require a 500-gallon storage tank. Because it would be a smaller system, the project would have a lower initial cost; however, because not as much rainwater would be collected (approximately 20,000 gallons annually), the payback is estimated to be longer at approximately 21 years.



Figure 9: Roof drains from Building 20 could be used to collect rainwater to be used in the building's cooling tower as make up water.

Wet Lab (Marine Culture and Marine Toxicology Testing Water)

The GEMMD conducts marine life toxicity testing and associated marine life culturing activity. Testing is conducted across a range of salinities. Seawater is obtained from Pensacola Bay, with approximately 30 parts per thousand (ppt) salinity. The seawater is blended with potable water at approximately 0 ppt to achieve a mixed water with approximately 18 to 22 ppt salinity for experimental purposes.

Potable water is stored in a 9,000-gallon freshwater tank prior to blending with seawater. The seawater system controls allow the water level of the freshwater tank to lower to 65 percent capacity before it refills the tank to 90 percent capacity. The Wet Lab Coordinator estimates that one to two freshwater tank fills occur daily. However, potable water use for this purpose is governed by experimental requirements.

Restroom Fixtures

Sanitary fixtures compliant with the Energy Policy Act of 1992 (EPA 1992) of 1.6 gallons per flush (gpf) or less for toilets and 1.0 gpf or less for urinals] have been installed in the majority of the GEMMD's restrooms. Older style toilets (estimated 3.5 gpf), installed prior to 1992, are still in use in a few of the GEMMD's restrooms. In total, 34 of 36 toilets and all six urinals are EPA 1992-compliant. While the GEMMD's urinal fixtures are rated at 1.0 gpf, 0.5 gpf rated flush valve inserts are installed by O&M staff as a water efficiency measure.

GEMMD facility management indicated that, within the last year, three major cleanouts were required to clear clogged sewer lines on the west side of the campus (associated with Buildings 1, 7, and 20). Due to aging sewer lines and low slope on the west side of the campus, the plumbing contractors have

suggested the primary cause of the recurring clogs is likely use of high-efficiency toilets. Their recommendation is those toilets be restored to the 3.5 gpf models until funds are available for relining or replacement of the aging and narrowed sewer lines. Three toilets (one in Building 7 and two in Building 20) were restored with the higher flow models until the improvements can be made to the sewer lines.

The American Society of Mechanical Engineers (ASME) and Canadian Standards Association (CSA) have established a standard for lavatory faucets in public use (essentially all applications except domestic residences) that specifies a maximum flow rate of 0.5 gallons per minute (gpm). This flow rate is sufficient for hand washing and is considered a best practice for lavatory sinks in public settings. Lavatory faucets that meet this standard have been installed only in Buildings 44, 45, and 67 (seven of the GEMMD's 34 lavatory sinks). The remaining 27 faucets flow between 1.2 gpm and 2.5 gpm or have an entirely unaerated flow.

EPA 1992-compliant showerheads, which flow at 2.5 gpm, are installed in all 10 shower stalls located at the GEMMD. Table 6 provides a complete inventory of sanitary fixtures.

Water system pressure is maintained between 20 to 80 pounds per square inch, which is necessary for adequate restroom fixture performance. Janitorial staff and employees are trained to report leaks or other maintenance problems to the Facilities Manager or O&M staff. Leaks or other problems are immediately corrected.

Building 67 is equipped with a system to collect rainwater from the building's roof and use it for toilet and urinal flushing. The collection system is not fully functional as currently designed, as the system regularly clogs with debris. Based on an assessment of potential water and cost savings from an operational system, it does not appear to be cost effective to retrofit or redesign the system at this time. Water from the system is instead periodically used for plant watering.

Table 6. Restroom Fixtures Inventory, GEMMD

Fixture Type	Flow Rate/Flush Volume	Total Number
Toilets	3.5 gpf	2
	1.6 gpf	30
	Dual flush (1.6/1.1 gpf)	3
	1.28 gpf	1
Urinals	1.0 gpf (fixture rating) 0.5 gpf (flush valve insert)	6
Lavatory faucets	2.5 gpm or unaerated	3
	2.2 gpm	13
	2.0 gpm	4
	1.8 gpm	5
	1.5 gpm	1
	1.2 gpm	1
	0.5 gpm	5
	0.4 gpm	2
Showerheads	2.5 gpm	10

Until existing sewer conditions are evaluated and possibly replaced, the GEMMD does not intend to pursue additional toilet and urinal replacements.

To further reduce restroom water use, the GEMMD should also consider installing 0.5 gpm faucet aerators on all lavatory faucets flowing at 1.5 gpm or higher. This project is very cost effective and will pay for itself in a matter of months. The GEMMD should also consider replacing existing showerheads that get the most use (e.g., showerheads in the Wellness Center/Dive Locker) with WaterSense labeled models flowing at 1.75 gpm or less.

Fire Hydrant and Control System Testing

The GEMMD uses approximately 49,000 gallons of water annually for periodic fire control system testing and flushing. Fire hydrant testing is conducted on six fire hydrants at the GEMMD once per year. The fire booster pumps and other fire sprinkler systems are also tested and flushed annually.

During the assessment, a small, continuous water discharge was observed from the Building 39 fire pump system. O&M staff noted that fire pump does regularly discharge water to keep the pump packing clean of debris, but that it is not typically continuous and that they were in the process of replacing the pump packing to eliminate the continuous flow of water. The assessment team confirmed that the flow was not continuous on a similar fire pump system installed at Building 1. A field measurement of the flow from the Building 39 fire pump quantified the continuous flow at 0.06 gpm. Over a full year, this continuous flow could consume approximately 31,500 gallons of water. Because it was unknown when the continuous flow began occurring, and because O&M staff intended to fix the pump to eliminate the flow, the quantity of water was not included in the water use for the GEMMD, summarized in Table 4. [Note: As of publication of this report, the Building 39 fire pump leak has been repaired.]

Seawater System Washdown

On a weekly basis, the seawater system that provides testing water for marine culture and toxicology research is washed down. The exterior surfaces are washed to remove any dust, debris, or salt build-up that has accumulated over the past week. Washdown occurs for approximately 20 minutes per week.

Research and Other Miscellaneous Water Uses

Approximately 2 percent of the GEMMD’s potable water is used for miscellaneous research purposes not otherwise captured throughout this water management plan. The GEMMD does considerable research on aquatic life.

The GEMMD briefly used a reverse osmosis (RO) system to generate laboratory-grade water. However, the laboratory staff concluded that DI water generated by ion exchange is more suitable. The GEMMD has three DI systems, one in Building 47/49 and two in Building 20.

Water is also used as necessary in individual laboratories for bench-scale experimentation and glassware preparation. There are three glassware washers at the GEMMD, one in Building 47/49 and two in Building 20.



Figure 10. DI use in Buildings 20 and 47/49 is monitored using flow totalizing meters.

The GEMMD operates two steam sterilizers, listed in Table 7. For one sterilizer, tempering water is only applied when condensate is being discharged to the drain. According to O&M staff, tempering water flows whenever the Amsco 3021 sterilizer is turned on. However, laboratory staff know to turn off the sterilizer at the completion of a sterilization cycle. Security personnel also monitor the equipment and turn it off, as needed, after hours.

Both sterilizers are managed so that they sterilize loads at 75 percent capacity or greater.

Table 7. GEMMD Steam Sterilizers

Room	Model	Continuous Tempering Water Flow?
Building 47/49, Room 8	Getinge	No – Only when needed.
Building 47/49, Room 11	Amsco 3021	Yes – Although equipment is managed to ensure water is not used when equipment is not actively sterilizing.

The GEMMD uses a washing machine to wash laboratory coats and clothes from field activities. The machine, an Estate by Whirlpool Model ETW41000SQ0, has a capacity of 2.5 cubic feet. It is not ENERGY STAR certified. The clothes washer is used approximately once per month; therefore, water use is anticipated to be minimal. At the end of its useful life, the GEMMD should replace the clothes washer with an ENERGY STAR certified model.

The GEMMD previously had a water-cooled ice machine in Building 47/49; however, this unit was replaced with an air-cooled model (Scotsman Model F0522A-1A) shortly after the 2014 assessment. The GEMMD has no remaining equipment that uses single-pass cooling.

Lastly, the GEMMD owns and operates several boats used for research purposes. Boats and motors are rinsed with a hose on an as-needed basis (approximately once per week for approximately 5 to 10 minutes).

Completed Water Efficiency Projects

As described in Table 8, the GEMMD has completed three projects to improve water efficiency and water management since FY 2007.

Table 8. Completed Water Efficiency Projects at the GEMMD Since FY 2007

Project	Estimated Annual Water Savings (Gallons)	Completion Year	Additional Notes
Urinal flush valve inserts	18,000	FY 2016	The GEMMD replaced flush valve inserts for six urinals flushing at 1.0 gpf with inserts rated at 0.5 gpf.

Project	Estimated Annual Water Savings (Gallons)	Completion Year	Additional Notes
Air handler condensate recovery	56,000	FY 2014	The GEMMD captures condensate from two of the three Building 20 air handlers and routes it to the Building 20 cooling tower as make-up water, reducing the amount of potable make-up water needed.
Eliminating water-cooled ice machine	19,000	FY 2014	The GEMMD replaced its last remaining water-cooled ice machine with an air-cooled model.
Air handler condensate recovery	400,000	FY 2011	The GEMMD captures condensate from the Building 49 air handlers and routes it to the Building 47/49 cooling towers as make-up water, reducing the amount of potable make-up water needed.
Eliminating cooling tower	1,040,000	FY 2011	The GEMMD consolidated its operations and research from Building 45 into other laboratories, resulting in the elimination of water use by the Building 45 cooling tower.

Drought Contingency Plan

Drought Risk

The GEMMD is located in an area that periodically experiences drought, most recently in 2018 and 2012. Water is supplied by ECUA, which obtains water from the Sand-and-Gravel Aquifer.

In the event of a drought or other water supply shortage, the GEMMD will follow the water use recommendations and restrictions from the Northwest Florida Water Management District issued on its website at: <https://www.nfwwater.com/>.

The District will issue a water shortage order when appropriate and will issue associated orders depending on the level of water shortage. The ECUA can also post recommendations and restrictions separate from Northwest Florida Water Management District if it deems necessary.

In the event that voluntary or mandatory water use restrictions are instituted by Northwest Florida Water Management District or ECUA, the facilities manager and lab director will jointly identify and implement modifications to facility operations to achieve the specified reductions in water use.

Recent Contributions to Drought Contingency

In FY 2018, the GEMMD had reduced its water use intensity by 37 percent compare to the baseline set in FY 2007. The GEMMD should monitor water meters and submeters to understand use patterns. Further, the GEMMD plans to pursue projects to reduce facility water use in accordance with this Water Management Plan.

Potential Capital Improvement Projects to Reduce Water Use

Potential capital improvement projects are identified in Table 1. These projects represent the GEMMD's plans to reduce facility water use, particularly if the facility is faced with water supply limitations or undergoes a major renovation. If necessary, many of the no- and low-cost projects could be implemented relatively quickly. If fully implemented, the projects in Table 1 are estimated to reduce facility water use by approximately 14 percent.

Opportunities for Short-Term Response to Local Drought

In the event of a drought or other water supply shortage, the GEMMD will follow any water use recommendations and restrictions from the Northwest Florida Water Management District or the ECUA.

Because the majority of the laboratory's water usage is for sanitary, research and laboratory functions that are critical to the GEMMD's mission, there is not much opportunity for short-term response to local drought. However, the GEMMD may be able to reduce the frequency of some water-using activities, such as seawater system washdown and boat washing.

Considerations for New Construction

If the EPA decides to pursue further expansion of the GEMMD through new construction or major renovations, the design choices listed below should be considered to reduce water use intensity and exhibit water efficiency.

- 1) Install restroom fixtures with flush volumes or flush rates at or below the maximum flush volume/flow rate and performance requirements provided in Table 9.

Table 9. Requirements for Restroom Fixtures in New Construction/Major Renovation

Fixture Type	Maximum Flush Volume/Flow Rate	Performance Requirement
Toilets	1.28 gpf	WaterSense labeled
Urinals	0.125 gpf	WaterSense labeled
Lavatory faucets	0.5 gpm	None
Kitchen faucets	1.8 gpm	None
Showerheads	1.75 gpm	WaterSense labeled

- 2) Incorporate air handler condensate collection and/or rainwater collection into the initial design for use as cooling tower make-up, toilet and urinal flushing, or other non-potable water end uses.
- 3) If applicable, carefully size laboratory systems, such as the RO system and vacuum system. Consider more efficient, point-of-use models, where feasible.

Stormwater Management

Stormwater from the GEMMD infiltrates the landscape of Sabine Island. Stormwater runoff that does not have an opportunity to permeate the landscape flows into English Navy Cove, part of the Pensacola Bay.

Onsite Green Infrastructure

The GEMMD does not currently have any onsite green infrastructure.

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