WATER STEWARDSHIP PLAN

INNOVATION

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WATER STEWARDSHIP PLAN

for University of Wisconsin-Milwaukee and School of Freshwater Sciences
in collaboration with Office of Sustainability
and Alliance for Water Stewardship

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Water stewardship is a crucial element of University of Wisconsin-Milwaukee's leadership in the water sector at local and global levels. We must build on our current successes in water conservation and environmental sustainability, and forge ahead in applying our water expertise, improving our resource management, and continuing to support innovative water education. As the world's water challenges become more pronounced and more complex, University of Wisconsin-Milwaukee is positioned to advance its leadership through quality research, active education, and extensive community service, all of which constitute important elements of the development and implementation of the Water Stewardship Plan.

The primary purpose of the Water Stewardship Plan is to provide deliberate direction in the strategic plan for future water consumption and conservation at University of Wisconsin-Milwaukee's local sites while participating in the Alliance for Water Stewardship's global water initiative. University of Wisconsin-Milwaukee (UWM) is aspiring to be the first university in the USA and the world to successfully apply the Alliance for Water Stewardship (AWS) International Water Stewardship Standard on campus. The UWM main campus is a large organization with over 25,000 students and 3,000 faculty and staff. To make the Plan feasible, the Office of Sustainability and the School of Freshwater Sciences joined in collaboration to enhance our analysis and strategic thinking. The Office of Sustainability, founded in 2008, has extensive knowledge and data on water use at UWM, and it assesses, supports, and drives sustainability initiatives across campus operations, student life, and academic affairs.

Our philosophical emphasis in developing the Water Stewardship Plan reflects the AWS statement we consider to be most formative: the Alliance defines stewardship as "the use of water that is socially equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that involves site and catchment-based actions." From this perspective, we have developed Water Stewardship Plans for the School of Freshwater Sciences harbor campus building and University of Wisconsin-Milwaukee main Kenwood Campus. We have also conducted stakeholder analyses and comparative analyses with other government offices and agencies, business and industry, intergovernmental organizations, nongovernmental organizations, and others that have recognized the need to advance policies and programs to protect and provide sustainable water resources. Through this undertaking, we have helped UWM understand its own water-use and catchment context as well as shared concerns in terms of water governance, water balance, water quality, Important Water-Related Areas (IWRA), and water-related risks. We have outlined criteria, indicators, and best practice actions for how UWM should manage water as well as how to engage in water stewardship beyond campus. The AWS Standard has not been implemented in a higher education setting yet and this effort is an opportunity for UWM to join AWS in international leadership in water stewardship policy and assessment. In addition, assessment information will be an indispensable part of UWM's current resilience efforts concerning water-related policy and planning.

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Section 1: Gather and Understand

1.1 Physical Scope

School of Freshwater Sciences

The School of Freshwater Sciences (SFS) is an extension of the University of Wisconsin Milwaukee Main Campus located within Milwaukee County in Wisconsin. It is a 6.95-acre site located off Greenfield Avenue in the City of Milwaukee (Figure 1). SFS has harbor access with the research vessel Neeskay. Potable water for the site is provided by Milwaukee Water Works treated at the Linwood Treatment Center located at 3000 N Lincoln Memorial Drive. Wastewater is treated from Milwaukee Metro Sewerage District (MMSD) through contract with Veolia at Jones Island Water Reclamation Facility located at 700 E Jones St in Milwaukee Wisconsin. Watershed for the facility is contained within the HUC 12-040400030606 boundary and is 975 acres. Watershed is primarily a combined sewer system with some Green Infrastructure (GI) near the harbor discharging directly to the harbor. There are multiple Best Management Practice (BMP) facilities within the watershed including green roofs, bioswales, raingardens, and permeable pavers.

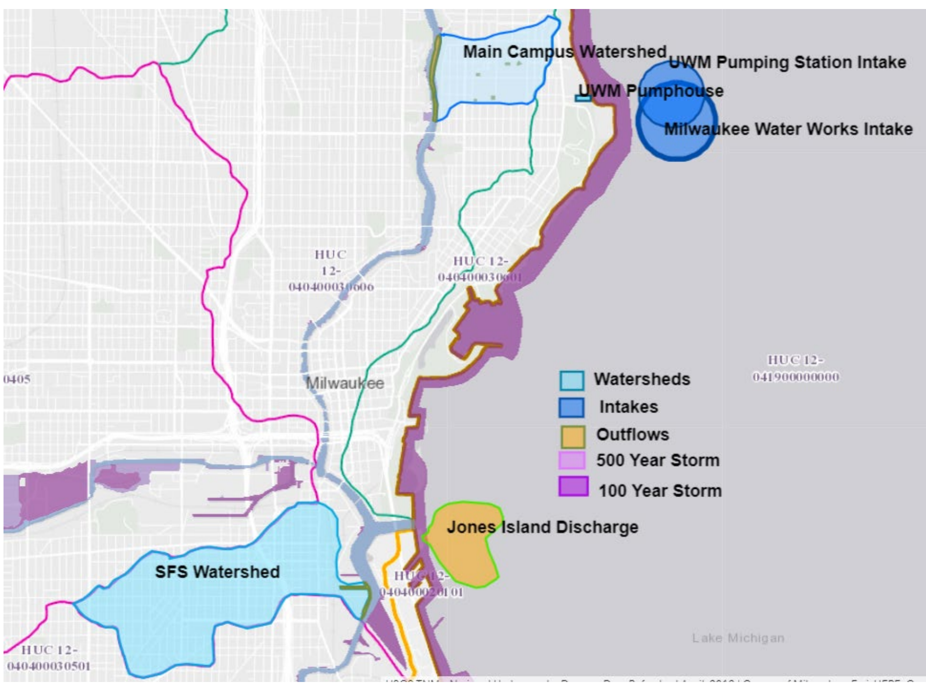


Figure 1. Watersheds were delineated using USGS topography maps as guidance and verified using 2015 LIDAR imagery.

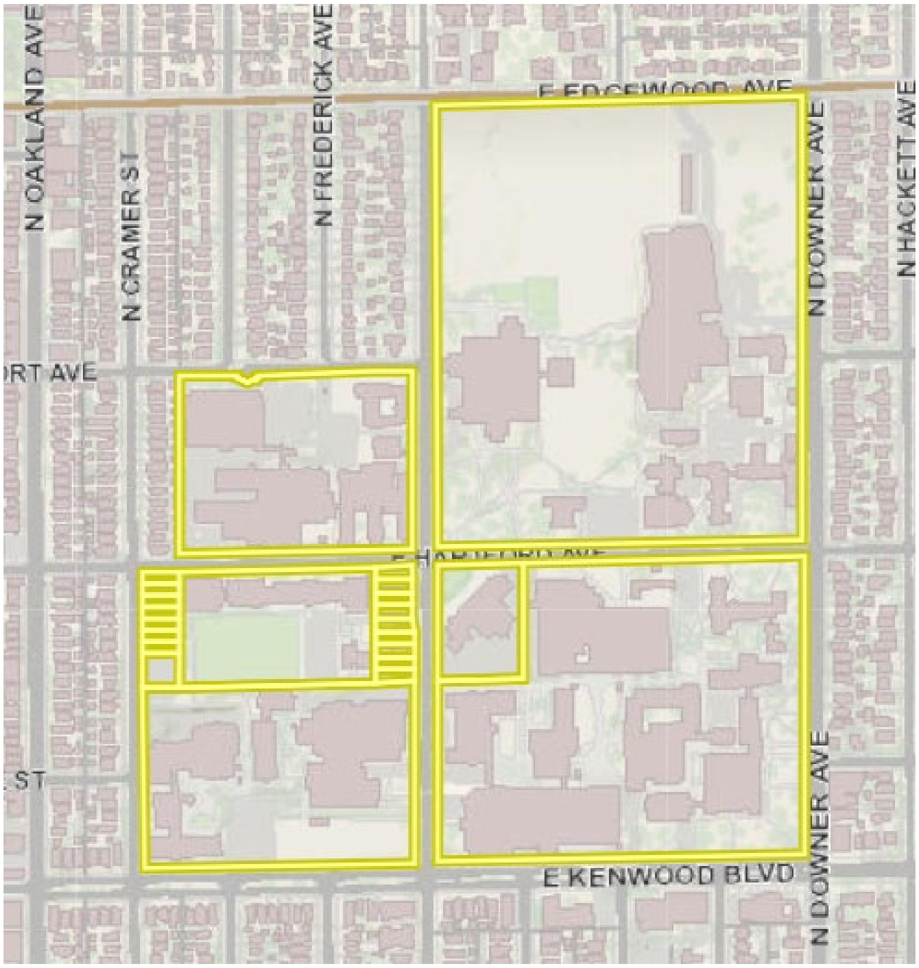


Figure 2. University of Wisconsin Milwaukee – Main Campus Quadrants

University of Wisconsin Milwaukee – Main Campus

The University of Wisconsin Milwaukee is part of the University of Wisconsin System and is located within Milwaukee County in Wisconsin. The Main Campus is a 103.79-acre site with multiple buildings located on the East Side of the City of Milwaukee. Potable water for the site is provided by Milwaukee Water Works treated at the Linwood Treatment Center located at 3000 N Lincoln Memorial Drive. Non-potable water used for cooling is provided through a campus-owned pumping site located at 3230 E Kenwood Blvd in Milwaukee Wisconsin. Wastewater is treated from Milwaukee Metro Sewerage District (MMSD) through contract with Veolia at Jones Island Water Reclamation Facility located at 700 E Jones St in Milwaukee Wisconsin. Watershed for the facility is contained within the HUC 12-040400030606 boundary and is 335.2 acres. Watershed is primarily a combined sewer system with some county owned storm sewer near the Milwaukee River discharging directly to the Milwaukee River. There are multiple Best Management Practice (BMP) facilities within the watershed including green roofs, bioswales, and raingardens. See Appendix for Map.

1.2 Stakeholders

1.2.1 &1.2.2 Stakeholders and their Water-Related Challenges

Stakeholder identification process

The Water Stewardship Plan was authored in the context of a graduate-level practicum in the School of Freshwater Sciences. Six master's students took part in the course. To identify stakeholders, our team brainstormed water-related entities, community organizations, businesses, and residential areas in proximity to our campuses that may share water-related challenges or be affected by campus practices. From this initial list, stakeholders were chosen because they met one or more of the following criteria

- The stakeholder plays a regulatory role in the water sector in the catchment;
- The stakeholder is involved in water-related public advocacy or outreach in the catchment;
- The stakeholder has knowledge of the water-related concerns of marginalized populations within the catchment such as racial or ethnic minority groups, indigenous communities, and people of low socioeconomic status;
- The stakeholder can speak to the water-related concerns of businesses and residents within the catchment;
- The stakeholder is actively involved in restoration efforts of water resources in the catchment;
- Stakeholder had avenue of influence on UWM;
- UWM had a level of influence on stakeholder;

After identifying potential stakeholders for each campus, we rated them as top-tier and bottom-tier stakeholders based on their influence and involvement. Team members were assigned entities to reach out to for further engagement to evaluate interest, influence, and to better understand their water-related concerns and challenges. All stakeholder interactions and inputs were documented. After evaluating the relevance and priority within our catchment, stakeholder concerns were addressed in our plan.

Stakeholder Contact and Categorization

Each stakeholder was asked to identify water-related challenges in the catchment. Contact with stakeholders is documented in the attached Stakeholder Communication Log.

To help make a judgement on the university's potential to influence water stewardship in the catchment and to drive decision making on future stakeholder outreach, each stakeholder was scored on level of interest, stakeholder's level of influence on UWM, and UWM's level of influence on the stakeholder based on the following rubrics (Table 1 & 2):

Table 1. Stakeholder Level of Interest Rubric

0	1	2	3	4	5
No response after repeated attempts to contact, or stakeholder declined to answer questions	Stakeholder declined further involvement after single conversation about water-related challenges	Stakeholder provided some responses, but contact was challenging	Stakeholder provided helpful responses	Stakeholder provided in-depth responses and expressed enthusiasm about the project	Stakeholder provided in depth responses, and has desire to be involved in future iterations of planning

Table 2. Stakeholder Level of Influence Rubric

For the purposes of this rubric, the entity doing the influencing is referred to as "Party A" and the entity being influenced is referred to as "Party B."

0	1	2	3	4	5
No interaction	Party B is aware of party A's activities	Party B actively keeps abreast of party A's activities	Activities of Party A play a partial role in driving decision making of Party B on an operational level	Activities of Party A drive decision making of Party B on an operational level	Activities of Party A drive decision making at highest levels of Party B

Several stakeholders were identified for both the University of Wisconsin Milwaukee's Main Campus and the School of Freshwater Sciences. Along with each stakeholder, their level of interest, level of influence, level to be influenced, identified water-related challenges, and a description about their role as a stakeholder are identified (Table 3 & 4).

Table. 3 List of Stakeholders—School of Freshwater Sciences

Stakeholder	Level of interest (1-5)	Stakeholder's level of influence on UWM (1-5)	UWM's level of influence on stakeholder (1-5)	Water-related challenges	Description
Milwaukee Metropolitan Sewerage District	5	4	2	• Stormwater management Pollution • CSO	MMSD is the regional wastewater governing body

				• EDC discharge/Medicine Collection • Backup reductions • HazMat collection	
Milwaukee Water Works	N/A	N/A	N/A	N/A	MWW supplies drinking water to Milwaukee and several surrounding communities
Harbor District, Inc.	5	4	4	• Industrial runoff • Salt runoff • Direct discharge • Site specific solutions • Soil leaching • Outdoor storage • Ballast water discharge • Dredging • Railroad runoff and lack of regulation	Non-profit organization located on site and working to revitalize the economic, environmental, and social aspects of Milwaukee's Harbor.
Milwaukee Riverkeeper	N/A	N/A	N/A	N/A	A nonprofit whose mission is science-based advocacy for swimmable, fishable rivers in the Milwaukee region.
Milwaukee Water Commons	3	3	1	• Stormwater management • Urban flooding • Water quality/pollution • Community Education • Urban flooding • Water quality • Water pollution	A nonprofit working to catalyze Milwaukee as a model water city

				• Community education	
Wisconsin Department of Natural Resources	3	3	1	• Phosphorus pollution	The state governing body for environmental protection
Sweet Water	4	3	1	• Cooperation among water leaders • High quantity of Impervious surfaces • Lack of green spaces in Milwaukee • Lack of pooled funding/grants	Also known as the Southeastern Wisconsin Watershed Trust, a nonprofit working to bring diverse partners together and provide leadership and innovation to restore Greater Milwaukee watersheds

Table 4. List of Stakeholders—UWM Main Campus

Stakeholder	Level of interest (1-5)	Stakeholder's level of influence on UWM (1-5)	UWM's level of influence on stakeholder (1-5)	Water-related challenges	Description
Milwaukee Metropolitan Sewerage District	5	4	3	• Stormwater management Pollution • CSO • EDC discharge/Medicine Collection • Backup reductions • HazMat collection	MMSD is the regional wastewater governing body
Milwaukee Water Works	N/A	N/A	N/A	N/A	MWW supplies drinking water to Milwaukee

					and several surrounding communities
Village of Shorewood	N/A	N/A	N/A	N/A	Main campus is bounded on the north by this suburban community
Urban Ecology Center	5	3	3	• Flooding • Milwaukee River health • Hardscape	Non-profit organization located near catchment and dedicated to connecting people and communities to each other and to their green spaces
Oak & Loc Business Improvement District	1	1	2	• High quality municipal water supply is critical, but a high level of trust exists between businesses and MWW • Concern about flooding at Oakland Ave. And Edgewood Ave. but is not critical currently.	A city-designated organization of business owners located southwest of campus on a main commercial street
UWM Student Conservation Club	N/A	N/A	N/A	N/A	UWM student campus led group located on the site

Murray Hill Neighborhood Association	5	2	3	• Snow buildup • Sinkholes • Floods/sewer backups • Salting of University property • Lead in old pipes • Keeping Lake Michigan free of debris and algae • High costs of managing water resources • Perception of crime or lack of safety around urban IWRAs (lakefront and river) prevent neighborhood residents from visiting these places	Neighborhood group located in the catchment focused on improving the neighborhood and addressing community concerns
Cambridge Woods Neighborhood Association	5	2	3	N/A	A neighborhood association located directly west of main campus

Milwaukee River Keeper was interested in communication about the water stewardship plan for UW-Milwaukee. However, conflicting schedules hindered a meeting between parties. Contact should be established and continued in the future.

Milwaukee Water Works was contacted. No reliable response or contact was made between parties. However, due to their involvement in Milwaukee's drinking water resources, it was decided that contact should be pursued and established in the future.

Furthermore, table components containing N/A should be contacted and pursued in the future.

Special Consideration for Indigenous Communities

> *"We acknowledge in Milwaukee that we are on traditional Potawatomi, Ho-Chunk and Menominee homeland along the southwest shores of Michigami, North America's largest system*

of freshwater lakes, where the Milwaukee, Menominee and Kinnickinnic rivers meet and the people of Wisconsin's sovereign Anishinaabe, Ho-Chunk, Menominee, Oneida and Mohican nations remain present."

- Statement by the Electa Quinney Institute for American Indian Education at the University of Wisconsin-Milwaukee.

The University of Wisconsin Milwaukee contains two gardens of native plants that are maintained by Indigenous student groups:

I. *Bolton Hall Indigenous Garden*

A garden of plants indigenous to the region, maintained by the American Indian Student Association, the Office of American Indian Student Services, and Electa Quinney Institute for American Indian Education.

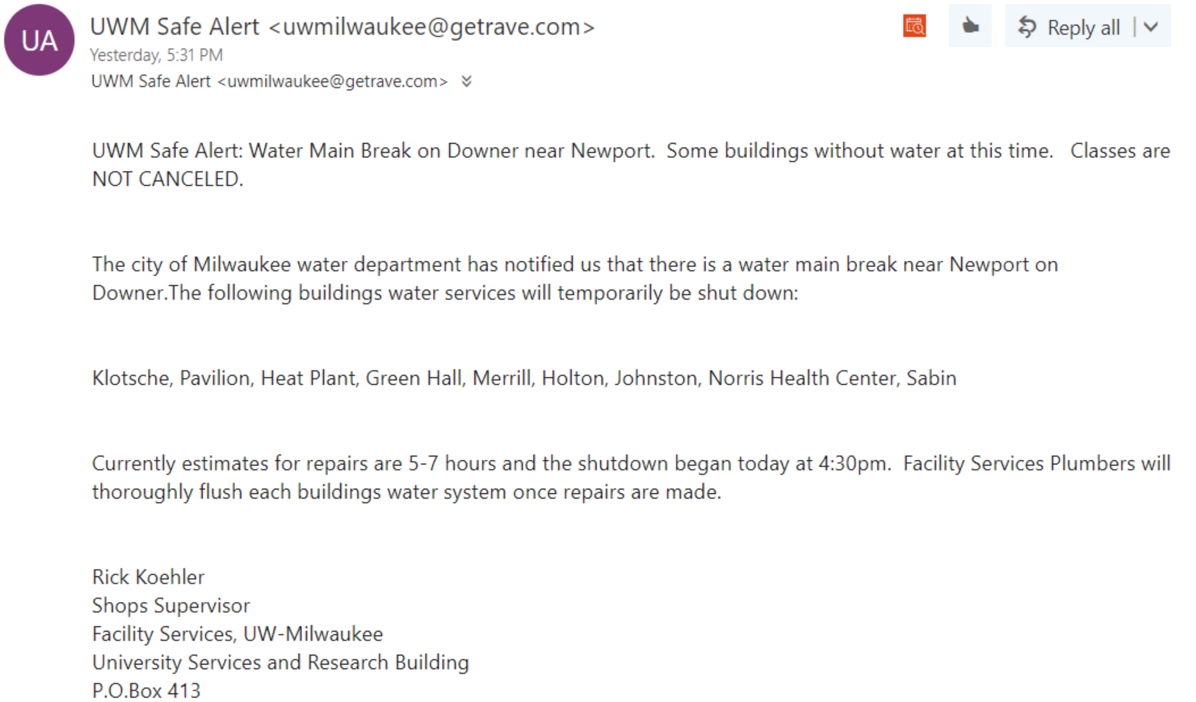
II. *Native Medical Plants Garden*

A garden of plants native to Wisconsin that are known to be used by First Nations in the region for traditional medicinal purposes. The garden is located outside the Electa Quinney Institute for American Indian Education.

1.3 Site Data

1.3.1 Water Stewardship and Incident Response Plans

Incident response plans are handled by the University Safety and Assurances office. In general, campus police are the first to be notified of any incident. Further action is taken by facilities and an assessment is conducted by the University Safety and Assurances office for insurance purposes. All students and staff are notified of any incidents and updates via a UWM Safe Alert email (Figure 3).


UWM Safe Alert <uwmilwaukee@getrave.com>
Yesterday, 5:31 PM
UWM Safe Alert <uwmilwaukee@getrave.com>

Reply all

UWM Safe Alert: Water Main Break on Downer near Newport. Some buildings without water at this time. Classes are NOT CANCELED.

The city of Milwaukee water department has notified us that there is a water main break near Newport on Downer.The following buildings water services will temporarily be shut down:

Klotsche, Pavilion, Heat Plant, Green Hall, Merrill, Holton, Johnston, Norris Health Center, Sabin

Currently estimates for repairs are 5-7 hours and the shutdown began today at 4:30pm. Facility Services Plumbers will thoroughly flush each buildings water system once repairs are made.

Rick Koehler
Shops Supervisor
Facility Services, UW-Milwaukee
University Services and Research Building
P.O.Box 413

Figure 3. Example of UWM Safe Alert Email

According to UWM's Laboratory Safety Coordinator Jennifer Herriges, who was met with on 4/3/19, all 500 UWM labs contain an electronic or hard-copy of a chemical master list and the corresponding information on safe handling, incident response plans, and proper disposal of chemicals and hazardous waste. This information is updated on a yearly or near yearly basis for each lab. Chemicals are properly stored on-site, some of which have locations that cannot be disclosed due to their sensitive nature.

Every lab worker is required to go through safety training relevant to their work. This includes a one-time chemical hygiene and lab conduct, yearly training on hazardous waste, as well as other trainings in custodial work and biohazards. All available training can be found on the UWM Safety and Assurances Safety and Health website (https://uwm.edu/safety-health/). Relevant programs and trainings are expanded upon below.

The Safety and Health Programs provide art/studio/shop, biosafety, chemical, emergency, and laboratory training. Included are proper chemical handling, storage, disposal, and spill response.

The Environmental Protection Program, as part of the Department of University Safety and Assurances, provides services in chemical recycling and waste management, hazardous materials management, underground storage tank monitoring, and local chemical emergency planning and response.

Environmental Protection Program Training

- Hazardous Waste Generator Training

- Hazardous Materials Shipping and Transportation Awareness Training
- Accepting Packages of Hazardous Materials
- Dry Ice Shipping
- Mercury Spill Clean Up
- Office Waste Training
- Spill Prevention Control and Countermeasures Training Program
- Laboratory Cleanout Training
- Universal Waste Generator Training

Biological Waste Handling Information

"The Institutional Biosafety Committee (IBC) is responsible for assessing risks and potential environmental impacts associated with activities involving biohazardous materials and making recommendations for the safe conduct of such studies. It also functions on behalf of the institution to ensure that campus activities involving biohazardous materials are performed in compliance with current policies and guidelines set forth by UWM, State of Wisconsin, Centers For Disease Control and Prevention (CDC), National Institutes of Health(NIH), and other regulatory agencies."

When working with any of the following, a biosafety protocol required to be filed and approved by the IBC as part of university and federal policies:

- Recombinant (transgenic) or synthetic DNA/ RNA materials, including human gene therapy, proteins, and enzymes of infectious biological agents.
- Microbes and disease-causing agents including bacteria, viruses, fungi, prions, protozoa, parasites, and their structural components.
- Large scale propagation consisting of a volume greater than 10L or more in one vessel.
- Human cells and cell culture, organs or tissues, or biological samples.
- Non-human cells and cell culture, organ or tissues, or biological samples that are infectious, potentially infectious, or recombinant.
- Animals (vertebrate and/ or invertebrate) that are recombinant (transgenic), exotic, and/ or grown in association with pathogens and/ or recombinant materials. This also includes arthropods that may be poisonous or illicit allergic reactions.
- Plants that are recombinant (transgenic), exotic, and/ or grown in association with pathogenic or recombinant microbes and/ or pathogenic or recombinant small animals (insects, etc.).
- Biological toxins (this does not include toxic chemicals or antibiotics).

1.3.2 Water Balance

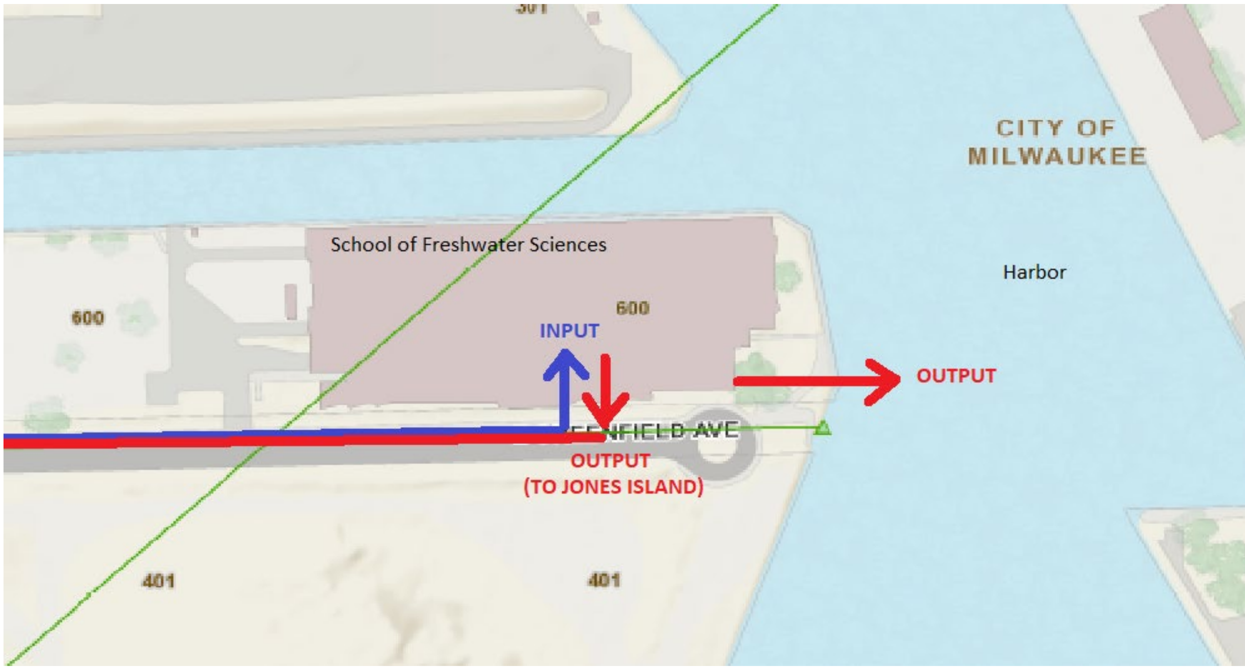


Figure 4. Map showing the input and output of water on the School of Freshwater Sciences campus.

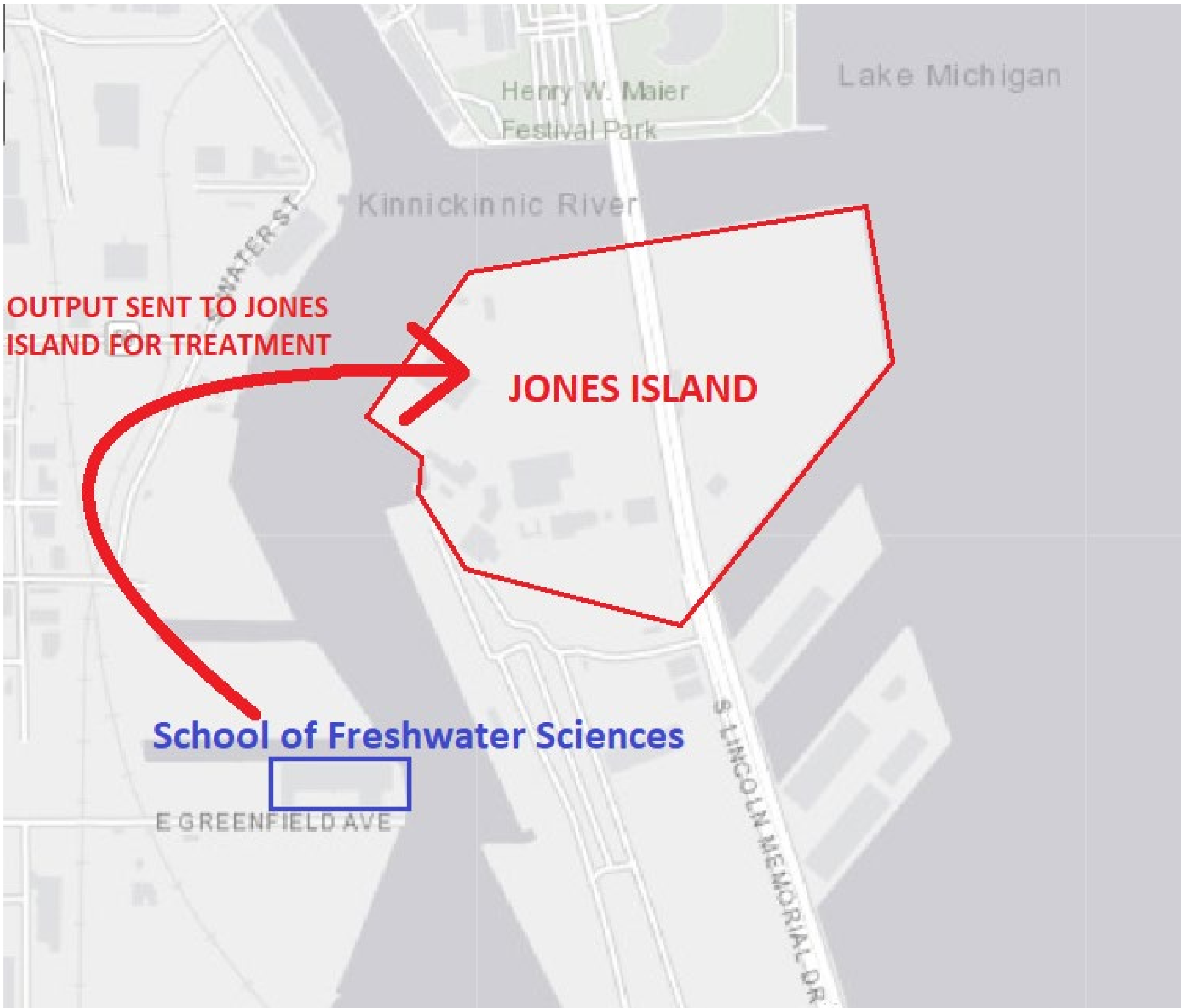


Figure 5. Map showing the location of Jones Island water treatment plant in relation to the School of Freshwater Sciences.

The UWM Main Campus has 6 cisterns with 4 of those being below ground with a total storage capacity of 55,710 gallons. These storage features have educational material placed outside to inform students and staff of the efforts to reduce flows into the combined sanitary sewer. These storage cisterns also provide water to be used for irrigation.

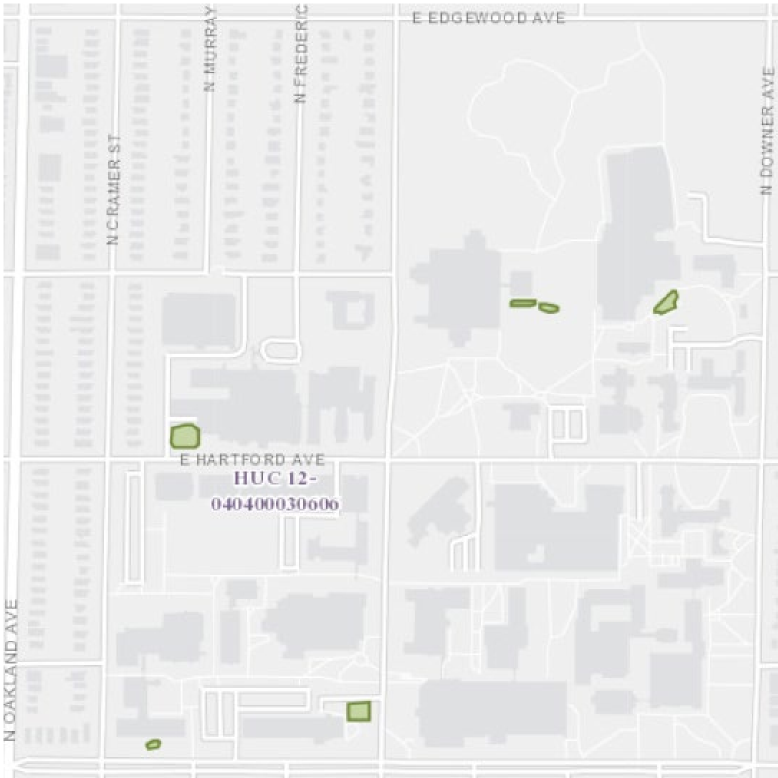


Figure 6. Milwaukee Cistern Locations Outlined in Green in the University of Wisconsin Milwaukee Main Campus Location.

1.3.3 Water Balance

Both the UW-Milwaukee Main Campus and School of Freshwater Sciences are situated near one of the greatest freshwater resources in the world. Public infrastructure for potable water supply and wastewater reclamation is highly sophisticated and well-funded when compared to less developed areas of the globe. However, there are several water-related challenges that pose a threat to UW-Milwaukee's water balance. According to the Wisconsin Initiative on Climate Change Impacts, Milwaukee is expected to become slightly wetter, with more frequent and more intense precipitation events. These changes will stress existing stormwater management infrastructure and could decrease already low rates of groundwater recharge, putting increased stress on Milwaukee River, Kinnickinnic River, and Milwaukee River Estuary ecosystems.

The annual variance in water use is of interest to UW-Milwaukee. UW-Milwaukee has already invested significant sums of money in water use efficiency measures, and policies put forth in the Water Stewardship Plan in Step 2 have the potential to continue to build on these efforts. Our analysis indicates that water-efficient fixtures installed on main campus may have helped to reduce water use rates by up to 25% compared to a 2005 baseline. The story of water use at SFS is more complicated. Despite relatively few users, SFS constitutes more than half of the University's annual water use because of water-intensive research activities. Significant changes to the educational program have taken place at SFS in the past decade, including a major building addition, changes to the educational program, and, in the past three years, the loss of multiple research labs. More study is required to further understand the causes in the changes in water use efficiency.

Water Balance

The following equation can be used to describe each site's water balance:

$$P + W_i + H_i = R + E + W_{eb} + W_{es} + H_e + \Delta S_g + \Delta S_c$$

where

P is precipitation

W_i is potable water supplied by Milwaukee Water Works

H_i is heat plant intake water

R is streamflow

E is evapotranspiration

W_{eb} is sewage discharged from buildings into municipal combined sewers

W_{es} is stormwater runoff discharged from impervious surfaces like rooftops, parking lots, and sidewalks into municipal combined sewers

H_e is heat plant effluent discharged to Lake Michigan

ΔS_g is the change in storage in groundwater

ΔS_c is the change in storage in cisterns

Precipitation: According to the Midwest Regional Climate Center, Milwaukee receives an average of 34.76 inches per year, with most of it falling in the spring and summer months as rain. SFS receives 8,779 centum cubic feet (CCF) of water as precipitation annually, while main campus receives 131,100 CCF.

This annual total does not present a major challenge to UWM. But the increased frequency and intensity of precipitation events could and do threaten stormwater conveyance systems on campus and regionally.

Potable Water supplied by Milwaukee Water Works: Treated potable water is supplied to the University through MWW's distribution system. This system is highly reliable. Despite occasional water main brakes, which are generally repaired by municipal and/or university staff within a matter of hours, service disruptions do not present a threat to water balance at UWM.

The volume of water used is driven by multiple factors, including the activities of students, staff, and faculty, the efficiency and usage levels of HVAC equipment, and, particularly at SFS, water-intensive research activities. Each of these factors are complex but are ultimately within the control of the University. Since 2005, SFS has used an average of 265,175 CCF per year, and main campus has used an average of 113,554 CCF per year. Annual variations in water usage rates are discussed further in the next section.

Because UWM uses a large volume of water, it is possible that Milwaukee Water Works could impose a maximum usage cap during times of peak demand. There are no such rules in place now, though we note it here because it could become a consideration in the future.

Heat plant intake and effluent: UWM uses a pumping station to withdraw water from Lake Michigan which is used for heating and cooling at the heat plant on Main Campus. It is a non-contact closed system, so effluent should theoretically match plant intake, as expressed by the following equation:

$$H_i = H_e$$

In practice, however, we expect some consumptive use.

Streamflow: No streams flow through either site, despite the proximity to the Inner Harbor and Milwaukee River. Any precipitation that falls on the sites flows into storm sewers, infiltrates to groundwater, or is returned to the atmosphere through evapotranspiration.

Evapotranspiration: This factor is difficult to measure and is not considered an important factor in this report. Despite large volumes of water evapotranspiring from the campus, particularly from natural areas like Downer Woods, it does not contribute directly to the water-related challenges identified here and is therefore omitted from our consideration.

Sewage discharge: Virtually all the water that is discharged into municipal sewers originates from the municipal supply. At the time of this writing, no rainwater recycling for indoor use is practiced on a significant scale at either site. Therefore, the municipal water balance can be expressed by the following equation:

$$W_i = W_{eb} + C + D$$

where

> C is consumptive use, or water that is supplied to buildings but is not returned to the sewer system.
>
> D is water directly discharged into waterways.

Main campus has no direct discharges, so any difference between water supplied and water discharges is assumed to be consumptive use. Since 2011, when tracking of these data began, the main campus has averaged 3.4% consumptive use.

SFS directly discharges a large portion of its water to the Milwaukee Harbor. While it is assumed that some small percentage of water is lost to consumptive use, this cannot be differentiated from discharges to the harbor, so any difference between water supplied and sewer volume is assumed to have been discharged into the harbor. Between January 2012 and March 2015, SFS discharged an average of 24,200 CCF into the harbor monthly. 91.4% of water supplied was discharged into the harbor.

Between April 2015 and October 2018, SFS discharged an average of 21,300 CCF into the harbor monthly, but 99.9% of water supplied was discharged into the harbor. This abrupt change to less water use but more of it being discharged to the harbor can be explained by the cessation of research activities that discharged water into the sewer system.

Because SFS discharges such a large volume and large percentage of its water to the harbor, more study into this area is necessary.

The spreadsheet file "20190312AWS_WaterTotalsDraft1.xls" contains data on this section.

Stormwater runoff: In 2013, UWM researchers published "UWM as Zero-Discharge: Pondering Net-Positive Stormwater Infrastructure," which estimated that during a 100-year storm event, main campus has a stormwater runoff rate of 120 cubic feet per second. It also estimated that before any European settlement occurred, the same magnitude of storm would have produced 30 cubic feet per second of runoff. UWM can attempt to return to this pre-settlement hydrology by decreasing impervious surfaces, increasing stormwater storage capacity, and increasing the amount of deep-rooted native vegetation on campus.

Change in storage in cisterns: As noted in 1.3.2, the cisterns on main campus have a storage capacity of 55,710 gallons, or 74.47 CCF. They increase the volume of water stored on campus and reduce peak flows, but since no active controls or monitoring exist, their impact is modeled rather than measured, and is discussed. Optimizing the performance of green infrastructure in general is a growing field of research and could be undertaken by engineering or freshwater sciences students at UWM.

Change in storage in groundwater: This factor has not been measured and is difficult to estimate. Multiple studies have shown that the effects of urbanization such as the increase of impervious surfaces, the replacement of deep-rooted native vegetation with turf grass, and soil compaction reduce groundwater recharge. These factors can cause increased runoff during major rain and snowmelt events, leading to flooding and increased erosion in streams and rivers. Conversely, river levels tend to drop during dry periods due to a decrease in groundwater recharge. The University has undertaken multiple efforts to increase pervious surfaces and plant more native plants and trees. The effects of these efforts are difficult to quantify and could be the subject of further study.

Annual Variations in Water Use Rates

Water usage was collected from municipal water bills for each building at both sites from 2005 to 2018. The amount of water used at each site varies considerably from year to year. Units are in CCF, or centum cubic feet.

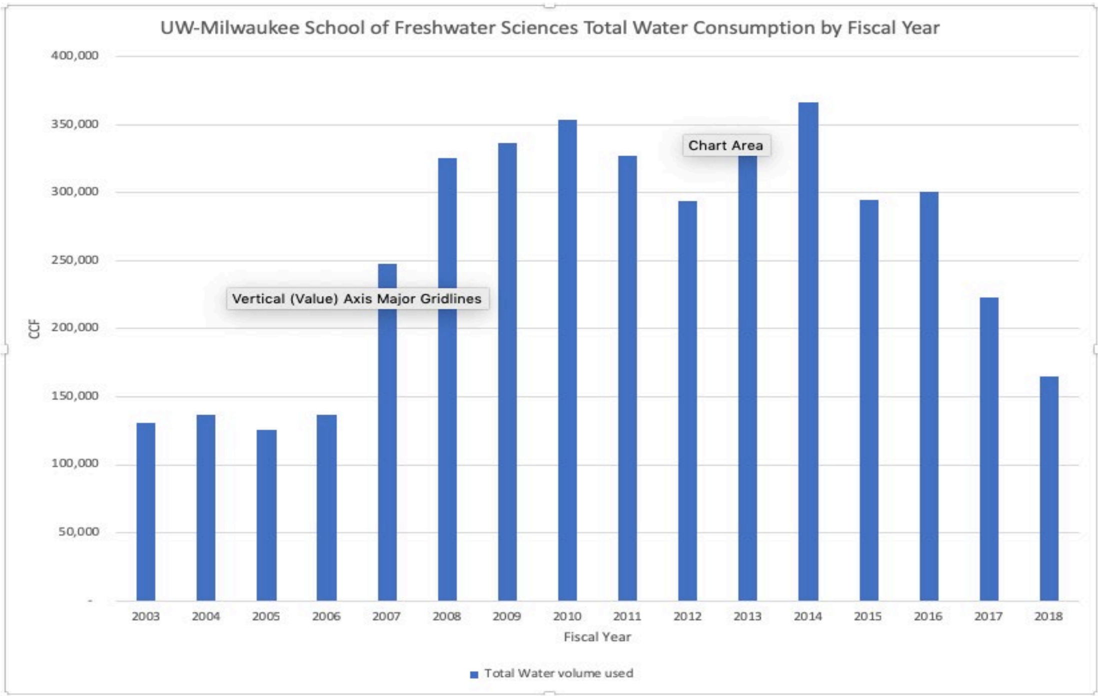


Figure 7. Water Consumption – School of Freshwater Sciences

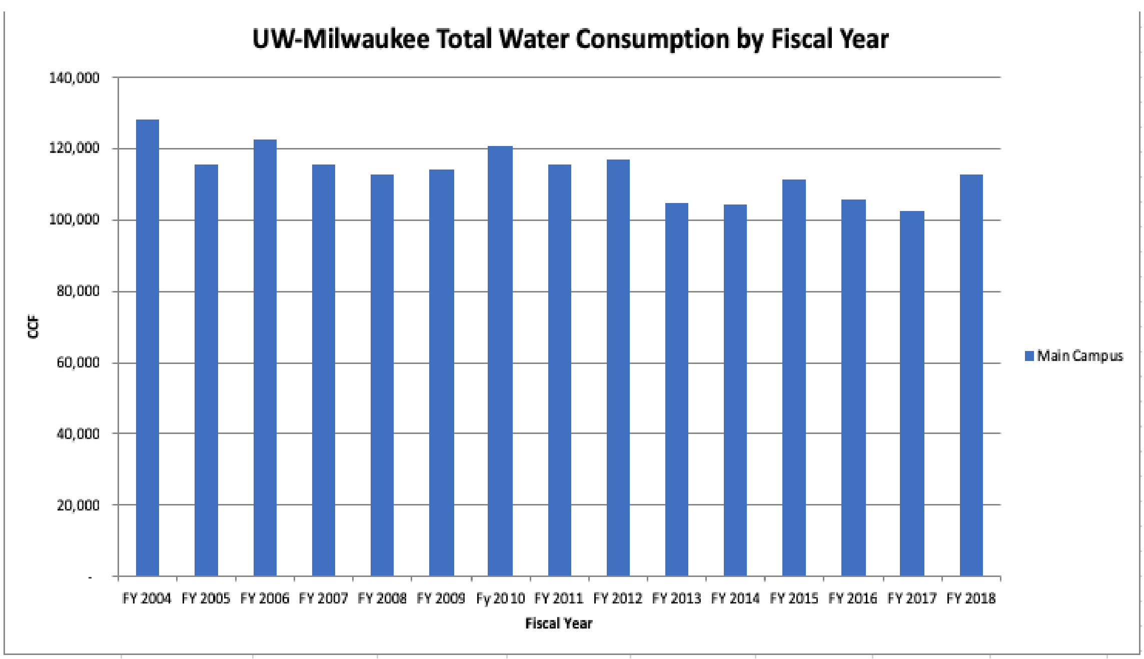


Figure 8. Water Consumption – University of Wisconsin Milwaukee Main Campus

Over the time period from 2005 to 2018, the number of users of the water has also changed. Staffing levels and student population fluctuated. The proportion of resident students at main campus did not stay constant; a student living on campus generally uses more water on site that a student living off campus. To account for these changes, "weighted campus user" (WCU) is used. WCU is a measurement of an institution's population that is adjusted to accommodate how intensively certain community members use the campus. The figure is used to normalize resource consumption and environmental impact figures in order to accommodate the varied impacts of different population groups. For example, an institution where a high percentage of students live on campus would likely witness higher water consumption figures than otherwise comparable non-residential institution since students' residential impacts and consumption would be included in the institution's totals.

Any of the categories that we don't have (e.g. FTE of students enrolled exclusively in distance education, employees residing on site) are ones that UWM doesn't have a good tracking system in place for. So while the data are not perfect, it provides a picture of how water-efficient UWM is on a per-person basis.

The formula is listed below:

$$\text{Weighted campus users} = (A + B + C) + 0.75\,[\,(D - A) + (E - B) - F\,]$$

A = Number of student residents on-site
B = Number of employee residents on-site
C = Number of other individual residents on-site and/or staffed hospital beds
D = Total full-time equivalent student enrollment
E = Full-time equivalent of employees (staff + faculty)
F = Full-time equivalent of students enrolled exclusively in distance education

Additionally, multiple new buildings have been constructed on campus since 2005. The SFS building underwent a major expansion. Multiple facilities have been renovated and repurposed. New equipment and lab facilities may have a greater impact on water use than the behavior of individuals, so we also examined water use on a gross square foot (GSF) basis. GSF includes buildings but not parking lots, since their water use footprint is minimal.

As measures of water use efficiency, CCF/WCU and CCF/GSF provide an important picture of how UWM uses water. One of the most obvious trends is that SFS uses far more water than main campus per person or per area due to the aquaponics labs.

To understand the annual variation in water use per person, the percent change versus 2005 levels in CCF/WCU and CCF/GSF are graphed below (Figure 9 & 10).

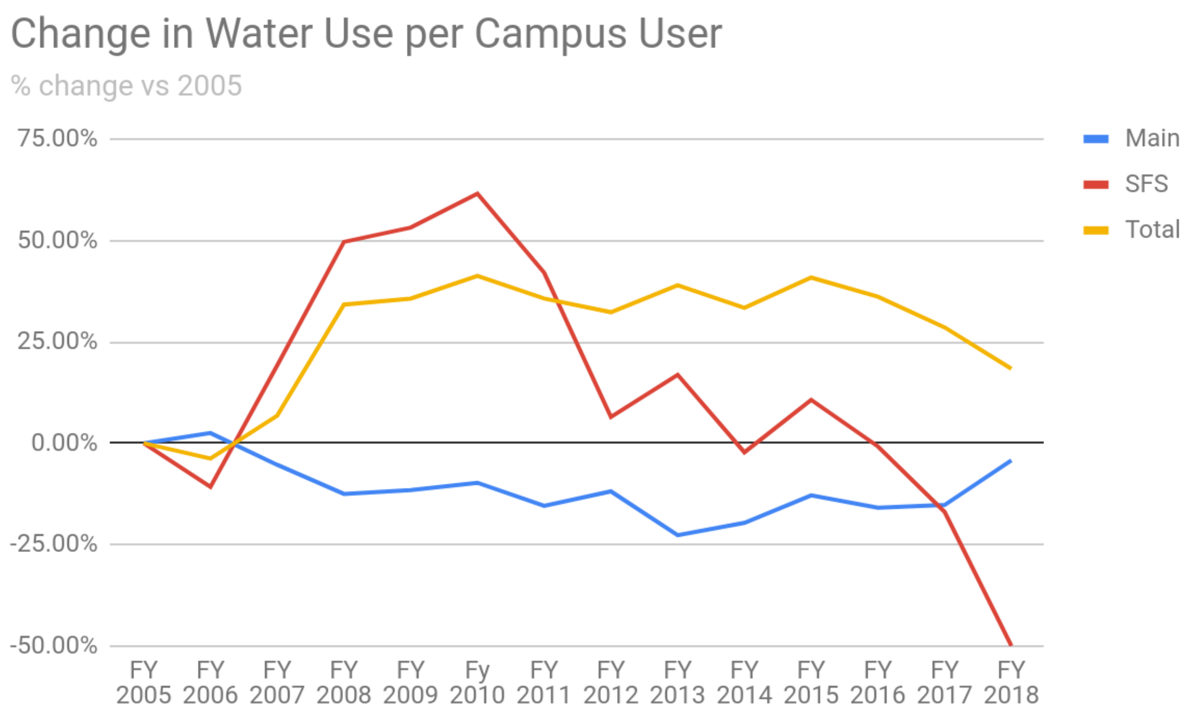


Figure 9. Change in Water Use – School of Freshwater Sciences

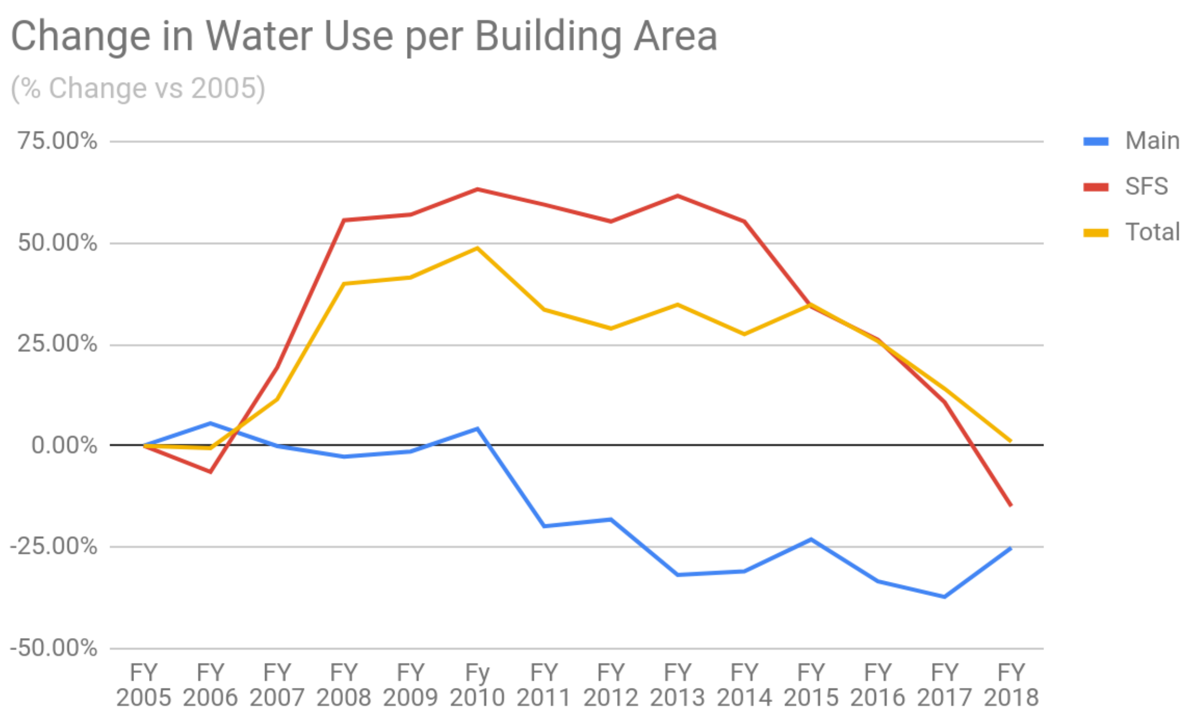


Figure 10. Change in Water Use – University of Wisconsin Milwaukee Main Campus

By both measures, main campus shows significant efficiency gains between 2006 and 2011. For most of this time period, SFS has been less water efficient than in 2005, apart from 2017 and 2018, when its major efficiency gains were made. It should be noted that 2005 may not be the best baseline of comparison for SFS, since the program underwent major changes in the early 2010's. It should also be noted that, when data from the two sites is combined, UWM has not made water efficiency gains since 2005.

1.3.4 Water Quality

Quantify the quality of the site's water sources

Both the main campus of the University of Wisconsin Milwaukee and the Freshwater Sciences building receive their water sources from Milwaukee Water Works (MWW). Milwaukee Water Works is responsible for supplying the city of Milwaukee, and the greater Milwaukee area, with clean drinking water derived from Lake Michigan. MWW is a government run utilities operation. They are a national leader in providing high quality, healthful drinking water to their service area customers. As such, they publish transparent data on their treatment process and water quality testing results. The 2018 Consumer Confidence Report published by MWW quantifies both site's water sources water quality, pages 4-7. It is in the documents section and verifies compliance with water quality laws and standards.

Quantify the quality of the site's provided waters

This category is not applicable to either site.

Quantify the quality of the site's effluent-effluent quality should be included in our discharge permits

Main Campus: Water discharged from the site's buildings discharge into the combined sewer regulated by the Milwaukee Metropolitan Sewerage District and are then treated by MMSD at their Jones Island treatment facility, see 1.1.1. Due to permitting requirements, effluent data must be kept for the sites pump house, as it discharges heated water back into Lake Michigan. The full permit accompanied by testing results of its effluent, are included in the documents section.

School of Freshwater Sciences: Due to permitting requirements, effluent data must be kept for this site. Rob Paddock, the site facilities manage, compiles this information and files the required permit for water discharged from the building. Discharge permits have been required of the site since it became a research facility in 1973, and compliance has been met hereafter. MMSD also conducts water sample testing of the waste the labs produce. The three most recent results of these tests are included in the documents section. Untreated stormwater is discharged directly into the harbor-see 1.1.1.

Quantify the quality of the site's receiving water bodies

Main Campus: As outlined from indicator 1.1.1, the wastewater treatment provider for the main campus site is the Jones Island treatment facility. The Jones Island treatment facility treats and discharges receiving sewage water into Lake Michigan. Water quality data for Lake Michigan before it is treated and distributed from Milwaukee Water Works is available in the 2018 Lake Michigan Source Water Quality report published by Milwaukee Water Works, pages 1-12, and located in the documents section.

Beyond the scope of the sewer lines serviced by the Jones Island treatment facility, the Main Campus site also has discharge points that outflow into the Milwaukee River. Water quality data for the Milwaukee River is in the 2016 annual summary report, pages 10-16, published by MMSD and located in the documents section. This report includes several parameters dictating water quality such as dissolved oxygen, fecal coliform, PH, conductance, nutrient levels, total suspended solids, and turbidity.

School of Freshwater Sciences: As outlined from indicator 1.1.1, the wastewater treatment provider for the Fresh Water Science Building site is the Jones Island treatment facility. The Jones Island treatment facility treats and discharges receiving sewage water into Lake Michigan. Water quality data for Lake Michigan before it is treated and distributed from Milwaukee Water Works is available in the 2018 Lake Michigan Source Water Quality report published by Milwaukee Water Works, pages 1-12, and located in the documents section.

Beyond the scope of the sewer lines serviced by the Jones Island treatment facility, the Fresh Water Science Building site also has discharge points that outflow into the Milwaukee Harbor. Water quality data for the Milwaukee Estuary and Milwaukee Harbor is located in the 2016 annual summary report, pages 27-36 published by MMSD and located in the documents section. This report includes several parameters dictating water quality such as dissolved oxygen, fecal coliform, PH, conductance, nutrient levels, total suspended solids, and turbidity.

Documents

- MWW 2018 Consumer Confidence Report https://city.milwaukee.gov/ImageLibrary/Groups/WaterWorks/Consumer-Confidence-Reports/2018ConsumerConfidenceReport.pdf
- MWW 2018 Lake Michigan Source Water Quality https://city.milwaukee.gov/ImageLibrary/Groups/WaterWorks/files/Annual-Reports/2018-CCR-docs/2018LakeMichiganSourceWaterQuality.pdf
- 2016 Surface Water Quality Annual Summary Report-MMSD https://www.mmsd.com/application/files/6115/0058/3181/2016_Annual_Summary_Report.pdf

1.3.5 Pollution Sources

The University of Wisconsin—Milwaukee's main campus is nestled between the Milwaukee River and Lake Michigan, while the School of Freshwater Sciences is located near the confluence of the Milwaukee, Kinnickinnic, and Menomonee Rivers, adjacent to the Milwaukee Harbor. Lake Michigan, Milwaukee River, and the harbor are most susceptible water bodies to pollution from UWM based on proximity and topography. Potential pollution includes non-point sources like stormwater runoff, fertilizers, herbicides and road salt, and point sources like laboratories and cleaning operations.

Stormwater Runoff

Stormwater runoff is a high priority for UWM. The Stormwater Master Plan that began in 2006 set a target for UWM to be a zero-discharge zone. While the target hasn't been met, efforts to reduce runoff continue to prevent sewer system overflows and reduce pollution.

De-Icing Salt Applications

Chloride pollution from road salt application during winter months of a high concern for the City of Milwaukee. While UWM must continue to use de-icing methods like salt applications to keep sidewalks and roadways safe, a large effort is made to reduce the amount of salt needed. Applying brines, manually shoveling and plowing before salt application all help reduce the amount of salt needed on surfaces. Grounds workers are also trained on appropriate salt amounts to disburse on an area, so over-salting is less likely to occur.

Landscaping Fertilizer and Herbicide Use

UWM currently uses minimal fertilizer and herbicide applications. Fertilizers are mainly used when growing new turf, and herbicide is rarely used for dandelion control. Pollution from these sources is not a large concern as noted by the Office of Sustainability, but still exists on a small scale.

Laboratory Practices

Chemical Use

According to UWM's Laboratory Safety Coordinator Jennifer Herriges, who was met with on 4/3/19, all 500 UWM labs contain an electronic or hard-copy of a chemical master list and the corresponding information on safe handling, incident response plans, and proper disposal of chemicals and hazardous waste. This information is updated on a yearly or near yearly basis for each lab. Chemicals are properly stored on-site, some of which have locations that cannot be disclosed due to their sensitive nature. Within the next year, UWM hopes to streamline the process of updating and monitoring chemical inventories through transitioning to a computer software.

All laboratory workers go through training sessions relevant to the hazards they are working with. With this training, workers know the necessary procedures to properly dispose of chemicals.

Aquaculture Labs

At the School of Freshwater Sciences, aquaculture labs cycle water through large tanks that breed fish. Currently, the water that is released meets all standards to be released directly into the harbor without treatment. This is potentially a pollution source, and UWM is looking into methods to reduce the TSS from these lab discharges. All hazardous waste produced by these labs is properly disposed of. Hazardous waste shipments occur on a regular basis, and reminders are sent out via email to students and staff.

Example of hazardous waste shipment email:

S Sfs-students <sfs-students-bounces@uwm.edu> on behalf of Patrick J Egan <eganp@uwm.edu>
Fri 12/14/2018, 12:11 PM
glwi-bldg

Reply all

Flag for follow up. Start by Sunday, May 05, 2019. Due by Sunday, May 05, 2019.

Dear Water Waste Generators,

There will be a hazardous waste shipment on Wednesday December 19th from 8:30am to 11:00am. This is the day I will pick up frozen fish carcasses for disposal. If you have any fish for disposal, please call or email me (414-550-9190, eganp@uwm.edu) before that date. Please have someone available to show me where the fish can be picked up, and what they are contaminated with. Also, please try to label the fish with approximate concentration of the contaminate, and separate out the mercury contaminated fish.

And, just as a reminder, here is the link to request a hazardous waste pickup:
http://www4.uwm.edu/usa/ep/request.cfm

Routine hazardous waste pickups usually occur on Tuesday afternoons, but I am flexible if that time/day doesn't work for you. Just let me know!

Our Hazardous Waste Training is online for your convenience. New and current hazardous waste generators are required to take the training annually. Here is a link to the training:
http://www4.uwm.edu/usa/ep/training/hazardous-waste-generator-training.cfm

PJ

PJ Egan, CHMM
Waste Management Specialist Senior
Department of University Safety and Assurances

University of Wisconsin-Milwaukee
P.O. Box 413, Engelmann Hall 270
Milwaukee, WI 53201
Phone: 414-550-9190
Fax: 414-229-6729
www.safety.uwm.edu

****For online training on Hazardous Waste and other related topics, please visit http://uwm.edu/environmental-protection/training/

Figure 11. Example of Hazardous Waste Shipment Email

Green Cleaning Practices

"The three elements of sustainability, being ecologically sound, socially just, and economically viable, are easily applied when a green cleaning program is implemented. It is not just about simply switching out products but also about reviewing and changing processes. Savings are garnered and the quality of work improves with new procedures."

– UWM Office of Sustainability

Ecologically Sound

- Installing low-maintenance flooring to reduce cleaning needs
- Utilizing machines that require no chemical product at all, but rather ionize a water molecule to pick up dirt
- Cleaning with biodegradable products, with little off gassing
- Using equipment that uses less water, to do the same job, or better

Socially Just

- Eliminating custodians' exposure to toxic chemicals
- Using less water or chemical, means less lifting and trips to the water closet to have to refill
- Keeping public waterways free of unnecessary chemicals

Economically Viable

- Using concentrated cleaners reduces packaging and over-purchasing
- Green Seal Certified cleaners, that tend to require less product and new procedures, have shown to save money within the first year of use

Cleaning Industry Management Standard (CIMS) Green Building Certified

The CIMS third party verified cleaning program began at UWM in 2013. Changes were made, building by building, to upgrade cleaning dispensers with measured release of Green Seal Certified cleaners, the addition of reusable microfiber cloths, and investing in efficient equipment. The CIMS program also standardizes cleaning expectations, indoor air quality, and campus policy. To date UWM has gone from 19 cleaners down to 4. Full Certification is expected by 2017.

Sourced from the Office of Sustainability

1.3.6 IWRA's

University of Wisconsin Milwaukee – Main Campus

Downer Woods

The Downer Woods Natural Area is an 11.1-acre fenced forest on the UWM campus, which became part of the UWM Field Station in the Spring of 1998. Prior to 1998, the woods were not managed as a natural area, and the vegetation bore little resemblance to that of the mature beech-maple forest which must have once occupied the site. Perhaps the most immediately apparent feature of the plant community when the Field Station assumed responsibility for its management was a dense shrub layer of non-native buckthorn and honeysuckle. Downer woods was chosen as an important water related area because it is a large natural area in an urban environment and the lack of natural areas in our catchment area has caused increased storm water flooding.

After the Field Station began managing the site, they started controlling exotic species, constructed a formal trail system, established a permanent grid system and sampled the vegetation of the forest. Now that the thicket of non-native shrubs has been removed and adequate trails are provided, Downer Woods is being used extensively by neighbors and students for enjoyment of the natural area.

The water related risk to this site is the potential for excessive flooding due to its proximity to the Milwaukee River. Excessive flooding to this Natural Area would degrade the natural habitat that the area is currently being managed for. The natural flora and fauna would not be able to service in the capacity that it is currently if flooding were to exceed abnormal levels for a prolonged period.

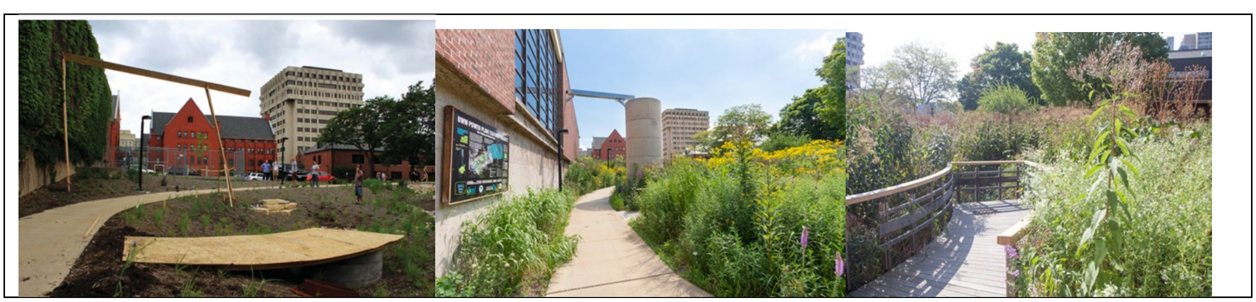
The current status of this IWRA is good. It is currently being managed by staff and students as a native landscape, which aids in the population of native plants and animals. This native landscape helps to reduce storm water runoff and erosion.

Spiral Gardens

The Spiral Garden is the centerpiece of a 41,000-square-foot zone, nestled among the Klotsche Center, Norris Health Center and the physical plant. Construction began in 2009 and completed in 2014. It includes a 358-linear-foot system of vegetated bio-swales, sunken gardens lining the parking lot and a 5,000-square-foot garden containing deep-rooted native plants that descends in elevation to form a kind of giant natural bathtub. In 2013, two 20-foot cisterns were added and together can hold 12,000 gallons of runoff diverted from the roof of the physical plant. In 2017, a new stone weir wall and a raised drain on the deepest part of the spiral garden were added. According to UWM's James Wasley, (professor of architecture) "Figuring the capacity of the whole system, however, is more difficult. We know it's doing the job of containment and that it's benefitting the MMSD's deep tunnel by curbing sewer overflows in the area," he said. "It's also a magnet for native birds and bees". In 2018, the spiral gardens were recognized by the American Society of Landscape Architect's Wisconsin Chapter and received the 2018 award for landscape projects. The spiral gardens were chosen as an important water related area because it provides storm water mitigation strategies for the campus specifically, and us for our catchment area generally. Additionally, the educational signage within the spiral gardens helps to educate the public about storm water mitigation and native Wisconsin plant species.

The current status of the Spiral Gardens is good. The Spiral Garden receives a yearly clear out during Earth week by volunteers supervised by knowledgeable Green Infrastructure professionals.

Risks to the Spiral Gardens include degradation to the native flora and other planted vegetation due to trash accumulation, possible drought, or future lack of yearly maintenance.



Sandburg Commons Green Roof

The UWM Sandburg Green Roof was built during the summer of 2008. Sandburg Commons, surrounded by four University Housing towers, is the largest green roof on campus to date. This 34,000 square ft. project is the first vegetated roof built by the State of Wisconsin. As such, it wrote the State specifications for Green Roofs. The lower roof is composed of bands of 8" medium planted in native perennials ascending fields of 4" medium planted in sedum. These bands are combined with bands of gravel pathway, offsetting the added weight of the deeper planting beds on an existing structure with limited excess capacity. On the upper roof, both the field and accent bands are planted in Wisconsin native dry prairie species. The success of these plants is a significant finding for the roof as a research effort. Food Services now use the intensive beds of the lower roof for vegetable and herb cultivation. The harvested produce is served throughout UWM's restaurants and cafeterias. The Sandburg commons green roof was chosen as an important water related area because it provides storm water mitigation strategies for the campus. Additionally, the green roof is used to grow produce that is then sold on campus, which provides a local source of food stuffs for individuals and a healthy alternative to processed food.

The current status of the Sandburg Commons Green Roof is good. The vegetable-growing portion of the Sandburg garden is maintained each year by UW-Milwaukee Restaurant Operations.

Risks to the Sandburg Commons Green Roof include degradation to the native flora due to trash accumulation, possible drought, or future lack of yearly maintenance.

Sandburg Hall Rain Gardens

In order to address the severe slope, pathways, and need for water collection, a rain garden that ends in an underground cistern (5,000-gallons) was developed at this sit. A series of three bioswale basins with a total surface area of approximately 1,730 square feet have been constructed down the existing slope. This storm-water interpretive path meanders through a series of native plant waysides, improving water quality all the way to its underground collection. There it becomes a source of sustainable irrigation, for growing the many vegetables, herbs, and fruits of these campus gardens. The green roof has functioned as a productive green space for storm water mitigation and food supply since 2014, which is why it was chosen as an important water related area.

The current status of the Sandburg Hall Rain Gardens is good and is managed by the UWM office of sustainability.

Risks to the Sandburg Commons Green Roof include degradation to the native flora due to trash accumulation, possible drought, or future lack of yearly maintenance.

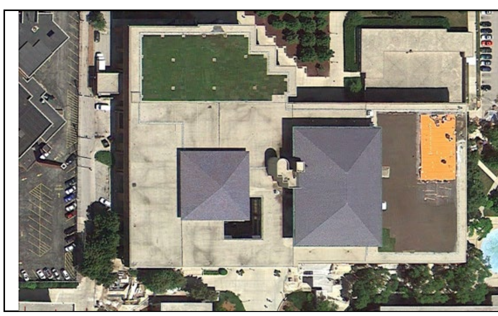


Golda Meir Library Green Roof

The Golda Meir Library Green Roof was completed on July 28, 2011. It employs a pre-vegetated Sedum mat system from Moerings Sempergreen. It features two separate roof sections and a 30-kilowatt system of solar cells that is sponsored by WE energy with Focus on Energy Grants. The newest addition to the Library Green roof now makes it the largest green roof on campus. The project was made possible through a partnership with the Milwaukee Metropolitan Sewerage District. The Golda Meir Library Green Roof was chosen as an important water related area because it produces energy for campus, while also acting to mitigate storm water run-off.

The current status of the Golda Meir Library Geen Roof is good.

Risks to the Golda Meir Library Green Roof include degradation to the native flora and other planted vegetation due to trash accumulation, possible drought, or future lack of yearly maintenance.




Sabin Hall Rain Garden

Sabin Hall rain garden was established by the student organization EcoTone. With the help of grant funding, and volunteers, this garden was planted in 2006 A disconnected downspout, native plantings, and slope design all work together to reduce the rate of storm-water runoff from the roof of Sabin Hall. Rainwater (or snowfall) is routed to the garden and filtered naturally by the plants and soils in this garden. This filtration process removes nutrients and pollutants, while retaining water closely to the site. By keeping as much rainwater as possible close to where it falls, we reduce the impact on our lakes and streams, as well as the local wildlife, which is why the Sabin Hall Rain Gardens was chosen as an important water related area.

The current status of the Sabin Hall rain garden good. The grounds crew at UW-Milwaukee maintains the vegetation found in the rain garden.

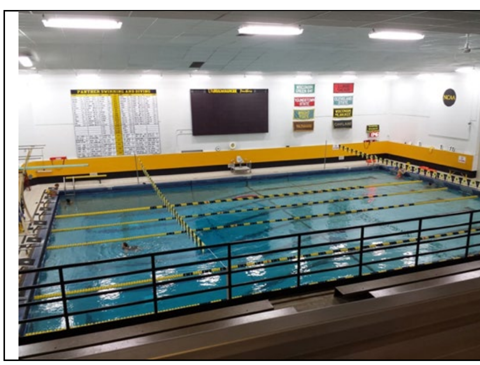
Risks to the Sabin Hall rain garden include degradation to the native flora due to trash accumulation, possible drought, or future lack of yearly maintenance.

Klotsche Center Pool

The pool is an indoor 25-yard, 8 lane pool which includes a diving tank with one 1-meter board. The pool is drained at the end of each summer, re-grouted and cleaned for every new academic year. The Koltsche center pool was chosen as an important water related area because it provides cultural value to the University and is enjoyed by students for water recreation.

The current status of the Klotsche Center Pool is good. The pool is maintained regularly.

Risks include future lack of maintenance.



Main Campus Fountain

The fountain in Ernest Spaights Plaza has significant cultural value to students and faculty at UW Milwaukee. It offers a meeting place for individuals and campus activities utilizes its aesthetics to promote gatherings on campus. These reasons are why it was chosen as an important water related area. The fountain was built by the campus' grounds crew.

The current status of the Main Campus Fountain is good. The fountain is maintained regularly by the campus' grounds crew.

Risks include future lack of maintenance.

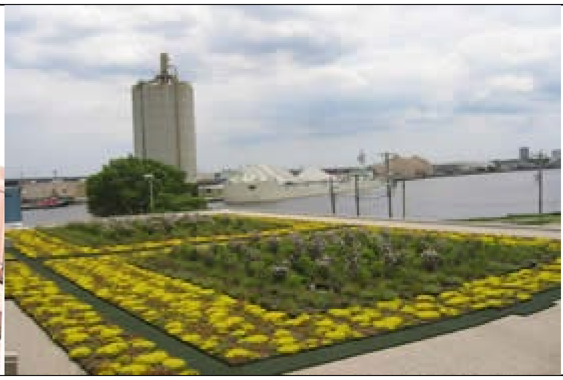
University of Wisconsin Milwaukee – School of Freshwater Sciences

Bio-Swales
No data for the Bio-swales currently.

Green Roof
In 2003, a 7,600 square foot first-floor section of the Fresh Water Science Building roof was converted to a vegetated 'green' roof in order to demonstrate an innovative and cost-effective storm water Best Management Practice for the Milwaukee metro area and University of Wisconsin System. The installation and maintenance of the green roof offers a working model of an aesthetically-impressive storm water mitigation strategy that is especially suited to dense urban development. In collaboration with the Milwaukee Metropolitan Sewerage District through their Storm water best management practices Partnership Program, funding was secured to make this pilot green roof a reality. The Green Roof is a modular system, called Green Grid Roofs. Various native, drought tolerant species of grass and sedums have been planted on this green roof. The Fresh Water Science Building green roof was chosen as an important water related area because it provides a valuable storm water mitigation strategy in an area of Milwaukee that has large amounts of impervious surfaces and few green spaces.

The current status of the Fresh Water Science Building is good. It is not maintained on a permanent basis but the hearty vegetation that it was planted with is self-sustaining and continues to provide effective storm water mitigation to the site.

Risks to the site include future drought and a complete lack of maintenance in the future.



1.3.7 Water-related Costs and Revenues

Water-related costs

Because water is used in so many direct and indirect ways at UWM, water-related costs fall into several categories, some easily quantifiable, others less so. Potable water is relatively inexpensive in Milwaukee compared to water-scarce regions. However, since UWM is a large institution, the costs associated with its use are significant.

Total Amount Spent to Procure Water

The University pays a water and sewer bill that is broken down into several categories:

- Water Usage Charge
- Sewerage Service Charge
- MMSD Certified State Charge
- Local Sewerage Charge
- Stormwater Management Charge
- Snow Removal Charge

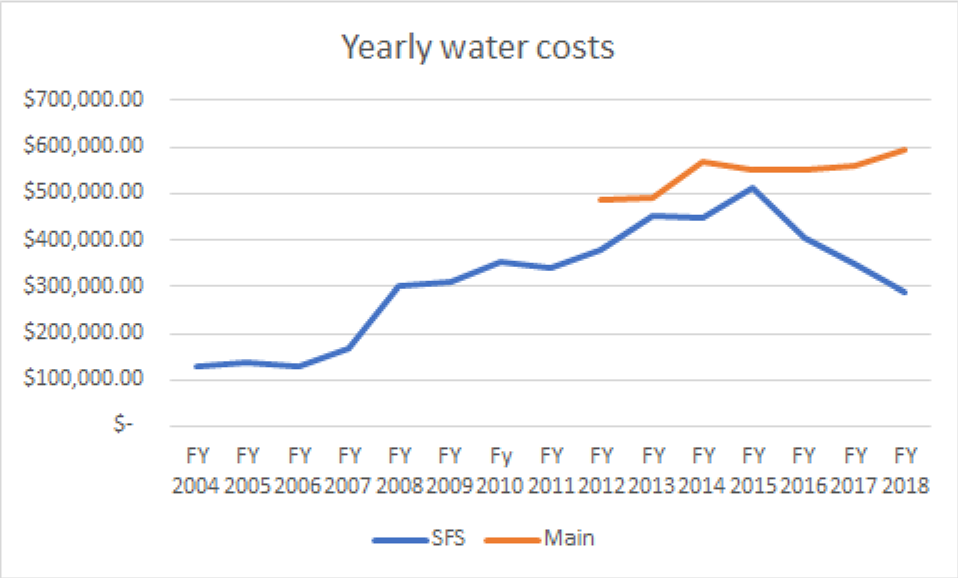


Figure 12. Yearly Water Costs

Total Amount Spent to Ensure Water Treatment

The School of Freshwater Sciences is classified as a Waste Strength Certified user by MMSD. This means that rather than being charged the standard rate for BOD and TSS as domestic users are, SFS and MMSD monitor key water quality parameters (HEM, TSS, BOD, and pH), and pay a rate based on these parameters. The table below contains charges going back to 2017. These costs are additional too the "total amount to procure water" costs above.

Table 5. Costs to Procure Water

	11/29/2017		5/22/2018		1/19/2019	
	Measure	**Fee**	**Measure**	**Fee**	**Measure**	**Fee**
TSS (mg/L)	20	$ 11.00	2.7	$ 11.00	6.3	$ 11.00
BOD 5 day total (mg/L)	<2	$ 18.00	7.6	$ 17.00	7.1	$ 17.00
Ending pH (S.U.)	6.89	$ 20.00	7.15	$ 20.00	6.99	$ 20.00
HEM (SPE) (mg/L)	2.2	$ 50.00	0	$ 53.00	<1	$ 53.00
Sample Collection Fee	-	$ 923.00	-	$ 981.00	-	$ 981.00
Total Fee		**$ 1,022.00**		**$ 1,082.00**		**$ 1,082.00**

Other Categories of Costs

- Energy for movement of water: UWM pumps water from Lake Michigan to its heat plant. The energy requirements for these pumps is significant, but this group did not quantify these costs, and further inquiry is required. Milwaukee Water Works provides potable water at pressure enough to move it throughout buildings. However, there are certain applications where pumping may be required, but this group did not investigate these situations. Further study is required.

- Energy for the heating and cooling of water: These costs are significant, but this group did not quantify them currently because of the complexity of the task. Buildings at UWM use a variety of HVAC systems, each using water in a different way. Additionally, potable water is heated differently across the site. Energy required for this equipment is not metered separately from other electrical or natural gas use. Further study is necessary to quantify these costs. However, we can draw the following conclusions:

    - Increasing water use efficiency would decrease energy costs;

    - UWM has undertaken several major efficiency upgrades at the heat plant and has saved millions of dollars over the past two decades, but further campus-wide efforts to increase the energy efficiency of equipment used to heat and move on UWM sites would decrease energy costs.

- Permit costs
    - UWM pays the DNR a fee for the water discharge into Lake Michigan for the power plant non-contact cooling water. The annual fee is:
        - Base fee: $125
        - Great Lakes fee: $9,5000
- Total amount spent on water-related infrastructure: the university has invested significant sums of money to increase the stormwater retention capacity of campus in recent decades, installing numerous green infrastructure projects outlined elsewhere in this report. This group did not quantify the costs associated with these projects.
- Total payroll for water-related staff: This group did not study this cost. A list of salaries that could be included in this category are:
    - Heat plant staff
    - Plumbers
    - All faculty and staff at the School of Freshwater Sciences

Costs associated with developing a water stewardship plan

Because the creation of the water stewardship plan was carried out under the auspices of a graduate-level practicum, costs for the development of the plan were minimal. The expertise on water-related issues was supplied by the professors and the graduate students carrying out the plan. At the time of this writing, no major additional costs have been recommended by the plan.

Financial benefits of outcomes

The financial benefits of enacting the water stewardship plan cannot be quantified at the time of this writing, since no efficiency recommendations have yet to be made. However, being the first university in the world to be certified to the AWS International Standard is of great value to UWM. Being perceived by the public as a water leader attracts and helps retains faculty talent, aids in the recruitment of potential students, and raises the profile of the university on a regional and global level.

Water-related revenues

Since the university does not sell a product, service, or assets, it does not have water-related revenues. This is a factor for AWS to consider as more institutions of higher learning seek to apply the Standard. Downer Woods plays an important role in stormwater management and provides habitat for species that impact overall ecosystem health.

Shared value creation

Economic

UW-Milwaukee plays a leading role in creating a water-centric culture in Milwaukee. Faculty at the University were instrumental in implementing the Water Centric City initiative. Because of its reputation as a water leader, numerous water-related companies have chosen to locate their offices in the city. Many UW-Milwaukee students work as interns at water-related agencies and companies, and graduates work at these same organizations, who would have access to the human capital because of the University.

University researchers make significant water-related contributions in the fields of engineering, ecology, chemistry, limnology, economics, and public policy. The economic effects of these activities are substantial but difficult to quantify.

Social

The University generates significant social water-related value. Native plantings, green infrastructure, visible stormwater management installations such as permeable pavers and bioswales, and the mere presence of the School of Freshwater Sciences building help give the University a reputation as a water leader in the community. The SFS campus hosts the annual Harbor Fest, which draws thousands of residents to the Harbor District to enjoy the water and engage with many educational activities such as wildlife viewing and conservation initiatives. Multiple water-related agencies and nonprofits such as Sweetwater, Harbor District, Inc., and Milwaukee Riverkeeper have offices in the School of Freshwater Sciences building. Each of these organization's mission is enhanced by the proximity to each other, to cutting edge academic research, and a pool of talented students.

Environmental

As a large institutional actor, any sustainability action that the University undertakes has a large impact on the catchment's environmental health. The university's activities in the following areas, detailed on the UWM Office of Sustainability website, generate positive environmental benefits for the catchment.

- Recycling, reuse, and hazardous waste handling
- Natural lawn care
- Management of prairie areas and Downer Woods
- Water Conservation
- Stormwater management
- Energy conservation
- Campus gardens
- Food procurement practices

1.3.8 WASH

The Occupational and Health Administration (OSHA) requires all businesses to abide by certain rules regarding sanitation services to ensure the safety of employees and individuals on sight. Both the main campus and Fresh Water Science building fall under these regulations and abide by the guidelines. These regulations cover the requirements for access and adequacy of WASH.

The standards put forth by the Occupational Safety and Health Administration (OSHA) are as follows 29 CFR 1910.141, 29 CFR 1926.51 and 29 CFR 1928.110. These sanitation standards of the Occupational are intended to ensure that workers do not suffer adverse health effects that can result if toilets are not sanitary and/or are not available when needed (Table 6).

Table 6. Required Restrooms on Site per Employee

Number of employees	Minimum number of water closets
1 to 15	1

16 to 35	2
36 to 55	3
56 to 80	4
81 to 110	5
111 to 150	6
Over 150	(2)

*Where toilet facilities will not be used by women, urinals may be provided instead of water closets, except that the number of water closets in such cases shall not be reduced to less than 2/3 of the minimum specified.

Beyond the scope of supplying toilets to employees and individuals on site, OSHA requires that employers must supply a clean facility, access to hand washing fixtures, and adequate amounts of soap and drying materials. Per the codes detailed above, employers must install 21 hand washing fixtures for each additional 40 employees and running water needs to be available from these fixtures at all time. Additionally, soap, air dryers, and hand towels must always be accessible in restrooms. To ensure that employees have access to clean facilities, it is the responsibility of the employee to establish and implement a schedule for servicing, cleaning, and supplying each facility to ensure it is maintained in a clean, sanitary, and serviceable condition.

Lastly, access to potable water and drinking water are a requirement to WASH and an OSHA regulation. Employers must provide potable drinking water in amounts that are adequate to meet the health and personal needs of each employee. Additionally, the employer has discretion on how to supply potable water; options include drinking water from a fountain, a covered container with single-use drinking cups stored in a sanitary receptacle, or single-use bottles. The employer shall prohibit the use of shared drinking cups, dippers, and water bottles.

University of Wisconsin Milwaukee – Main Campus

Sandburg Hall, located within the main campus site, is unique regarding the rest of the site's WASH requirements because it is a residence hall where students eat, live, and sleep. As such, we determined that as part of the WASH requirements, access to shower facilities, as well as the previously mentioned sanitary services is a requirement for adequate WASH within the residence hall. Included in the documents section are floor plans for each type of layout available to students in Sandburg Hall. Each type of room layout includes a communal bathroom, equipped with a toilet, sinks, and a shower, to be shared by the individuals occupying said room.

Documents

- Sandburg Hall Room Layout

1.4 Indirect Water

1.4.1 Primary Inputs

University of Wisconsin Milwaukee – School of Freshwater Sciences

Within the site's catchment at the School of Freshwater Sciences, there is embedded water use involved with the primary inputs of computers, televisions, paper products, and agricultural related inputs. The staff members are equipped with desktop computers and laptops that have an embedded water use during their production phase. The quantity of desktop and laptop computers owned by the site can be estimated around 200. A desktop computer can require 7,300 gallons of water to produce; therefore, there is water risk associated with this primary input to the school if it uses almost 1.5 million gallons of embedded water for electronic purchases (Michigan Water Stewardship).

The staff and students the School of Freshwater Sciences use paper and printing during daily operations. UWM purchased $189,479 worth of office paper in the 2016 fiscal year and it is assumed that the FY18 purchases are very similar (UWM Reports). Because the School of Freshwater Sciences is only a fraction of the size of the other schools within UWM, it can be assumed that only a small portion of these funds represent the SFS paper purchases. However, paper is still used within this building and one sheet of paper requires 3 gallons of water to produce; thus, there is water risk associated with this primary input (USGS). The site has reduced its embedded water usage with its reduction of paper usage via online classroom portals. Sites such as D2L or Canvas have allowed for classes to discuss, turn in homework, and obtain access to notes and lectures without using paper; yet, the amount of paper that is being reduced at the site is still unknown.

Finally, there is embedded water usage in the site's aquaculture facility supplies. The site is known to contain and maintain large aquaculture facilities when performing research related to the aquaculture and fishing industry. The research conducted still relies on some purchased fish and eggs to initiate those experiments or to provide food for the experiments; however, purchases are limited (Villet, 2018). Because there are minimal fish purchased and there is less embedded water associated with this input. However, it is important that the aquaculture inputs remain minimal because they are an indirect use of water and they will pose a strong water risk if they rely on imported fish.

University of Wisconsin Milwaukee – Main Campus

Within the site's catchment at UWM's main campus, there are several examples of embedded water use involved with the primary inputs of computers, televisions, paper products, and agricultural related inputs. In the 2016 fiscal year, UWM spent $2,286,341 on laptops, computers, and related displays (UWM Reports). This technology is the main primary input of the University since staff, students, and researches heavily rely on computers for their daily activities. The site houses computer labs, desktop computers for staff members, and laptops for each staff member. Because a desktop computer can require around 7,300 gallons of water to manufacture, there is a large level of water risk associated with this primary input (Michigan Water Stewardship). The water risk posed by laptops and computers will be hard to address because the students and staff depend on these technologies for daily operations and the use of technology in the class room is only increasing.

Another primary input of a University is paper products. In the 2016 fiscal year, UWM purchased $189,479 worth of office paper and it is assumed that the FY18 purchases are very similar (UWM Reports). UWM students and staff use large amount of paper products every day and those products have an embedded water risk. In general, a sheet of paper can require 3 gallons of water to produce, creating a water risk because the campus is not entirely paper free (USGS). However, UWM has made attempts to reduce the amount of paper used daily through online class portals such as D2L and Canvas. These portals allow for electronic submission of work, as well as online note access.

Finally, the on-campus dining halls indirectly use water because of the primary input of food. The school imports food from a supplier that results in water used in the creation or growth of such food, processing of the food, and transportation of the food. The school recognizes the food service to be an indirect use of water and that there is a large water footprint associated with the agricultural industry in terms of growing, processing, and transporting the food.

Real Food Challenge

Hemideh Moayyed, a former student at the University of Wisconsin Milwaukee performed a research base study involving the source of the food on campus in order to find more sustainable practices. The Real Food Challenge categorized their food inputs, and "Real food" referred to food that met specific criteria. Some of that criteria included nutritional value, access to the food source, working conditions of the farm laborers, unnatural additives, fair-trade policies, and ease of access to the food product as seen from page 4 (Moayyed, 2018). Real Food had a Green and Yellow tier, where Green Level of Real food held the highest standards with categories including Locality, Fairness, Ecologically Sound, and Humane. This report was based on the previous food supplier, Reinhart Foodservice LLC and this year UWM has a new food supplier; however, this data will still provide the right information regarding food purchase trends.

The largest spending category of food within the 2017-2018 academic year included "Grocery" items such as grains, staples, oils, or canned products which accounted for 26% of the total food expenditure at $772,000 (Moayyed, 2018). Poultry and produce both accounted for 14% of the total food expenditure. Only 1.52% of the food purchased at the university met the real food criteria (Moayyed, 2018). The embedded water within the most commonly purchased food products is large enough to make food purchases a primary input for the campus. For example, 1 lb. of chicken can require 500 gallons of water to grow, maintain, and feed (USGS). Moreover, the water footprint of vegetables and fruit can be 300 m^3/ton and 1000 m^3/ton respectively (Water Footprint).

1.4.2 Outsourced Services

University of Wisconsin Milwaukee – School of Freshwater Sciences

An outsourced service that originates within the School of Freshwater Science’s catchment is energy use and there is embedded water use associated with the production of electricity. The transportation of fuel sources for energy and the production of energy itself like condensing and cooling, results in indirect use of water. The energy providing the catchment mainly results from a combination of coal and natural gas inputs (Gardner, 2019). The coal supplying the catchment originates from Wyoming and Canada; while, the natural gas typically comes from Minnesota and upper Wisconsin provides the sand for fracking (Gardner, 2019). In FY18, energy was about 2% of UWM’s operating budget (UWM Office of

Sustainability). Moreover, in 2013, energy was reduced by 25% and 10% of the energy purchased now comes from a mixture of renewable sources (UWM Office of Sustainability).

University of Wisconsin Milwaukee – Main Campus

An outsourced service that originates within the UWM Main Campus catchment is energy and the production of electricity requires embedded water. For example, the transportation of the variety of fuel sources and the production of the energy itself such as condensing and cooling operations, results in indirect use of water. The energy providing the catchment mainly results from a combination of coal and natural gas inputs (Gardner, 2019). The coal supplying the catchment originates from Wyoming and Canada; while, the natural gas typically comes from Minnesota and upper Wisconsin provides the sand for fracking (Gardner, 2019). In FY18, energy was about 2% of UWM's operating budget (UWM Office of Sustainability). Moreover, in 2013, energy was reduced by 25% and 10% of the energy purchased comes from renewable sources (UWM Office of Sustainability).

Another outsourced service that originates in the catchment is waste disposal. Ignoring all other waste generated in the catchment, Sandburg Café alone produces 3,000 lbs. of pre-consumer waste every week (UWM Office of Sustainability). UWM has adopted a composting system where volunteers collect kitchen scraps for compost at the campus hoop house. UWM also takes part in off-site composting of dairy, meat, and uneaten food from the Sandburg Café Dinning Hall and UWM's 20/20 Catering. The food is collected by Compost Crusaders and taken offsite to be composted (UWM Office of Sustainability).

1.5 Catchment Data

1.5.1 Water Governance Initiatives

One of the major drivers of water governance in the Milwaukee Area is the Total Maximum Daily Load (TMDL) analysis for the Milwaukee River watershed. Mandated by the USEPA for water bodies that do not support beneficial uses such as aquatic life and recreation and administered by the Wisconsin Department of Natural Resources, the Milwaukee River TMDL sets a pollution "budget" for total suspended solids, fecal coliform bacteria, and phosphorous in the river system. The DNR mandates that regional jurisdictions, like the Metropolitan Milwaukee Sewerage District, discharges into its system. It also empowers municipalities to regulate land use and wastewater discharges in order to meet TMDL limits.

Because responsibility for meeting the requirements of the TMDL falls to multiple overlapping and sometimes contradictory jurisdictions, MMSD and the DNR commissioned Sweetwater, a regional nonprofit organization, to prepare a plan that lays out concrete strategies for different regional actors such as municipalities, nonprofits, MMSD, the private sector, and academic institutions to collaborate to work toward meeting the water quality goals laid out in the TMDL. This document describes *how* work is funded and implemented, *how* work is prioritized, *how* collaboration can work, and *how* to leverage the strengths of each sector in this, and *how* the impacts of watershed restoration efforts can be monitored and measured over time. The document is still in its planning stages at the time of this writing, but an “options paper” has been released. This paper highlights the important role UWM can play in carrying out scientific research, monitoring, and assessing the impacts of regional plans.

The main campus’ power station withdraws non-contact cooling water and discharges directly into Lake Michigan. Like the TMDL framework, this activity is also regulated under the federal Clean Water Act, and is administered by the DNR under the WPDES permit. MMSD’s water treatment plants’ discharges into Lake Michigan are also regulated by a WPDES permit.

Stormwater management is one of the major areas of concern addressed in this stewardship plan. Under Chapter 13 Subchapter III of MMSD’s Rules, any new development that disturbs more than 2 acres of land or adds more that 5,000 square feet of impervious surface must use green infrastructure to retain at least the first ½” of rain that falls on the site. UW-Milwaukee has already implemented many green infrastructure elements, and this regulation sets regional standards for implementing green infrastructure.

1.5.2 Water-related Legal and Regulatory Requirements

Drinking Water Quality

The Environmental Protection Agency sets the national standard and regulation of the Safe Water Drinking Act. Through the Safe Water Drinking Act, regulated contaminants are assigned safe levels of accumulation in drinking water. If water providers detect levels above these designated maximums, they must react accordingly to lower the contamination level back down to their safe level.

A list of regulated contaminants and their action level set force by the EPA through the Safe Water Drinking Act can be found in the documents section.

Consumer Confidence Reports (CCR) are required by the Federal Environmental Protection Agency (EPA). Our Catchment CCR can be found in the documents section under the Milwaukee Water Works Consumer Confidence Report

Drinking Water Pricing

Drinking water prices in Milwaukee (and both catchment sites) are grouped into the overall price for water usage. According to the city of Milwaukee’s Website “Milwaukee water is a great value: Two gallons cost one cent, and that includes water use and service charges and the public fire protection charge (pays for hydrant maintenance)”. Water rates are determined by the Public Service Commission of Wisconsin based on cost of service, so all customers, including those tax-exempt, are charged fairly for the water they use.

As measured by the customers water meter, 100 cubic feet (748 gallons) cost $1.96. (rates effective 2014). The Milwaukee Water Works measures and bills for water use in 100 cubic feet, or Ccf. The average residential customer (ranges from single family home to large, multi-family buildings) uses 26 Ccf (100 cubic feet of water) per quarter, or 8.6 Ccf per month, and pays about $300.00 a year, or $25.40 per month, for water. On an individual basis, the typical person in Milwaukee enjoys 10 Ccf of water per quarter.

Requirements to Provide Water and Sanitary Facilities

The Occupational Safety and Health Administration (OSHA) puts force requirements to provide water and sanitary facilities for workers. The sanitation standards of the Occupational Safety and Health Standards (29 CFR 1910.141, 29 CFR 1926.51 and 29 CFR 1928.110) are intended to ensure that workers do not suffer adverse health effects that can result if toilets are not sanitary and/or are not available when needed. The following table details the required number of restrooms that must be provided on premises per employees on site at a given time (Table 7).

Table 7. Required Restrooms per Employee

r of employees	Minimum number of water closets
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
1 to 110	5
11 to 150	6
Over 150	(2)

*Where toilet facilities will not be used by women, urinals may be provided instead of water closets, except that the number of water closets in such cases shall not be reduced to less than 2/3 of the minimum specified.

There are several other sanitary requirements employers must provide besides the addition of water closets. Soap, air dryers, hand towels, and running water always need to be available. The employer must establish and implement a schedule for servicing, cleaning, and supplying each facility to ensure it is maintained in a clean, sanitary, and serviceable condition. The employer must provide potable drinking water in amounts that are adequate to meet the health and personal needs of each employee. The employer must dispense drinking water from a fountain, a covered container with single-use drinking cups stored in a sanitary receptable, or single-use water bottles. Lastly, the employer must prohibit the use of shared drinking cups, dippers, and water bottles.

Wastewater Discharge Standards

Regulations that apply to both sites

Stormwater management is regulated by local municipalities, the MMSD, the Wisconsin Department of Natural Resources (WDNR), and the United States Environmental Protection Agency (USEPA), and the U.S. Army Corps of Engineers (CORPS). Impacts to waterways and wetlands are also regulated by all of the above listed entities. Both sites (main campus and Fresh Water Science building) are subject to Milwaukee's Ordinance 120 requirements.

Applicable Stormwater Regulations for UWM Landholdings in Milwaukee:

- NR 216 (Comm 60) Storm Water Discharge Permits—covers three types of stormwater discharge permits: municipal, industrial and construction site.

- NR 151 (Comm 60, Comm 82, Comm 85) Runoff Management (water quality)
- NR 116 Wisconsin's Floodplain Management Program
- Chapter 30 of the Wisconsin Statues: Navigable Waters, Harbors and Navigation
- City of Milwaukee Ordinance—Chapter 120 (addresses increase in impervious area and peak run-off flow)
- City of Glendale Ordinance—Title 6, Chapter 5
- Milwaukee Metropolitan Sewerage District (MMSD)—Chapter 13 (defines stormwater detention requirements for the MMSD service area)
- Section 404 of the Federal Clean Water Act (regulations discharges to "Waters of the U.S).

University of Wisconsin Milwaukee – School of Freshwater Sciences

The Department of Natural Resources (DNR) provides the Wisconsin Pollutant Discharge Elimination System (WPDES) permit for the discharge from Jones Island. WPDES permit for facility is WI-0036820-03-01.

The Department of Natural Resources (DNR) provides the Wisconsin Pollutant Discharge Elimination System (WPDES) permit for the discharge from The School of Freshwater site. The Current permit to discharge from the School of Freshwater Science site is WI-0045942-06-0

University of Wisconsin Milwaukee – Main Campus

The Department of Natural Resources (DNR) provides the Wisconsin Pollutant Discharge Elimination System (WPDES) permit for the discharge from Jones Island. WPDES permit for facility is WI-00362820-03-1.

The Main Campus Site also has a power plant and cooling station, whereas, a discharge permit is required. WPDES permit for this site is WI-0040282-08-0. A copy of said permit can be found in the documents section.

Environmental Regulations to Protect Water Bodies

The Clean Water Act regulates the protection and conservation of water bodies from pollution. In Wisconsin, the Wisconsin Department of Natural Resources (WDNR) sets forth criteria in order to help meet the Clean Water Act in our lakes and rivers. Criteria is based on water quality standards as determined by the WDNR. Water quality standards consist of three components: antidegradation, designated uses, and water quality criteria. Water quality criteria represent the quality of water that supports a designated use. Pollutants included in the water quality criteria are; floating or submerged debris, oil, scum or other material; substances that cause objectionable deposits on the shore or in the bed of a body of water; substances that produce color, odor, taste or unsightliness; substances in amounts which are toxic or harmful to humans and; substances in amounts which are harmful to animal, plant or aquatic life (Figure 13).

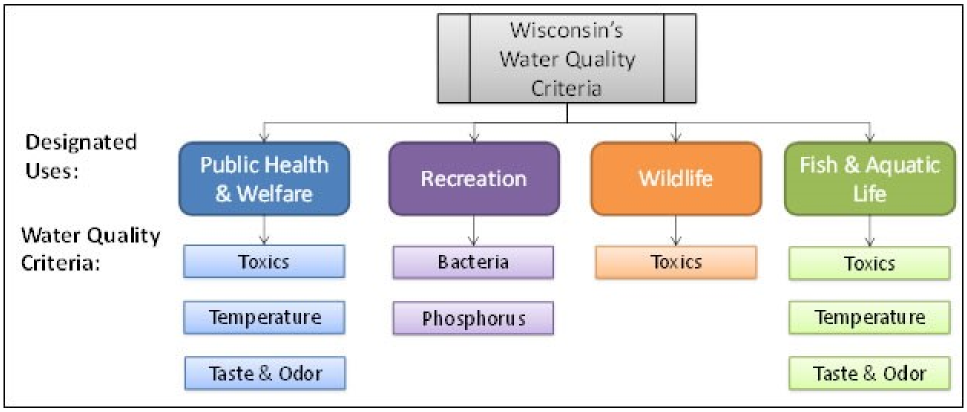


Figure 13. Wisconsin's Water Quality Criteria

In congruence with the Clean Water Act and the WDNR's water quality standards, Section 303(d) of the Clean Water Act requires all states to develop Total Maximum Daily Load (TMDL) for waters on the Impaired Waters List. A TMDL is the amount of a pollutant a waterbody can receive and still meet water quality standards. TMDL's are a pollution "budget" for a water body or watershed establishes the pollutant reduction needed from each pollutant source to meet water quality goals. It is important to keep in mind that the development of a TMDL for a water body is required, but meeting these goals is an ongoing process. When waterbodies are reported as impaired, and in excess of their TMDL, immediate action is not legally required.

As outlined in the previous section, 1.5.1, our specific catchment, the Milwaukee River Water Shed, has an active TMDL report. The current TMDL report for the Milwaukee River is in the documents section. The Milwaukee River Watershed is impaired, and included in the 303 (d) list, mainly because of the following degradation/pollution factors: low dissolved oxygen, degraded biological community, degraded habitat, recreational restrictions due to pathogens. Combating these factors and meeting the goals of the TMDL report is an ongoing and lengthy process. Many organizations (refer to section 1.5.1) within Milwaukee are currently collaborating to determine how best to meet the goals set forth by the TMDL report.

Documents

- MWW CCR https://city.milwaukee.gov/ImageLibrary/Groups/WaterWorks/Consumer-Confidence-Reports/2018ConsumerConfidenceReport.pdf
- EPA drinking water standards https://www.epa.gov/ground-water-and-drinking-water/national-primary-drinking-water-regulations
- WPDES Permit Power Plant
- WDNR Water Quality Criteria
- Milwaukee River TMDL Report

1.5.3 Water Balance

Due to the extensive size of Lake Michigan neither campuses have a water scarcity issue. Rainfalls vary with season with peak precipitation during the summer and lower through the winter. SEWRPC Tech Report 40 provides hydrographs with guidance for annual precipitation.

University of Wisconsin Milwaukee – School of Freshwater Sciences

- 1.5 in rainfall equals 5,308,875 cubic ft. and 3,074 linear ft. of harbor
- 0.5 in rainfall equals 1,769,625 cubic ft. and 1,024 linear ft. of harbor

University of Wisconsin Milwaukee – Main Campus

- 1.5 in rainfall equals 1,825,164 cubic ft. and 3,199 linear ft. of Milwaukee River
- 0.5 in rainfall equals 608,388 cubic ft. and 1,066 linear ft. of Milwaukee River

The following maps project the floodplain and the amount of flooding per specified rainfall for both the University of Wisconsin Milwaukee's Main Campus and the School of Freshwater Sciences (Figure 14-17).

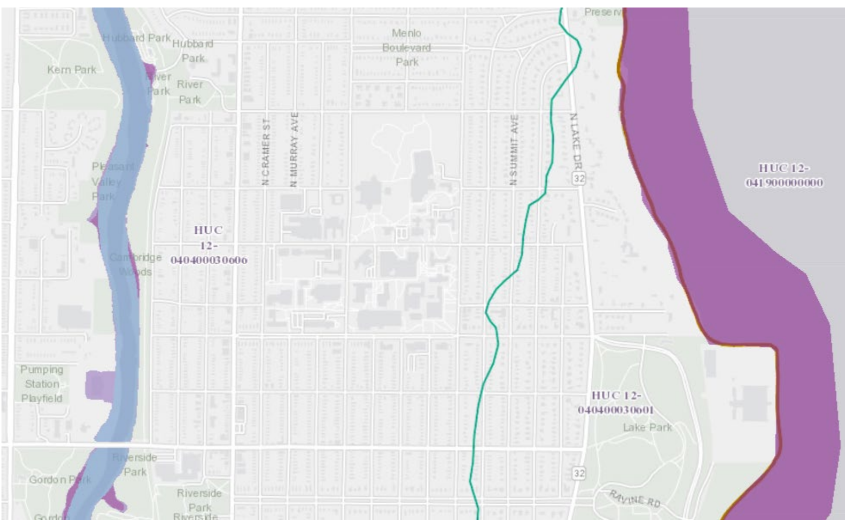


Figure 14. University of Wisconsin Milwaukee – Main Campus 100 Year and 500 Year Floodplain

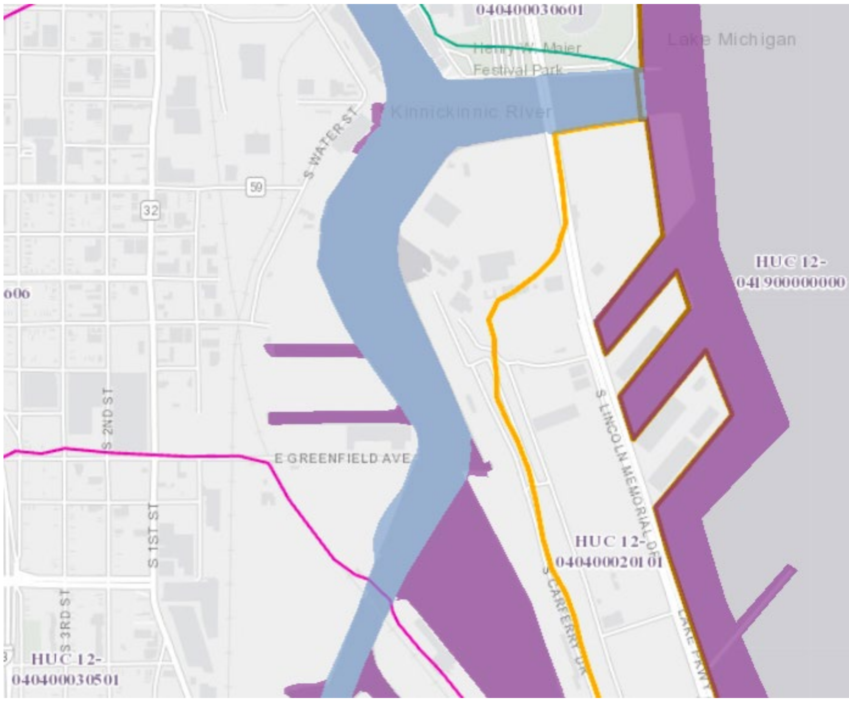


Figure 15. University of Wisconsin Milwaukee – School of Freshwater Sciences 100 Year and 500 Year Floodplain

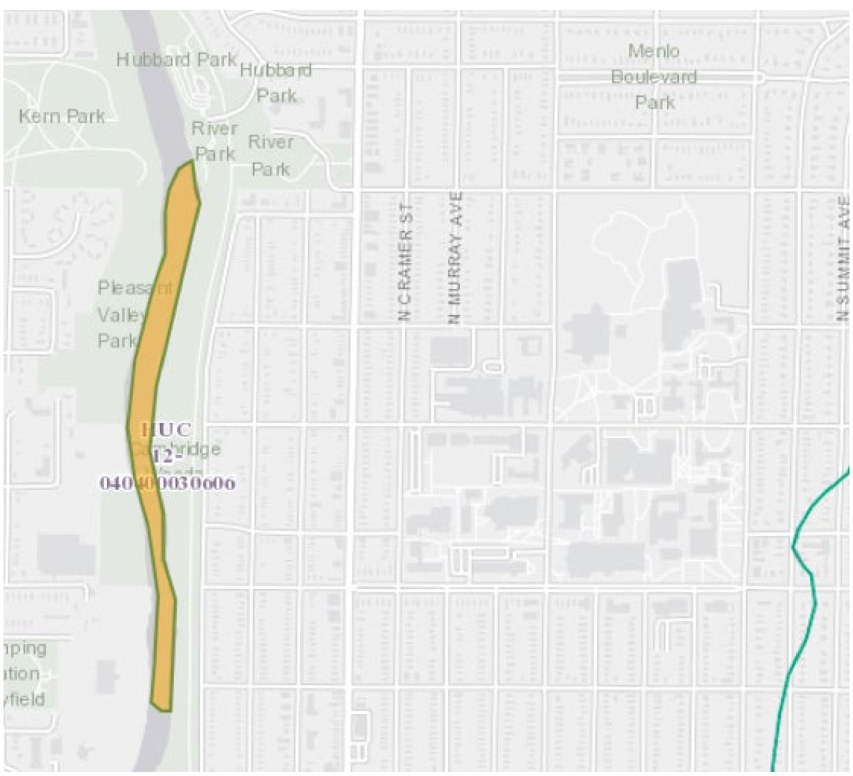


Figure 16. University of Wisconsin Milwaukee – Main Campus 1.5 inch. Rainfall Watershed Plume

Figure 17. University of Wisconsin Milwaukee – School of Freshwater Science 1.5 inch. Rainfall Watershed Plume

1.5.4 Water Quality

Like many urban surface water bodies, the Milwaukee River basin and Lake Michigan face multiple water quality challenges. The Milwaukee River, which forms the western boundary of the Main Campus' catchment, is on the list of Impaired Waters under the federal Clean Water act, and therefore qualifies for the TMDL program, discussed in 1.5.2. The Milwaukee River Estuary, which encompasses the Inner Harbor and the Milwaukee River as far upstream as North Avenue (1 mile south of the catchment boundary) is listed as an Area of Concern under the Great Lakes Water Quality Agreement. In general, water bodies in the catchment are impaired in the following ways:

- High total suspended solids
- High phosphorous concentrations
- High levels of fecal coliform bacteria
- Presence of aquatic invasive species
- restrictions on fish and wildlife consumption
- degradation of fish and wildlife populations
- degradation of benthos
- restrictions on dredging activities
- eutrophication or undesirable algae
- beach closings
- degradation of aesthetics
- degradation of phytoplankton and zooplankton
- loss of fish and wildlife habitat

To quantify these challenges, water quality data was gathered from multiple sources:

I. Milwaukee Riverkeeper 2017 River Basin Report Card (MR 2017)
  - This report gives letter grades (A, B, C, D, F) to each sub-basin on eight parameters: temperature, dissolved oxygen, pH, turbidity, phosphorus, chloride, specific conductivity, and bacteria. It also assigns an average macroinvertebrate biotic index score (MBIS) (1 to 4 where a high biotic index indicates a healthy stream).

II) Wisconsin DNR Wisconsin Water Search Tool (DNR)

III) <u>MMSD Summary of 2017 Surface Water Quality Monitoring</u>
  - This report compiles data MMSD collected at points in multiple regional water bodies, including the Milwaukee River (where Main Campus is located), Milwaukee Estuary (where SFS is located), the Outer Harbor (where effluent from the Jones Island treatment plant is discharged), and Nearshore Lake Michigan (where Milwaukee Water Works withdraws municipal water). The report contains maps indicating the locations of each of the sampling stations.
  - This report shows that the Outer Harbor and nearshore waters of Lake Michigan consistently meet water quality standards, while the Estuary and Milwaukee River are more compromised in terms of specific conductance, nitrogen, phosphorus, total suspended solids, and turbidity.

Water Quality Results

Percent of samples meeting standards

Parameter	RI-01	RI-02	RI-03	RI-04	RI-05
Chloride	●	●	●	●	●
Dissolved Oxygen	●	●	●	●	●
Fecal coliform	●	●	▲	▲	▲
Specific Conductance	◆	◆	◆	◆	◆
Total Ammonia Nitrogen	●	●	●	●	●
Total Kjeldahl Nitrogen	◆	◆	◆	◆	◆
Total Phosphorus	▲	▲	▲	▲	▲
Total Suspended Solids	●	●	▲	◆	◆
Turbidity	◆	▲	▲	◆	◆

● >75%   ▲ 75-50%   ◆ <50%

Figure 18. Outer Harbor Water Quality Results – Milwaukee Riverkeeper

Percent of samples meeting standards

Parameter	OH-01	OH-02	OH-03	OH-04	OH-05	OH-07	OH-09	OH-10	OH-11
Chloride	●	●	●	●	●	●	●	●	●
Dissolved Oxygen	●	●	●	●	●	●	●	●	●
Fecal coliform	●	●	●	●	●	●	●	●	●
Specific Conductance	◆								
Total Ammonia Nitrogen	●	●	●	●	●	●	●	●	●
Total Kjeldahl Nitrogen	◆								
Total Phosphorus	●	△	●	●	●	●	●	●	●
Total Suspended Solids	●	●	●	●	●	●	●	●	●
Turbidity	△	△	●	●	●	●	●	●	●

● >75% △ 75-50% ◆ <50%

Figure 19. Estuary Water Quality Results – Milwaukee Riverkeeper

Percent of samples meeting standards

Parameter	RI-06	RI-07	RI-08	RI-11	RI-14	RI-15	RI-17	RI-18	RI-19	RI-20	RI-31
Chloride	●	●	●	●	●	●	●	●	●	●	●
Dissolved Oxygen	●	●	●	●	●	●	●	●	●	●	●
Fecal coliform	●	●	●	●	●	●	●	●	●	●	●
Specific Conductance	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Total Ammonia Nitrogen	●	●	●	●	●	●	●	●	●	●	●
Total Kjeldahl Nitrogen	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆	◆
Total Phosphorus	△	△	△	△	●	△	△	●	●	●	●
Total Suspended Solids	◆	△	△	◆	△	△	△	●	●	●	●
Turbidity	◆	◆	◆	◆	◆	◆	◆	△	◆	△	△

● >75% △ 75-50% ◆ <50%

Figure 20. Nearshore Lake Michigan Water Quality Results – Milwaukee Riverkeeper

Percent of samples meeting standards

Parameter	OH-06	OH-08	OH-12	OH-13	OH-14	OH-16	OH-17
Chloride	●	●	●	●	●	●	●
Dissolved Oxygen	●	●	●	●	●	●	●
Fecal coliform	●	●	●	●	●	●	●
Total Ammonia Nitrogen	●	●	●	●	●	●	●
Total Phosphorus	△	◆	●	△	△	◆	△
Turbidity	●	●	●	●	●	●	●

● >75% △ 75-50% ◆ <50%

Figure 21. Milwaukee River Water Quality Results – Milwaukee Riverkeeper

Physical

- Temperature: A (MR 2017)
- Turbidity: D (MR 2017)

- Specific Conductivity: F (MR 2017)

Chemical

- Dissolved Oxygen: B+ (MR 2017)
- Dissolved Oxygen: Low (DNR)
- PCB contaminated sediments, unspecified metals contaminated sediments (DNR)
- pH: A (MR 2017)
- Phosphorus: F (MR 2017)
- Chloride: A (MR 2017)

Biological

- Bacteria: F (MR 2017)
- MBIS: 2.29/4
- PCBs contaminated fish tissue (DNR)
- Fish and aquatic life condition (DNR 2019): Poor

1.5.5 IWRAs

Important Water-Related Areas

After engaging with stakeholders, we established Important Water-Related Areas include Lake Michigan, the Milwaukee Harbor and the Milwaukee River. These areas all hold great value to the community as cultural and environmental assets.

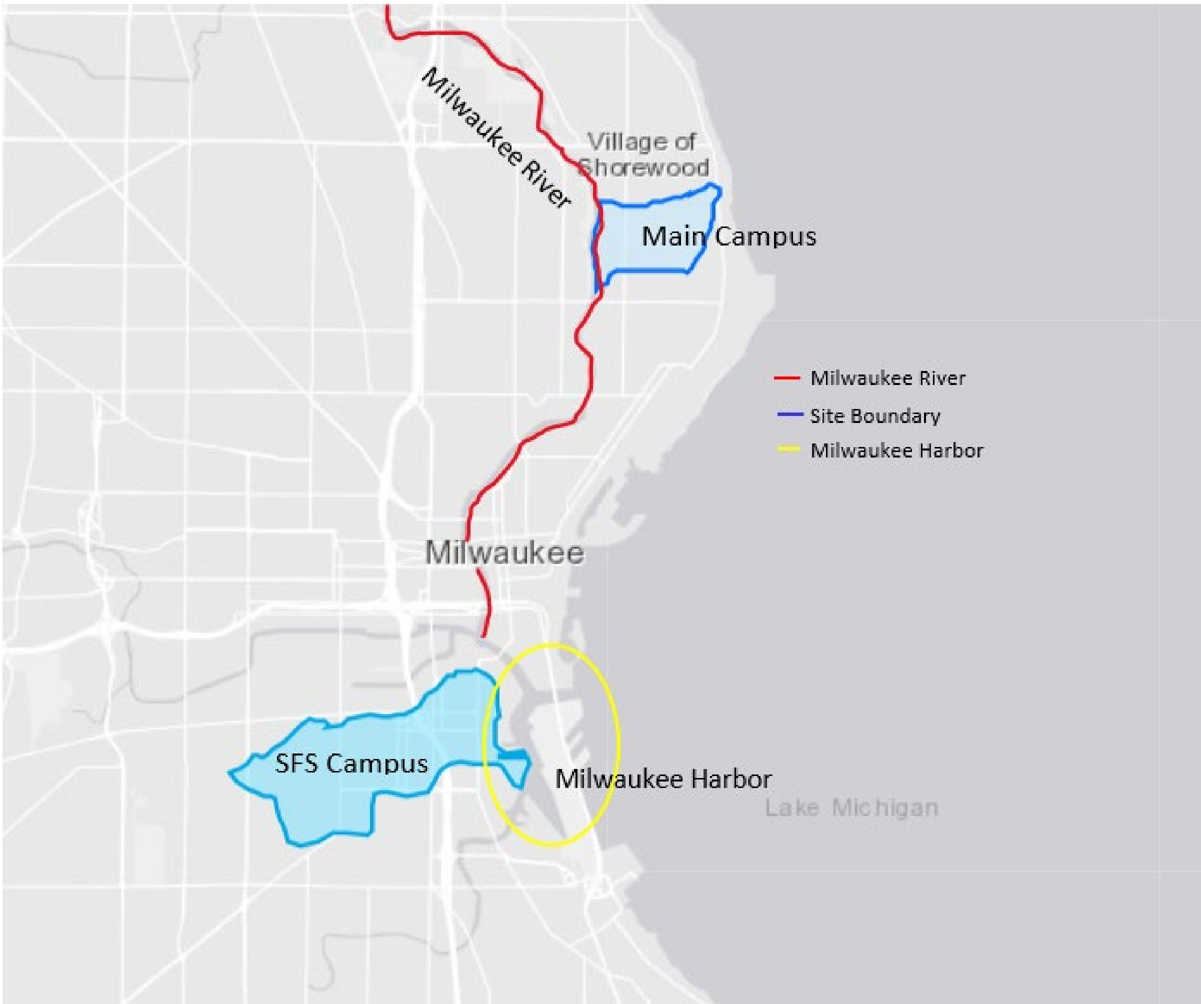


Figure 22. Map of IWRAs in Relation to UWM Campus Catchments

Lake Michigan

Lake Michigan is valuable to Milwaukee on so many levels; this large body of freshwater is a source of health, recreation, and commerce. The City's drinking water is sourced from the Lake and provides as a necessary resource for many industries. The Lakefront provides beautiful beaches for pedestrians to enjoy and many adventures further onto the water via boat. The habitat supports fisheries, large bird populations, and other plants and animals vital to the ecosystem.

Though Lake Michigan is a well-loved resource, it is constantly under threat. Phosphorus and chloride pollutants from runoff can throw-off the nutrient and chemical balance in the Lake. Large animal die-offs can occur from algae blooms that suck oxygen from the water once they begin to decompose. Blue-green algae blooms (cyanobacteria) also can wash on shore, causing odor on beaches, and even shut them down due to their potential harm to humans. These occurrences can prompt costly cleanups by the city. Other pollution from litter and transportation also effects Lake Michigan health. The current invasion of quagga mussels has also altered the Lake ecosystem—water is clearer than ever, but food for fish in the water column has depleted. It seems Lake Michigan teeters back and forth in health, but overall has been improving.

A popular summer spot in Milwaukee: Bradford Beach
Image sourced from VisitMilwaukee.org

Milwaukee Harbor

The Milwaukee Harbor has been a hub for many industrial businesses and provides Milwaukee with a valuable trading port. The Harbor District is currently undergoing a transformation with revitalization efforts aimed to strengthen the community and economy (these can be found in more detail on the Harbor District website). Connected to the Lake, it shares the same water quality challenges. Current efforts by the Harbor District include expanding the park system and installing Habitat Hotels on the steel sheet piling that is prolific in the area. The Milwaukee Harbor is in improving condition based on these efforts.

View of the Milwaukee Harbor
Image sourced from Milwaukee Department of City Development

Milwaukee River

Historically, the Milwaukee River has been an incredible source of recreation. However, as Milwaukee grew, the riparian habitat was developed, and the River suffered from industrial pollution. Since the passing of the Clean Water Act, remediation efforts have greatly improved the Milwaukee River's in attempt to reach the goal of a "fishable and swimmable river." In 2018, the Milwaukee Water Commons even hosted the Cream City Classic open river swim in the Milwaukee River. Valuable natural riparian habitat still exists north of downtown along the Milwaukee River Greenway, a corridor that is commonly utilized for hiking and fishing. Though highly developed, the downtown area has a paved Riverwalk that connects pedestrians to local businesses and attractions. Based on the current status and ongoing efforts, Milwaukee River is considered in good condition and improving with each year.

Downtown Milwaukee Riverwalk

Image sourced from Milwaukee Riverwalk District

1.5.6 Infrastructure

Both UWM campuses have the necessary infrastructure to transport water to input, output, and point-of-use locations. All water-related infrastructure is currently in good-working order to the best of our knowledge. A water main broke on 4/2/19 near Newport and Downer but was repaired by city workers. Condition of the green infrastructure good, as maintenance is performed regularly or as needed.

Extreme storm events may damage and clog green infrastructure, but these issues can be remedied post-event.

University of Wisconsin Milwaukee – Main Campus

There are multiple green infrastructure facilities within the campus discussed within this report. These BMP's provide reductions in TSS and TP as well as relief to the combined sanitary sewer. County has storm sewer within the catchment area located closer to the river.

University of Wisconsin Milwaukee – School of Freshwater Sciences

School of Freshwater Science has implemented multiple green infrastructure within the its campus that are discussed within this report. These BMP's provide reductions in TSS and TP as well as relief to the combined sanitary sewer. Rain gardens, bioswales, and pave-drain discharge storm water directly into the harbor.

1.5.7 WASH

Catchment Access to Water

Both defined catchment's populations have 100% access to good water. Milwaukee Water Works supplies drinking water to our catchment area. Water quality monitoring data for the service area can be found in the documents section under the 2018 Consumer Confidence Report published by Milwaukee Water Works to see the quality of the water being delivered throughout the service area. Furthermore, a map of the service area with pinpointed site locations is provided below (Figure 23). A PDF version from Milwaukee Water Works website is also available in the documents section.

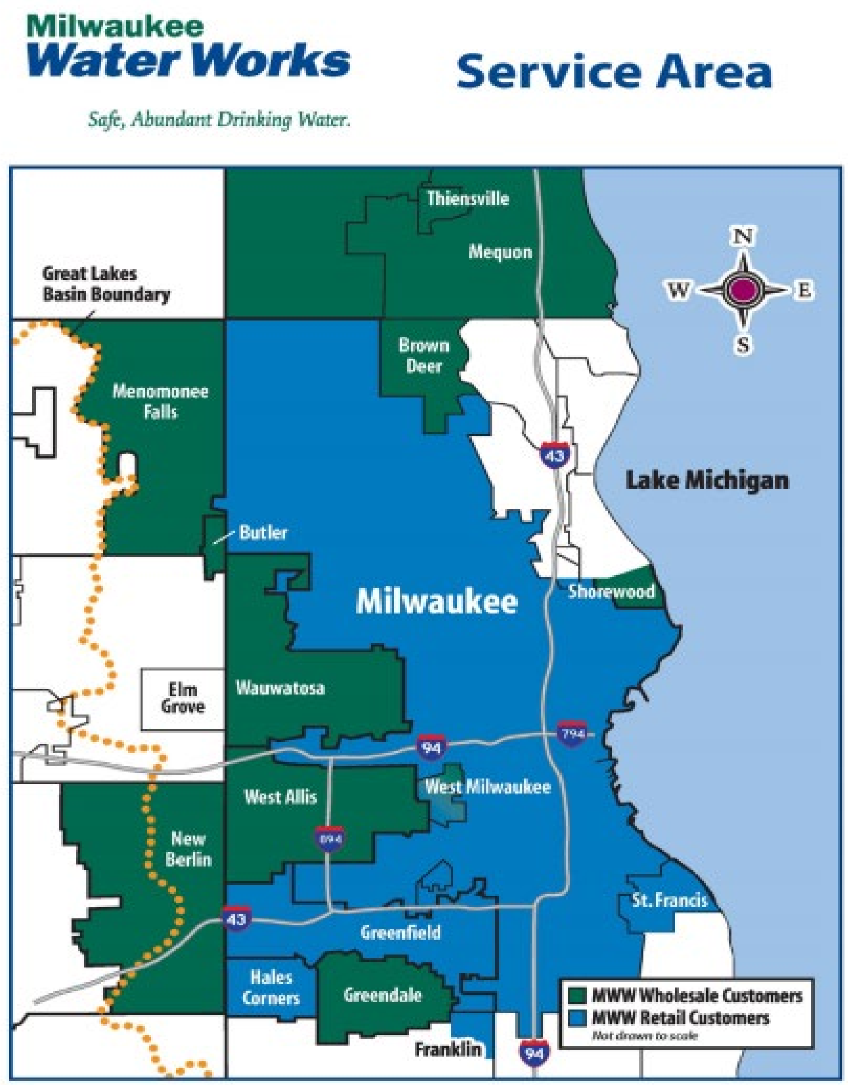


Figure 23. Wisconsin Water Works Service Area – Water Works

Catchment Access to Wastewater Services

Both defined catchment's populations have 100% access to Wastewater Services. Milwaukee Metropolitan Sewerage District supplies wastewater services to our catchment area. A map of the wastewater service area is provided below (Figure 24). A PDF version from Milwaukee Metropolitan Sewerage District's website is also available in the documents section.

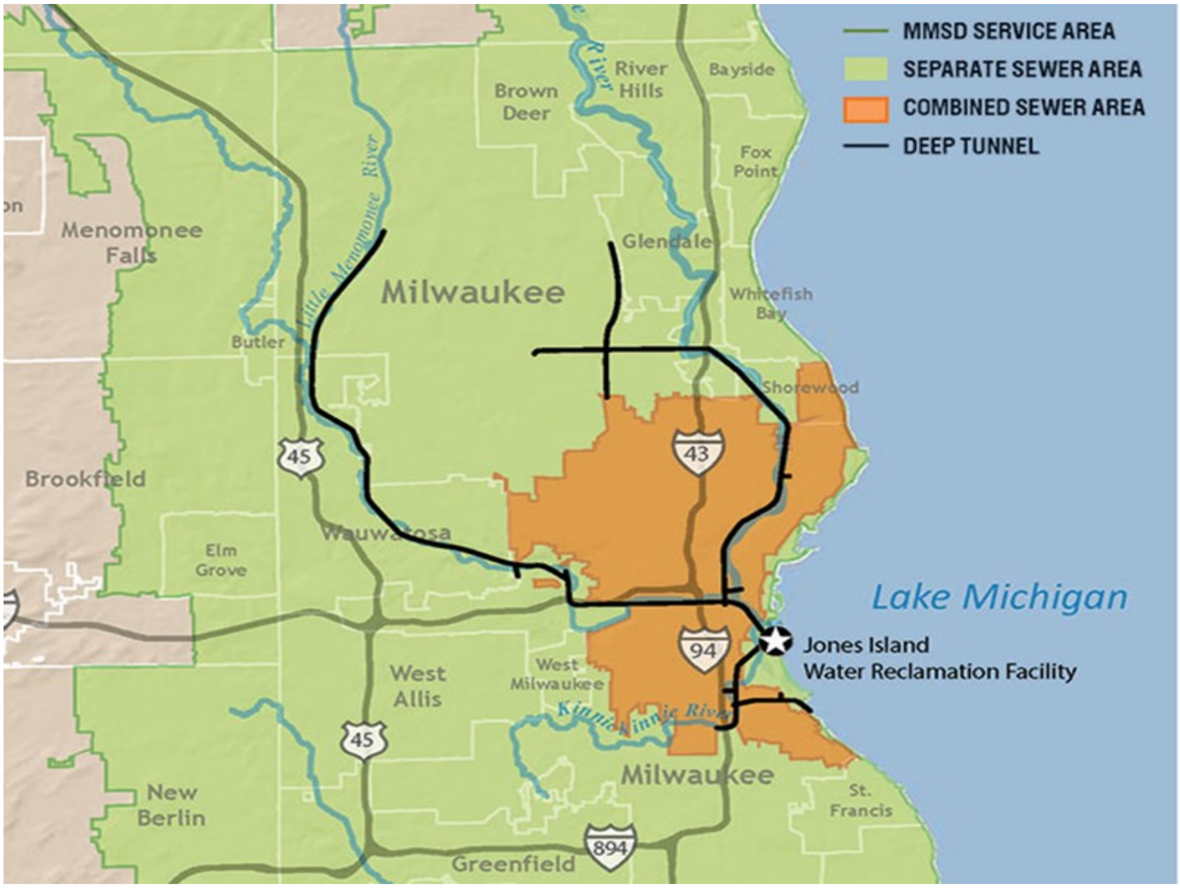


Figure 24. Wisconsin MMSD Service Area – MMSD

Documents

- Milwaukee Water Works 2018 CCR
- Milwaukee Water Works Service Area
- MMSD Service Area

1.6 Shared Challenges

1.6.1 Identify and Prioritize

Shared challenges provide an opportunity for collective action in the catchment and to guide the water stewardship plan. 1.6.1 The identified shared challenges should be listed and prioritized in terms of their significance and urgency. Recommendations are not given on how to prioritize due the very large number of possible circumstances, but reasonable judgements should be made, with justification.

For example:

- A concern for complete loss of water supply is more significant than concern for a 10% rise in water charges

- Occasional interruption of water supply experienced now, is more urgent than concern for reduced supply in the future.

Significance and urgency were assigned ratings based on concerns expressed by stakeholders and our research and understanding of challenges.

University of Wisconsin Milwaukee – School of Freshwater Sciences

Table 8. Shared Water Challenges Significance and Urgency – School of Freshwater Sciences

Shared Water Challenges	Significance	Urgency
Salt runoff into Harbor	High	High
Stormwater runoff and sewer direct discharge into harbor from parking lots	High	High
Combined Sewage Overflows	Medium	Medium
Species Diversity in the Harbor	Medium	Low
Cost of water	Medium	Low
Level of phosphates in the Harbor	High	Medium
Energy Costs	Medium	Low

University of Wisconsin Milwaukee Main Campus

Table 9. Shared Water Challenges Significance and Urgency – University of Wisconsin Milwaukee Main Campus

Shared Water Challenges	Significance	Urgency
Salt runoff	High	High
Stormwater runoff	Medium	Medium
Combined Sewage Overflows	Medium	Low
Flooding in community and damage to property	High	High
Cost of water	Low	Low
Milwaukee River health	Medium	Medium
Lead pipes	Medium	Medium
Energy Costs	Low	Low

1.6.2 Initiatives

After identifying shared water challenges, it was important for us to research possible causes and initiatives to address these challenges. The following assessments of challenges, causes, and initiatives were developed through stakeholder input, professional insights, and team research.

University of Wisconsin Milwaukee – School of Freshwater Sciences

Table 10. Shared Water Challenges – School of Freshwater Sciences

Shared Water Challenges	Possible Causes	Initiatives
ɔad salt application runoff into ilwaukee Harbor	○ Road salting ○ Sewers drain into harbor	○ Using sand instead of salt ○ Reducing the amount of salt used and applied

		○ Monitor the amounts applied and where
ormwater runoff and direct scharge into Harbor	○ Sewers drain into harbor ○ Lack of natural banks ○ Impermeable surfaces	○ Introduce and expand green infrastructure such as rain gardens and permeable surfaces
ombined Sewage Overflows	○ Excessive use of water ○ Water used by Milwaukee ○ Extreme weather events	○ Reduce the amount of water used ○ Increase fixture efficiency ○ Reduce water used in heavy rain events ○ Use signage to remind people to reduce water consumption ○ Install greywater systems
ecies Diversity in the Harbor	○ Lack of natural shoreline; lack of habitat ○ High levels of pollutants ○ Low DO levels	○ Allow for a more natural shoreline to improve species habitat ○ Install man-made habitats (ex: The Harbor District Habitat Hotels) ○ Reduce the runoff from the parking lots with natural barriers or rain gardens to improve habitat conditions
ost of Water	○ Amount of municipal water used on site ○ Milwaukee Water Works rates	○ Reduce the amount of water used ○ Implement sustainable aquaculture water use ○ Use signage to promote water conservation ○ Introduce greywater systems
vel of Phosphates in the Harbor	○ Direct discharge of aquaculture wastewater ○ Agricultural runoff ○ Yard fertilizer runoff ○ Urban runoff	○ Reduce runoff with natural barriers to absorb excess nutrients running off the site and hardscapes ○ Combined action with local farmers to introduce natural barriers to prevent agricultural runoff ○ Combined action with local homeowners; provide

		education on hazards associated with lawn fertilization ○ Regulate and monitor aquaculture water use and recycling ○ Introduce ways to limit phosphates and aim to come out lower than TMDLs
ergy Costs	○ Amount of energy used ○ Types of energy used ○ WE Energies rates	○ Decrease the amount of energy used ○ Introduce more than 10% renewable energy resources ○ Improve green roof conditions for proper heating and cooling

Table 11. Shared Water Challenges – University of Wisconsin Milwaukee Main Campus

Shared Water Challenges	Possible Causes	Initiatives
Road and Sidewalk Salt Runoff	○ Salting roads and sidewalks in the winter ○ Lack of alternatives ○ Pricing	○ Using alternatives instead of salt (sand, brine sprays, beet juice) ○ Reducing the amount of salt used and applied ○ Monitor application practices
Stormwater Runoff	○ Hardscapes (parking lots, sidewalks, etc.) ○ Lack of natural green spaces and green infrastructure ○ Extreme weather events	○ Introduce and expand green infrastructure (rain gardens, permeable pavements, etc.) ○ Reduce the amount of water entering the sewer system
Combined Sewage Overflows	○ Water used by the catchment ○ Water used by Milwaukee ○ Large quantities of water runoff from site hardscape ○ Extreme weather events	○ Reduce the amount of water used ○ Reduce water used in heavy rain events ○ Use signage to remind people to reduce water consumption ○ Install greywater systems ○ Install and expand green infrastructure

Flooding in Community and Damage to Property	○ Hardscapes ○ Lack of rain retention and natural areas	○ Reduce hardscape areas ○ Introduce green spaces with native plants and storm trees that can absorb more water ○ Introduce and expand green infrastructure
Cost of Water Delivery	○ The amount of water used by the site and the community members ○ The amount of water used by the dorms ○ Milwaukee Water Works rates	○ Reduce the amount of water used ○ Use signage to promote water conservation ○ Introduce more water fountains that have a water bottle fill-up stations and that count the number of plastic bottles saved ○ Introduce greywater systems ○ Introduce duel flushing toilets and other efficient fixtures
Milwaukee River Health	○ Runoff into the river ○ Agricultural runoff ○ Sedimentation ○ Urban pollution	○ Allow for a more natural shoreline ○ Reduce the runoff from urban areas with natural barriers or rain gardens ○ Combined action with local farmers to introduce natural barriers to prevent agricultural runoff up-stream
Lead in Water	○ Lead Pipes and plumbing components (laterals, solder, etc.) ○ Not replacing old lead pipes in buildings	○ Renovate and remove any existing lead pipes from older buildings purchased by UWM ○ Provide educational materials for students and residents in the area ○ Use signage to advocate the lack of lead pipes in buildings and highlight the work that has been completed

Energy Costs	○ The amount of energy used for daily operations ○ WE Energies rates	○ Decrease the amount of energy used ○ Set dorm competition energy goals and reward the dorm that uses the least ○ Have more than 10% of energy coming from renewable resources ○ Improve green roof conditions for proper heating and cooling ○ Educate the students and public about our energy sources and the water input of each

1.7 Water Risks and Opportunities

1.7.1 Identify Risks

Table 12. Water Related Risks, Likelihood, Severity, Cost, and Impacts

Risk	Likelihood*	Severity of Impact*	Potential Costs	Business Impact
Sudden Infrastructure Failure	2	3	$	Temporary closures, repair costs
Increasing Charges	2	5	$$ - $$$$	Water usage would have to be reduced, profits would need to be increased
Contamination (lead)	2	4	$$ - $$$	Loss of trust over safety of campus water
Failing Permit Requirements	1	5	$$	University would be fined, permits need to be up-to-date for facilities to function
Reputation of UWM	3	3	$$	Pressure from local communities, enrollment and

				funding could decrease
Flooding	2	4	$ - $$$	Temporary closures, property damage
Environmental Pollution	5	2	$$ - $$$	Pressure from local communities, decreased property quality
Sewer Overflow into lake	4	2	$	Pressure from local communities

*Likelihood and Severity of Impact and based on a 10-year timeframe, on a scale of 1-5, with 1 being the least likely/severe and 5 being the most likely/severe. Scoring based on research and knowledge of past, current, and potential future risk exposures.

*Costs currently unknown so a best estimate of cost ratings were applied.

1.7.2 Identify Opportunities

Following through with water sustainability plan actions provides valuable opportunities for UWM while mitigating risks and addressing challenges. UWM would likely notice long-term cost savings. While initial investments of fixture installations, property improvements and education may be costly, the water savings would eventually financially benefit the University. This in turn benefits the reputation of UWM as a water steward, ensures campus safety, and increases the quality of our environment.

1.8 Best Practices

1.8.1 Water Governance

- Develop a 2020 Sustainability Master Plan to evaluate and update past and future goals.
- Act as a university leader in water stewardship, providing as an example to other institutions.
- Assign a water steward to offer input on all university projects and development.
- Train students and staff on principles of water stewardship to increase education and outreach.
- Continue engagement with students, staff, and stakeholders about water stewardship, local challenges, initiatives, and improvements.

1.8.2 Water Balance

We have found the following methods to be of best practice for water balance within our catchment:

- Install water efficient fittings (toilets, sinks, washing facilities, etc.) in all buildings.

- Use landscaping that requires little-to-no watering, such as native plants. When watering is necessary, do so in the early morning with captured stormwater.
- Reduce leaks through early detection and repair. Assessments will be required.
- Train students and staff on water efficiency in daily activities (example: turning off taps while scrubbing hands or brushing teeth).
- Promote and reward university dorm residents through challenges to reduce their water consumption.

1.8.3 Water Quality

Based on information provided by the City of Milwaukee, MMSD and the Milwaukee Riverkeeper, the following best practices for water quality were developed:

I. Match water quality to its intended purpose; landscaping and gardening can use lower quality water, like that from rain barrels or cisterns. Reserve higher quality water for essential purposes and human consumption.
II. Use landscaping that requires minimal watering, fertilizing, and chemical treatment. If possible, use natural fertilizers such as compost, and do not apply any chemical herbicides.
III. Implement "buffer zones" to reduce the transport of pollutants through runoff. This can be done through manmade GI such as bioswales or preserved natural habitat areas.
IV. Implement GI to increase capture and reduce sewage overflows during large rain events to protect the quality of Lake Michigan.
V. Apply only the necessary amount of road salt in winter months on walkways and roads. Reduce chloride pollution from road salt through preventing over-application, investing in new technologies, and adapting to alternative methods.

Documents

- Milwaukee Riverkeeper Annual Report Card
- ReFresh MKE Plan
- MMSD Green Infrastructure
- City of Milwaukee Fishable Swimmable Water

1.8.4 IWRAs

The following best practices were developed for Important Water-Related Areas to promote the improvement and maintenance of their quality:

I. Maintain existing green infrastructure and incorporate GI into any new or re-development. Create a program to monitor GI for maintenance and repair needs.
II. Maintain adequate riparian habitat along any natural IWRA (excluding areas already highly developed).
III. Support public communication initiatives through signage to raise awareness and protect IWRAs
IV. Promote volunteer events that support the health of IWRAs (river cleanups, GI revitalization, etc.).
V. Support local monitoring efforts of IWRA's (through Riverkeeper, MMSD, etc.)

1.8.5 WASH

Requirements to Provide Water and Sanitary Facilities for Workers

The Occupational Safety and Health Administration (OSHA) puts force requirements to provide water and sanitary facilities for workers. The sanitation standards of the Occupational Safety and Health Standards (29 CFR 1910.141, 29 CFR 1926.51 and 29 CFR 1928.110) are intended to ensure that workers do not suffer adverse health effects that can result if toilets are not sanitary and/or are not available when needed.

The following table details the required number of restrooms that must be provided on premises per employees on site at a given time.

Table 13. Number of Restrooms per Employee

Number of Employees	Minimum Number of Water Closets
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
81 to 110	5
111 to 150	6
Over 150	(2)

*Where toilet facilities will not be used by women, urinals may be provided instead of water closets, except that the number of water closets in such cases shall not be reduced to less than 2/3 of the minimum specified.

There are several other sanitary requirements employers must provide besides the addition of water closets. Soap, air dryers, hand towels, and running water need to be available at all times. The employer must establish and implement a schedule for servicing, cleaning, and supplying each facility to ensure it is maintained in a clean, sanitary, and serviceable condition. The employer must provide potable drinking water in amounts that are adequate to meet the health and personal needs of each employee. The employer must dispense drinking water from a fountain, a covered container with single-use drinking cups stored in a sanitary receptable, or single-use water bottles. Lastly, the employer must prohibit the use of shared drinking cups, dippers, and water bottles.

Catchment Access to Water

Both defined catchment's populations have 100% access to good water. Milwaukee Water Works supplies drinking water to our catchment area. Water quality monitoring data for the service area can be found in the documents section under the 2018 Consumer Confidence Report published by Milwaukee Water Works to see the quality of the water being delivered throughout the service area. Furthermore, a map of the service area with pinpointed site locations is provided below. A PDF version from Milwaukee Water Works website is also available in the documents section.

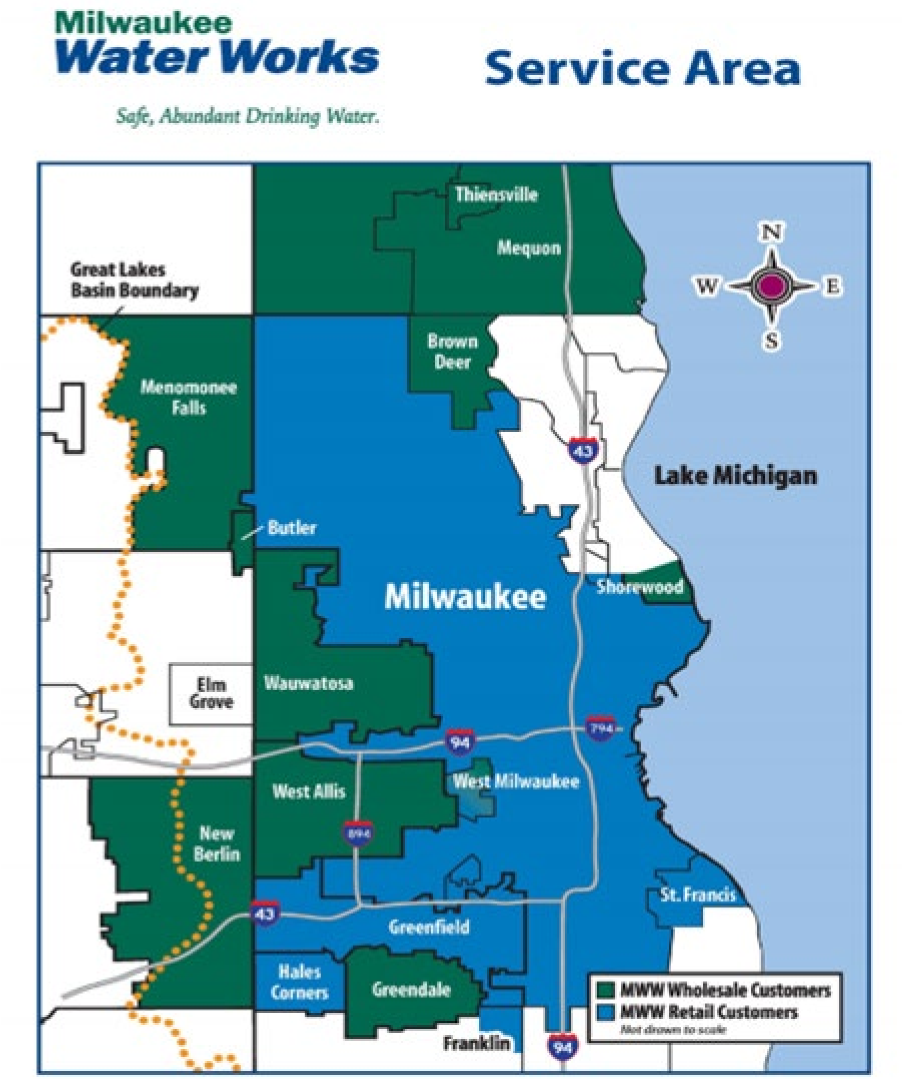


Figure 25. Milwaukee Water Works Service Area

Catchment Access to Wastewater Services

Both defined catchment's populations have 100% access to Wastewater Services. Milwaukee Metropolitan Sewerage District supplies wastewater services to our catchment area. A map of the wastewater service area is provided below. A PDF version from Milwaukee Metropolitan Sewerage District's website is also available in the documents section.

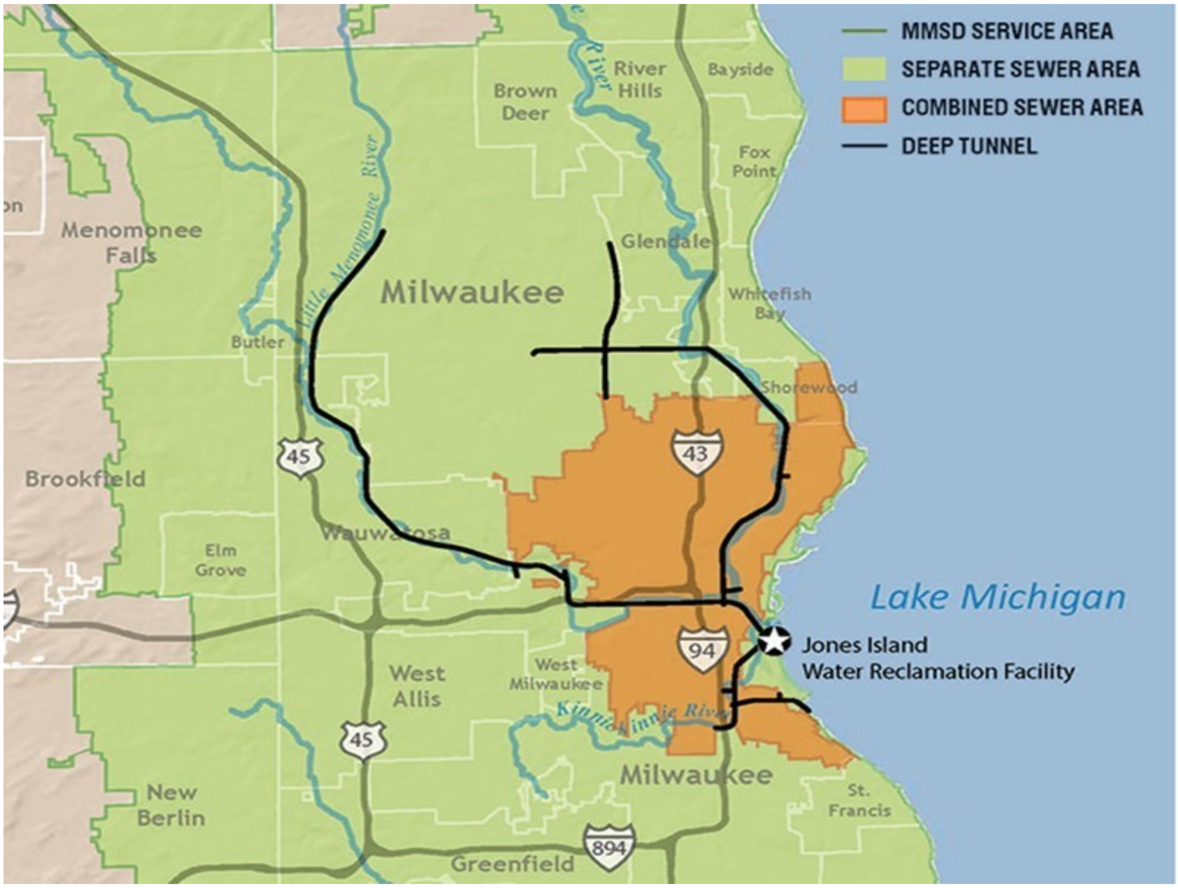


Figure 26. Wastewater Service Area

Documents

- Milwaukee Water Works 2018 CCR
- Milwaukee Water Works Service Area
- MMSD Service Area

Section 2

2.1 Site Commitment and 2.1.1 Signed Document

Office of Sustainability and School of Freshwater Sciences are the bases of operations for this joint UWM-AWS project. The three key entities committed to advancing this project are John Gardner, Office of Sustainability and School of Freshwater Sciences; Jenny Kehl, Office of the Provost and School of Freshwater Sciences; and the graduate students who developed the AWS report; Hannah Burby, Spencer Charczuk, Christopher Dwyer, Erin Ganzke, Kate Markiewicz, and Megan Weller. After the final report and Water Stewardship Plan are submitted and the corresponding course FRSHWTR 650 is complete, John Gardner will be the Program Manager and Jenny Kehl will be the Deputy Program

Manager. The key internal stakeholders at School of Freshwater Sciences from whom we seek commitment are the Faculty Committee, the Student Water Council Committee, and the Dean, Val Klump, who will facilitate commitment from the Assistant Dean for Facilities, Rob Paddock.

September 2018: The Faculty Committee of SFS approved the project to develop a Water Stewardship Plan in accordance with Alliance for Water Stewardship *International Standard*. The Faculty Committee approved the syllabus with the full course description and full project description to be offered as FRSHWTR 650: Policy Analysis and Evaluation: Developing an AWS Water Stewardship Plan for School of Freshwater Sciences and University of Wisconsin-Milwaukee.

October 2018: Associate Dean, Tim Grundl, approved the project to develop a Water Stewardship Plan in accordance with Alliance for Water Stewardship *International Standard*. The Associate Dean approved the syllabus with the full course description and full project description to be offered as FRSHWTR 650: Policy Analysis and Evaluation: Developing an AWS Water Stewardship Plan for School of Freshwater Sciences and University of Wisconsin-Milwaukee. The Dean, Val Klump, gave final approval.

March 2019: Dean, Val Klump, attended a meeting with the Water Council, whose leadership reported afterwards that the dean verbally expressed to them that he was "highly supportive" of the project. This was later documented in an email follow-up message to the dean.

March 2019: Dean, Val Klump, sent written approval of and commitment to advance the project via email response to the aforementioned message exchange.

May 2019: Dean of SFS, Val Klump; Director of Office Sustainability, Kate Nelson; Chair of the Executive Committee of the Faculty, Michael Carvan; and Program Manager for AWS, Dylan Waldhautter, attended the students' presentation of the Water Stewardship Plan. All stayed for a two-hour discussion and all approved our advancement of the Plan. Kate Nelson asked Dean Val Klump for confirmation of commitment, he gave it, Jenny Kehl asked for written confirmation (in addition to the written email approvals and verbal agreements), and it is pending Val's signature on the document. The summer intern will need to follow-up on the written document.

2.2 Regulatory Compliance

2.2.1 Regulatory System

The following systems are in place at UWM to maintain compliance with water-related legal and regulatory requirements. For further documentation, please reference section 1.5.2.

Drinking water quality

UWM files Consumer Confidence Reports as required by the Federal Environmental Protection Agency. This assures drinking water on campus meets the EPA's national standard and regulation as defined by the Safe Water Drinking Act. UWM will continue to provide Consumer Confidence reports on annually. All drinking water amenities are managed by UWM Facility Services.

Drinking water pricing

Drinking water prices in Milwaukee (and both catchment sites) are grouped into the overall price for water usage. Water rates are determined by the Public Service Commission of Wisconsin based on cost of service, so all customers, including those tax-exempt, are charged fairly for the water they use.

As measured by the customers water meter, 100 cubic feet (748 gallons) cost $1.96. (rates effective 2014). The Milwaukee Water Works measures and bills for water use in 100 cubic feet, or Ccf.

Requirements to Provide Water and Sanitary Facilities for Workers

UWM campuses meet all OSHA requirements to provide water and sanitary facilities for workers. These requirements (29 CFR 1910.141, 29 CFR 1926.51 and 29 CFR 1928.110) are intended to ensure that workers do not suffer adverse health effects that can result if toilets are not sanitary and/or are not available when needed. Schedules for servicing, cleaning, and supplying each sanitary facility is managed by UWM Facility Services (uwm.edu/facility-services).

All existing and new campus developments will remain compliant with OSHA standards. Reference 1.5.7.

Wastewater Discharge Standards

Wastewater discharge standards are determined by the Department of Natural Resources and is monitored by MMSD. Both UWM campuses currently hold valid permits and meet the discharge standards. If standards are predicted to change, the School of Freshwater Sciences will adapt their discharge water treatment practices. How we will adapt to that is unknown at this time.

The University of Wisconsin Milwaukee – School of Freshwater Sciences

The Department of Natural Resources (DNR) provides the Wisconsin Pollutant Discharge Elimination System (WPDES) permit for the discharge from Jones Island. WPDES permit for facility is WI-0036820-03-01.

The Department of Natural Resources (DNR) provides the Wisconsin Pollutant Discharge Elimination System (WPDES) permit for the discharge from The School of Freshwater site. The Current permit to discharge from the School of Freshwater Science site is WI-0045942-06-0

The University of Wisconsin Milwaukee – Main Campus

The Department of Natural Resources (DNR) provides the Wisconsin Pollutant Discharge Elimination System (WPDES) permit for the discharge from Jones Island. WPDES permit for facility is WI-00362820-03-1.

The Main Campus Site also has a power plant and cooling station, whereas, a discharge permit is required. WPDES permit for this site is WI-0040282-08-0. A copy of said permit can be found in the documents section.

Stormwater Management

Stormwater management is regulated by local municipalities, the MMSD, the Wisconsin Department of Natural Resources (WDNR), and the United States Environmental Protection Agency (USEPA), and the U.S. Army Corps of Engineers (CORPS). Impacts to waterways and wetlands are also regulated by all these listed entities. Both campuses are subject to Milwaukee's Ordinance 120 requirements.

The following is a list of applicable stormwater regulations for UWM landholdings in Milwaukee:

- NR 216 (Comm 60) Storm Water Discharge Permits—covers three types of stormwater discharge permits: municipal, industrial and construction site.
- NR 151 (Comm 60, Comm 82, Comm 85) Runoff Management (water quality)
- NR 116 Wisconsin's Floodplain Management Program
- Chapter 30 of the Wisconsin Statues: Navigable Waters, Harbors and Navigation
- City of Milwaukee Ordinance—Chapter 120 (addresses increases in impervious area and peak run-off flow)
- City of Glendale Ordinance—Title 6, Chapter 5
- Milwaukee Metropolitan Sewerage District (MMSD)—Chapter 13 (defines stormwater detention requirements for the MMSD service area)
- Section 404 of the Federal Clean Water Act (regulations discharges to "Waters of the U.S)

Environmental Regulations to Protect Water Bodies

The Clean Water Act regulates the protection and conservation of water bodies from pollution. In Wisconsin, the Wisconsin Department of Natural Resources (WDNR) sets forth criteria in order to help meet the Clean Water Act in our lakes and rivers. There is also required TMDL reporting and catchment reporting done by Milwaukee Riverkeeper.

Hazardous Materials Transportation Regulation

The U.S. Department of Transportation (DOT) regulates both surface and air shipment of hazardous materials shipped within the United States. Regulations for compliance are found in 49 CFR Parts 171-177, the Hazardous Materials Transportation Act (HMTA), and the Hazardous Materials Transportation Uniform Safety Act of 1990 (HMTUSA). International and U.S. domestic air shipments are also regulated by the International Air Transportation Association's (IATA) Dangerous Goods Regulations (DGR) and are enforced by the Federal Aviation Association (FAA).

These regulations set out the responsibilities for institutions and individuals involved the transportation-related activities of hazardous materials and dangerous goods, which include the following hazard classes: explosives, compressed gases, flammable liquids and solids, oxidizers, reactive, poisons, infectious substances, radioactive materials and corrosive materials. In addition, the regulations specify: proper classification, packaging, labeling, security assessment, and documentation of all shipments. The regulations require training for anyone who prepares, offers, or receives materials for shipment and establishes penalties and fines for non-compliance. Failure to comply with the regulations may not only result in substantial fines and penalties for the University, but the individual(s) causing the violation can also be held personally liable.

Handling Biological Materials

The Institutional Biosafety Committee (IBC) is responsible for assessing risks and potential environmental impacts associated with activities involving biohazardous materials and making recommendations for the safe conduct of such studies. It also functions on behalf of the institution to ensure that campus activities involving biohazardous materials are performed in compliance with current policies and guidelines set forth by UWM, State of Wisconsin, Centers For Disease Control and Prevention (CDC), National Institutes of Health(NIH), and other regulatory agencies.

When working with any of the following, a biosafety protocol required to be filed and approved by the IBC as part of university and federal policies:

- Recombinant (transgenic) or synthetic DNA/ RNA materials, including human gene therapy, proteins, and enzymes of infectious biological agents
- Microbes and disease-causing agents including bacteria, viruses, fungi, prions, protozoa, parasites, and their structural components
- Large scale propagation consisting of a volume greater than 10L or more in one vessel
- Human cells and cell culture, organs or tissues, or biological samples
- Non-human cells and cell culture, organ or tissues, or biological samples that are infectious, potentially infectious, or recombinant
- Animals (vertebrate and/ or invertebrate) that are recombinant (transgenic), exotic, and/ or grown in association with pathogens and/ or recombinant materials. This also includes arthropods that may be poisonous or illicit allergic reactions.
- Plants that are recombinant (transgenic), exotic, and/ or grown in association with pathogenic or recombinant microbes and/ or pathogenic or recombinant small animals (insects, etc.)
- Biological toxins (this does not include toxic chemicals or antibiotics)

Laboratory Regulations

UWM's Department of Safety and Assurances is responsible for maintaining proper lab practices that protect the local waterways, some of which have already been described in the above sections. This includes necessary employee trainings, inventorying chemicals, safety data sheets, and spill response plans.

2.3 Strategy and Plan

2.3.1 Strategy

Mission Statement

Water stewardship is a crucial element of University of Wisconsin-Milwaukee’s leadership in the water sector at local and global levels. We must build on our current successes in water conservation and environmental sustainability, and forge ahead in applying our water expertise, improving our resource management, and continuing to support innovative water education. As the world’s water challenges become more pronounced and more complex, University of Wisconsin-Milwaukee is positioned to advance its leadership through quality research, active education, and extensive community service, all of which constitute important elements of the development and implementation of the Water Stewardship Plan.

The primary purpose of the Water Stewardship Plan is to provide deliberate direction in the strategic plan for future water consumption and conservation at University of Wisconsin-Milwaukee's local sites while participating in the Alliance for Water Stewardship's global water initiative. University of Wisconsin-Milwaukee (UWM) is aspiring to be the first university in the USA and the world to successfully apply the Alliance for Water Stewardship (AWS) International Water Stewardship Standard to water use and conservation on campus. The UWM main campus is a large organization with over 25,000 students and 3,000 faculty and staff. To make the Plan feasible, the Office of Sustainability and the School of Freshwater Sciences joined in collaboration to enhance our analysis and strategic thinking. The Office of Sustainability, founded in 2008, has extensive knowledge and data on water use at UWM, and it assesses, supports, and drives sustainability initiatives across campus operations, student life, and academic affairs.

Our philosophical emphasis in developing the Water Stewardship Plan reflects the AWS statement we consider to be most formative: the Alliance defines stewardship as "the use of water that is socially equitable, environmentally sustainable and economically beneficial, achieved through a stakeholder-inclusive process that involves site and catchment-based actions." From this perspective, we have developed Water Stewardship Plans for the School of Freshwater Sciences harbor campus building and University of Wisconsin-Milwaukee main Kenwood Campus. We have also conducted stakeholder analyses and comparative analyses with other government offices and agencies, business and industry, intergovernmental organizations, nongovernmental organizations, and others that have recognized the need to advance policies and programs to protect and provide sustainable water resources. Through this undertaking, we have helped UWM understand its own water-use, catchment context as well as shared concerns in terms of water governance, water balance, water quality, Important Water-Related Areas (IWRA), and water-related risks. We have outlined criteria, indicators, and best practice actions for how UWM should manage water as well as how to engage in water stewardship beyond campus. The AWS Standard has not been implemented in a higher education setting yet and this effort is an opportunity for UWM to join AWS in international leadership in water stewardship policy and assessment. In addition, assessment information will be an indispensable part of UWM's current resilience efforts concerning water-related policy and planning.

2.3.2 Plan

Objective 1:

Increase the stormwater retention capacity of both sites.

In 2010, the UWM Master Plan put forth an ambitious goal of zero-stormwater discharge from the Kenwood campus at the roof top and ground level. The University has made considerable strides in meeting this goal. Every installation of green infrastructure has had a tremendous impact on the University's storm water retention. We believe that this goal should continue to be carried out and expanded upon to include the School of Freshwater Sciences. Our objective in meeting this goal is to the increase of stormwater retention at both the Main campus and School of Freshwater Sciences. Targets to achieve this objective will be a continuation of the principles outlined in the UWM Stormwater Master Plan; landscape for zero net stormwater discharge from campus sites at the rooftop and ground level, meeting the same stormwater discharge rate for a 100-year storm event as it would have pre-European settlement. The metric to gauge success of this objective and targets will be a modeled peak-flow discharge rate of 30 cubic feet per second during 100-year storm event. We have identified a six-fold strategy that should be incorporated within the engineering and landscaping plans going forward to achieve zero-water discharge.

The are several benefits associated with meeting this objective. First and foremost, it will decrease storm water runoff which decreases runoff contamination and reduces the risk of combined sewerage overflows within our catchment. Second, carrying out strategies three through six will increase wildlife habitat, which is beneficial to local flora and fauna and beautifies campus. Third, by creating a zero waste water campus, UWM's reputation as a water leader will grow and its culture of water stewardship will expand.

Target

Continue to enact the principles outlined in the UWM Stormwater Master Plan and landscape for zero net stormwater discharge from campus sites at the roof top and ground level, meeting the same stormwater discharge rate for a 100-year storm event as it would have in its pre-European settlement state.

Metric

Modeled peak-flow discharge of 30 cubic feet per second during 100-year storm event

Strategies

- Carry out a new Stormwater Management Model (SWMM) analysis of both sites
- Include a water-related expert, such as a faculty member at the School of Freshwater Sciences or in the Civil & Environmental Engineering Department in planning process for new campus buildings and changes or expansion of site landscape/hardscape
- Revitalize green roof at SFS and implement a maintenance plan
- Include green infrastructure in all new campus buildings and landscape/hardscape capital projects
- Introduce more rain gardens and minimize hardscapes; hardscapes should utilize porous pavement
- Continue to maintain green roofs and green infrastructure to ensure maximum effectiveness
- Measure continual improvement; revisit planning goals in annual capital project meetings

Benefits and Cost Considerations

The benefits of this objective are an increase in stormwater retention capacity that will contribute to regional decrease in TSS, phosphorous, and other contaminants mandated by TMDL. Gardens and natural areas will provide wildlife habitat. There is also political capital that can be gained by initiating stormwater management and best practices within the community.

Persons Responsible

SWMM: Department of Civil and Environmental Engineering, Facilities Management, Office of Sustainability, UWM Faculty, planning and development

Objective 2:

Maintain the policy put forth by the 2010 UWM Master plan regarding the elimination of the use of all pesticides and synthetic fertilizers, while increasing the health of campus soil and lawns by aeration, natural compost, and seeding (From 2010 UWM Master Plan Report).

The 2010 UWM Master Plan outlines several goals concerning water quality and water pollution. With occasional lapses in the Master Plan's goal of eliminating the use of pesticides and synthetic fertilizers, the campus has been widely free of pesticides and synthetic fertilizers for many years. However, because of its importance to water quality and water pollution, our third objective is to maintain strict observance the 2010 UWM Master plan policy of eliminating the use of all pesticides and synthetic fertilizers. At the same time, the health of campus soil and lawns can instead be increased by aeration, natural compost, and seeding. The target to reach for this objective will be the removal of all pesticides and synthetic fertilizers from campus. The metric that will be used to gauge success will be a confirmation from all building custodians and snow removal contractors that current guidelines are being followed, a list of reasons why the current guidelines are sometimes not followed, and an attempt to address those reasons. We have identified a three-part strategy for meeting this objective.

The benefit of this objective is the reduction of pesticides and synthetic fertilizer runoff into waterways. A reduction in cost to the annual land scaping budget is anticipated due to the decrease in pesticides and fertilizer purchased; however, an assessment on the current expenses would be necessary. The persons identified as being responsible for meeting this objective is the Office of Sustainability in conjunction with Grounds and Environmental Services.

Target

Remove all pesticides and synthetic fertilizers from campus.

Metric

Confirmation from all building custodians that current guidelines are being followed, a list of reasons why the current guidelines are sometimes not followed, and an attempt to address those reasons.

0lbs of synthetic fertilizer on campus per year.

Strategies

- Perform an assessment of current lawn and soil care practices
- Verify guideline compliance with campus planning on a yearly basis; communicate with custodial staff and landscaping contractors to compile information into a yearly report, use feedback from custodial staff and landscaping contractors to develop guidelines for compliance
- Provide information about products to use as alternatives to pesticides and synthetic fertilizers

Benefits and Cost Considerations

The benefit of this objective is the reduction of pesticides and synthetic fertilizers entering waterways via runoff to improve water quality. There is an anticipated reduction in cost with the lowered use of pesticides and fertilizers; however, an assessment of current expenses is necessary.

Persons Responsible

Office of Sustainability in conjunction with Grounds and Environmental Services

Objective 3:

Reduce de-icing salt application on campus.

As a continuation of reducing polluted runoff and improving water quality, the next <u>objective</u> is to reduce de-icing salt application on campus. The determined <u>target</u> is a 50% replacement of sidewalk and road salts with alternative de-icing methods. The determined <u>metric</u> to gauge the success of this objective is a confirmation from all building custodians and snow removal contractors that guidelines are being followed, a list of reasons why the guidelines are sometimes not followed, and an attempt to address those reasons. We have developed a two-part <u>strategy</u> for meeting this objective.

The <u>benefits</u> of meeting this objective is the reduction of chloride runoff into sewers and waterways. The <u>cost</u> considerations of meeting this objective are anticipated to include performing assessments and determining alternative to current de-icing practices. It is anticipated that using less road salt will result in lowered costs, but alternatives to using traditional road salt may exceed the current budget. Persons <u>responsible</u> for overseeing the implementation and success of this objective will be the Office of Sustainability in conjunction with Grounds and Environmental Services.

Target

Replace 50% of sidewalk and road salts with alternative de-icing methods

Metric

A confirmation from all building custodians and snow removal contractors that guidelines are being followed, a list of reasons why guidelines are sometimes not followed, and an attempt to address those reasons.

Strategies

- Perform assessment of current practice (consider pre-wetting method)
- Conversations with custodial staff and snow removal contractors, use feedback from custodial staff and snow removal contractors to develop future guidelines

Benefits and Cost Consideration

The benefits of reducing traditional de-icing salt application is a reduction of chlorides in runoff that enters sewers and waterways. Cost considerations included the cost of performing assessment. Additionally, it is anticipated that using less road salt will result in a reduction in costs, but alternatives to using traditional road salt may exceed the current budget.

Persons Responsible

Office of Sustainability in conjunction with Grounds and Environmental Services

Objective 4:

Increase student, staff, and faculty awareness of water stewardship on campus.

The success of many of the objectives laid out in this report is dependent upon the degree to which UW-Milwaukee's students, staff, and faculty value water and see the University as a leader in water stewardship. Buy-in from all members of UW-Milwaukee will enhance the ability of the University to lead on water issues. To further this consideration, we have created an objective to enhance internal awareness of water stewardship on campus. The determined target for this objective is to increase UWM student awareness of water related initiatives and research on campus. The metric to gauge the success of this objective will be the number of areas on campus with water-related signage and various marketing tools to better advocate campus water initiatives. We have developed a three-part strategy to meet this objective.

The benefits of this objective will be an improvement in support generated and an improvement of UW-Milwaukee's reputation as a water leader. Costs associated with meeting this objective are the additional cost of internal marketing regarding new initiatives to promote water stewardship. The persons identified as being responsible for overseeing and meeting this objective are School of Freshwater science student senate representatives as well as the Office of Sustainability in conjunction with Grounds and Environmental Services.

Target

Increase UWM student, staff, and faculty awareness of the shared water challenges facing UWM's catchment and actions individuals can take to address them.

Metric

A narrative description of internal campaigns focused on water stewardship, the number of sites on campus with water-related signage

Strategy

- Conduct an audit of all internal water conservation and awareness campaigns

- Add signage regarding green infrastructure installations, important water-related areas, and less harmful initiatives for de-icing procedures and lawn care procedures.
- Increase coordination of existing and future efforts through the Office of Sustainability in conjunction with the School of Freshwater Sciences

Benefits and Cost Considerations

The benefits of this objective will be an increase in the sense of shared community and responsibility within the UWM community. It will also improve UW-Milwaukee's reputation as a water leader. Cost considerations are associated with community outreach, marketing, and stakeholder engagement.

Persons Responsible

SFS student senate representative; Office of Sustainability in conjunction with Grounds and Environmental Services

Objective 5:

Build on UW-Milwaukee's reputation as a water leader on a local, regional, and global scale.

UW-Milwaukee was founded on the Wisconsin Idea: that the research produced by public universities will drive public policy, and in turn, that public opinion and the public good be the drivers of research at public universities. The success of this idea and the reputation of UW-Milwaukee as a water leader is extremely important to Milwaukee's goal of being a water centric city, students attending the School of Freshwater Sciences, and community members that value clean water and strong water governance. To further this consideration, we have created an objective to build upon UW-Milwaukee's reputation as a water leader on a local, regional, and global scale. The determined target for this objective is to increase community engagement, marketing techniques, and engagement with elected officials. The metric to gauge the success of this objective will be a narrative report on community and governmental outreach activities performed by the University and the number of people who attend community outreach events. We have developed a four-part strategy to meet this objective.

The benefits of this objective will be an improvement in support generated and an improvement of UW-Milwaukee's reputation as a water leader at the local, national, and global scale. Costs associated with meeting this objective are the additional cost of community outreach, marketing, and stakeholder engagement regarding new initiatives to promote UW-Milwaukee's water leadership. The persons identified as being responsible for overseeing and meeting this objective are the Center for Water Policy in conjunction with the Office of Neighborhood & Community Relations and the Office of Sustainability.

Target

Increase community engagement, marketing techniques, and engagement with elected officials in regards to water stewardship and UWM as a water leader.

Metric

A narrative description of community engagement activities around water; the number of people in attendance at community outreach events; and documentation of contact with elected officials

Strategy

- Conduct an audit of water-related outreach already underway at the University
- Increase coordination between existing efforts
- Create "Water Adviser" internships with elected officials through the School of Freshwater Sciences
- Continue to develop the relationship between SFS students and researchers and regional water policy agencies and nonprofits such as SEWRPC, Sweetwater, and the MMSD Research Division

Benefits and Cost Considerations

The benefits of this objective will be an improvement in support and of UW-Milwaukee's reputation as a water leader at a local, national, and global scale. Cost considerations are associated with community outreach, marketing, and stakeholder engagement.

Persons Responsible

Spearheaded by the Center for Water Policy in conjunction with the Office of Housing and Neighborhood Relations and the Office of Sustainability

Objective 6:

Continue the 2010 UWM Master Plan goal of sustaining and increasing the use of native and perennial landscaping with the aim of reducing maintenance costs over time and fostering an awareness of Wisconsin Ecology.

A goal from the 2010 UWM Master Plan which we have included as our fifth objective is sustaining and increasing the use of native and perennial landscaping within UW Milwaukee's open spaces. Advantages of using native and perennial landscaping is the reduction of landscaping maintenance costs over time, increased habitat for wildlife, and an increased awareness of Wisconsin ecology. The determined target for meeting this objective is for 100% of all new plants purchased or planted within the site to be native perennials (excluding turf areas, green roofs, and small planter boxes). The metric to gauge success of this objective is the implementation of 100% native plants in new landscaping projects and/or when seasonal plants are removed. To achieve this objective, a five-part strategy has been developed.

The benefits of this objective include: a reduction in plant and landscape maintenance, increased water sequestration into soil, reduced flooding, and increased plant biodiversity on campus which benefits the overall ecology of campus, surrounding community, and provides educational opportunities. The cost considerations anticipated are the maintenance requirements of landscaped areas and the cost of purchasing native perennials. The persons identified as being responsible for meeting this objective are the Office of Sustainability in conjunction with Grounds and Environmental Services.

Target

100% of all new plants purchased or planted within the site must be native perennials (excluding turf areas, green roofs, and small planter boxes).

Metric

Implement 100% native perennial plants during new construction, during landscaping projects, and during seasonal plant rotation. Implement native perennial plants to when creating rain gardens on campus.

Strategy

- Purchase native plants to use in landscaping instead of non-native species
- Work with land stewards to strategically place native perennial plants
- Introduce rain gardens with perennial plants to identified regions that would benefit most
- Increase signage and labels explaining the value of native plants over non-native species
- Encourage student groups to participate in the maintenance of native landscapes and gardens

Benefits and Cost Considerations

The benefits of this objective include: a reduction in plant and landscape maintenance, increased water sequestration into soil, reducing flooding, and increased plant biodiversity on campus which benefits the overall ecology of campus, surrounding community, and provides educational opportunities. The cost considerations anticipated are the maintenance requirements of landscaping these areas.

Persons Responsible

Office of Sustainability in conjunction with Grounds and Environmental Services

Objective 7:

Enhance preservation strategies for Downer Woods, focusing on the management of invasive species and encouraging the campus community engagement and education.

Preserving natural areas is important for water stewardship; the objective of enhancing preservation strategies for Downer Woods focuses on the management of invasive species and encouraging the campus community to use the woods for environmental education. The target identified to achieve this objective is the planning and execution of yearly biological surveys in Downer Woods by the UW Milwaukee field station director. An additional target is planning and conducting a yearly campus wide survey to measure attendance and satisfaction of Downer Woods. The metric to gauge the success of this objective is to have a qualified ecologist conduct values of the Floristic Quality Index and the Coefficient of Conservatism Values for Downer Woods in order to evaluate ecological complexity within the natural area. Downer Woods is actively managed against invasive species and should have a Floristic Quality Index above 60 and should improve upon this value in years to come. Additionally, measuring the attendance in Downer Woods through a yearly survey will adequately compare attendance year to year. We have identified a five-part strategy to meet this objective.

The benefits of achieving this objective are continued storm water mitigation provided by the natural landscape of Downer Woods. Additionally, Downer Woods serves as an outdoor educational resource for students whom are interested in natural sciences. The cost considerations for this objective are none. The budget for the activity of the UW-Milwaukee Field Station Director, whom is responsible for the preservation of Downer Woods and conducting ecological surveys, is already accounted for in UW-Milwaukee yearly budget. Additionally, students and volunteers will be recruited to help control invasive species within Downer Woods.

Target

Plan for yearly biological surveys to take place in the Downer Woods community. Plan for yearly campus wide survey to measure attendance and satisfaction of Downer Woods.

Metric

Have a qualified ecologist conduct values of the Floristic Quality Index and the coefficient of conservatism values for Downer woods in order to evaluate ecological complexity within the natural area. Downer woods is actively managed against invasive species and should have a Floristic Quality Index above 60 and improve upon this value in years to come. Measure attendance in Downer Woods.

Strategy

- Conduct annual plant species list for Downer Woods to assess any changes in the Floristic Quality Index and Coefficient of Conservatism Values
- In congruence with target 2, pesticides for the removal of non-native species should not be used. Mechanical methods such as hand-pulling will be used instead
- Use of downer woods for environmental education can take place through outdoor classes provided by the university.
- Signage including the history of the woods and the current ecology of it should be erected.
- Conduct annual campus wide surveys to measure attendance and satisfaction with Downer Woods

Benefits and Cost Considerations

The benefits of this objective are continued storm water mitigation provided by the natural landscape of Downer Woods. Additionally, Downer Woods serves as an outdoor educational area for students whom are interested in natural sciences. The cost considerations for this objective are none. The budget for the activity of the UW-Milwaukee Field Station Director, whom is responsible for the preservation of Downer Woods, to conduct ecological surveys, is already accounted for in UW-Milwaukee yearly budget. Additionally, students and volunteers help to control for invasive species within Downer Woods.

Persons Responsible

UW-Milwaukee Field Station Director

Objective 8:

Advance UWM's stated goal to reduce campus water usage by 20%, as put forward by UWM's 2010 Master Plan. To reduce water consumption by 20% through operations and human behavior changes from a 2005 baseline by 2025; and continue to conserve and reduce consumption incrementally each year.

Water conservation and water usage efficiency is another goal identified in the 2010 Master Plan, specifically to "reduce campus water usage by 20% through operations and human behavior changes from a 2005 baseline by 2012" and "continue to conserve and reduce consumption incrementally each year." Main campus has reduced water use per gross square foot by over 25% compared to 2005 baseline in 5 of the past six years. Use per user has decreased less. The School of Freshwater Sciences used water at higher rates than in 2005 until 2015, when usage rates declined. For both main campus and SFS, it is important for the UWM to understand what has driven these changes.

In 2000, under Phase IV of a Wisconsin Energy initiative, 97% of all toilets on campus capable of cost-effective upgrades and those in need of efficiency were to be changed over to low usage, 1.6 gallons-per-flush (GPF) toilets. Also, 97% of all campus faucets capable of cost-effective retrofits were to be converted over to 0.5, 1.0, or 1.5 gallons-per-minute (GPM), tamper-resistant, ultra-low-flow faucet restrictors. In addition, 74% of all showerheads on campus, mainly in Sandburg Hall, were to be replaced with 2.5 GPM adjustable spray showerheads. We have reworked the original goal set forth by the 2010 master plan by forming the objective to reduce campus water usage by 20% through operations and human behavior changes from a 2005 baseline and continue to conserve and reduce consumption incrementally each year. Because the School of Freshwater Sciences constitutes a large proportion of water use for the University as a whole, and water use at SFS is driven by different factors than at Main Campus, it is critical that changing water use patterns be studied and clear benchmarks be set to drive future conservation efforts. The target to reach for this goal is the overall reduction of campus water usage by 20% by 2022 based on 2005 water usage. The metric that will be used to measure success is the total yearly water consumption (measured by utility bills), per weighted campus user and gross square foot. We have developed a six-part strategy to achieve this objective.

The main benefit of this objective is a decrease in water procurement and its associated cost. Additionally, by providing resources to students on how to reduce their water footprint, this objective will increase the awareness water stewardship goals and water conservation. The costs associated with this objective are the initial increased costs of installing water efficient fixtures on appliances that have not already been updated. It is anticipated that reducing the overall water consumption on campus will reduce the amount of money spent on water procurement over time. The persons identified as being responsible for overseeing the success of this objective is the Office of Sustainability.

Target

Reduce total campus water usage by 20%

Metric

Total yearly water consumption (measured by utility bills) per gross square foot and weighted campus user. See 1.3.3. for a detailed description of these measures.

Strategy

- Conduct a study of water usage rates from 2005 to 2019, starting with the data compiled in section 1.3.3.
- Include housing in conversations and provide incentives for reduced water use by students. Provide educational materials, workshops, or online trainings, such as water footprint calculators to students annually
- Specific areas of student water usage education: running washing machines in on-campus laundry facilities at capacity, running dishwashers at capacity, taking shorter showers, turning off the tap when brushing teeth
- Include signage reminding users to practice water conservation
- Continue to transition WASH facilities into water sustaining systems i.e. low flow toilets/ shower heads, water efficient drinking fountains. Install only water sustaining systems in new building construction
- Assign a responsible party to compile an annual report on the water usage of both sites in order to more systematically compare water usage year to year

Benefits and Cost Considerations

The costs associated with this objective are the increased costs of installing water efficient fixtures on appliances that have not already undergone a switch to efficient fixtures. It is anticipated that reducing the overall water consumption on campus will reduce the amount of money spent on water procurement.

Persons Responsible

Office of Sustainability, Faculty at School of Freshwater Sciences

Objective 9:

Continue to abide by all permitting requirements under DNR WDPES permit.

The objective of abiding by all permitting requirements under the DNR WDPES permit is important for our water stewardship and sustainability. Our compliance is a required by Wisconsin Law to protect the aquatic environment and drinking water. The campus is currently up to date and abides by all permit requirements. The target to achieving this objective is to stay current with DNR WDPES permitting. The metric that will be used to measure success of this objective is the permit itself, provided by the WI Department of Natural Resources, for the UW-Milwaukee pumping station and School of Freshwater Sciences. The strategy developed to achieve this objective is to file permits on time.

The benefits of this objective will the avoidance of costly fees and sanctions associated with not renewing or complying with DNR WDPES permitting. Cost considerations are anticipated to be none since DNR WDPES permits are applied for regularly and fees for these permits are already included in UW-Milwaukee's budget. The persons identified as responsible for overseeing the success of this objective are the heat plant superintendent (pumping station) and the School of Freshwater Sciences Assistant Dean of Facilities.

Target

Stay current with DNR WDPES permitting

Metric

Physical permit, provided by the WI Department of Natural Resources, for the UW-Milwaukee pumping station and School of Freshwater Sciences

Strategy

- File permits on time

Benefits and Cost considerations

The benefits of this objective will the avoidance of costly fees and sanctions associated with not renewing or complying with DNR WDPES permitting. Cost considerations are anticipated to be none since DNR WDPES permits are applied for regularly and fees for these permits are already included in UW-Milwaukee's budget.

Persons Responsible

Heat plant superintendent, SFS Assistant Dean of Facilities

Objective 10:

Streamline reporting of potentially harmful discharges from labs and campus buildings; continue proper lab training and practices to prevent harmful discharges.

UWM takes the possession and use of chemicals very seriously. Chemical inventories are updated on a yearly or near-yearly basis, and all labs meet safety data sheet requirements. However, the format of these inventories and data sheets vary by each department. After a meeting with the Department of University Safety and Assurances, it was noted that a transition of all inventories was planned to transition to a software provided by the chemical supplier. This transition would streamline inventory updates and ensure all necessary documents are up-to-date. Such improvement in chemical inventorying would increase UWM's preparedness and ability to mitigate potentially harmful discharges.

individuals handling potentially harmful chemicals must partake in lab training to ensure safety as well as proper use and disposal of chemicals.

While compiling information on potentially harmful pollution sources on campus, it was discovered that there is not a centrally located information database for chemicals stored and used on the SFS campus. Not having a chemical master list to distribute to first responders in the event of an accident is a high risk. In order to promote safety and lesson the possibility of chemical pollution on campus, the <u>objective</u> to compile a list of all potentially harmful discharges from labs and campus buildings and to evaluate ways to decrease harmful discharges continually in conjunction with lab and maintenance staff on an annual basis was developed. The <u>target</u> developed to achieve this objective is to transition every lab's chemical inventories to a computer software that is centrally located and easily accessible to lab personnel and the Department of Safety and Assurances.

The <u>metric</u> to gauge success of this objective will be the completion of a master list of stored chemicals on site the general amounts of chemicals stored, their Safety Data Sheets, and their location on campus on a computer software. The strategy developed to meet this objective is to transition lab's chemical inventories to computer software while utilizing a standard template for every department and lab. This master inventory list will update inventories and necessary safety response sheets regularly.

The benefits of this objective are a more streamlined inventory system to help monitor chemicals that pose a water risk. Additionally, updating safety data sheets as needed will provide laboratory personnel with the necessary safety protocols for the chemicals they are using. Cost of the transition and the compilation of an accessible chemical master list is unknown. There is likely a fee to utilize the supplier's software, but this would be outweighed by the benefits of time saved and assurance in inventory accuracy. The persons identified as being responsible for overseeing the achievement of this objective is the UWM department Safety and Assurances

Target

Transition lab's chemical inventories to computer software for more efficient updates and remove specific materials

Metric

Move 100% of chemical inventories to the supplier provided computer software application

Software should include general amounts of chemicals stored, their Safety Data Sheets, and their location on campus (sensitive information may only be available to select people)

Find records of communication between office of sustainability and lab, maintenance staff

Strategy

- Transition lab's chemical inventories to computer software. Utilize a standard template for every department
- Update inventories and necessary safety response sheets regularly

Benefits and Cost considerations

Benefits: A more streamlined inventory system to help monitor chemicals that pose as a water risk and update safety data sheets as needed.

Cost Considerations: Cost of the transition is unknown. There is likely a fee to utilize the supplier's software, but this would be outweighed by the benefits of time saved and assurance in inventory accuracy.

Persons Responsible

Department of Safety and Assurances

Objective 11:

Reduce single-use petroleum-based plastics on campus to reduce water consumption and pollution.

Single-use plastics are unfortunately an all too common occurrence in American society. In order to reduce waste and litter, the objective to reduce single-use petroleum-based plastics on campus was developed. UW-Milwaukee has already started to reduce their purchasing and distribution of plastics on campus, like with paper straws being offered instead of plastic straws at the Grind coffee shops. Additionally, ambitious goals have been set forth when purchasing plastics to lessen plastic usage in the end; plastics should be suited for its function to maximize its lifetime, made from pre/post-consumer or industrial recycled material, be recycled in the end, documented to produce significantly less toxins, preferably biodegradable, be harvested or made within a 500 mile radius of UWM, and be shipped with minimal packaging (consistent with care of the product). The target developed to achieve this objective is the completely end the use and sale of petroleum-based single-use plastics on campus. The metric to gauge success of this objective is to research the number of single-use petroleum-based plastics currently purchased by the main campus site and School of Fresh Water science building and measure their decline annually. An additional metric developed is to eliminate the sale of single use plastics in school stores and restaurants and replace them with bio-plastics or other organic alternatives. We have developed a three-part strategy to meet these objectives.

The benefits of reducing single use plastics on campus is the overall reduction of the amount of plastic waste in local rivers and streams. Additionally, a campus as large as UW-Milwaukee taking an extreme initiative to end the use of single use plastics could propel other organizations to do the same. Initially, it is expected that bioplastics will cost more than traditional plastics, but over time it is expected that the cost of bioplastics will be comparable to petroleum-based plastics. Campus will see a small reduction in cost if they ended use of plastic bags or require bags to be purchased when needed, which could be profitable while better for the environment. The persons identified as being responsible for overseeing the success of this objective is the UWM Purchasing and Procurement Office.

Target

Reduce and eventually end use of petroleum-based single-use plastics on campus

Metrics

Number of single-use petroleum-based plastics purchased by the main campus site and SFS building and eliminate the sale of single-use petroleum-based plastics in school stores and restaurants.

Strategy

- Transition to using bioplastic or paper single-use items on campus, such as utensils, plates/bowls, and straws
- End distribution of plastic bags from campus facilities (restaurants, stores, etc.)
- Research sustainable suppliers for UWM to source biodegradable items

Benefits and Cost considerations

Initially, it is expected that bioplastics will cost more than traditional plastics. Over time, it is expected that the cost of bioplastics will be comparable to petroleum-based plastics. Campus will see a small reduction in cost if they ended use of plastic bags or require bags to be purchased when needed, which could be profitable while better for the environment. Reducing the amount of plastic waste could reduce the amount of waste that finds itself in local rivers and streams.

Persons Responsible

Purchasing and procurement

2.4 Public Sector Plan

2.4.1 Plan

Milwaukee is working to increase city-wide green infrastructure to reduce urban flooding and overwhelming MMSD's sewer treatment facilities. UWM plans to continue implementing green infrastructure with sustainability plans in-line with city goals. This infrastructure will also help reduce water pollution via runoff, which helps protect the rivers and lakes from pollutants such as phosphorus and chlorides. The reduced fertilizer and pesticide use on campus also reduces the likelihood of polluted runoff during heavy rain events.

In these stated strategies for the advancement of the Water Stewardship Plan, SFS and UWM will continue to demonstrate leadership in water sector and improve water management as informed and active water stewards.