# Climate Adaptation in the Great Lakes Region

## *A Case Study of Milwaukee, Wisconsin*

Milwaukee's Lake Michigan Skyline, by Mike Fisk

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# Project description

We are a team of six University of Michigan graduate students, based out of UM's School of Natural Resources and Environment. Our Master's Project focuses on climate adaptation and resiliency planning for Great Lakes municipalities. We work for NOAA's Great Lakes Regional Collaboration Team, in partnership with the Great Lakes and St. Lawrence Cities Initiative (GLSLCI). Our goal is to develop a useful online toolbox of climate adaptation resources, including online webinars, case studies and infographics.

Our city case studies stem from municipal interviews conducted during the summer and fall of 2014. They aim to both capture Great Lakes regional best practices in climate resilience, and also to assess common barriers that Great Lakes communities face in enhancing their climate change adaptation efforts.

On June 17 2014, we spoke with Kevin Shafer, Executive Director of Milwaukee Metropolitan Sewerage District (MMSD), Erick Shambarger, Environmental Sustainability Manager for City of Milwaukee, Karen Nenahlo, Project Manager for MMSD, and Dean Amhaus, President and CEO of the Water Council. We are very grateful to them for sharing their time and insights with us!

**Fast Facts**

Location: Wisconsin

Population: 594,000

Primary industries: Trade, transportation, manufacturing, education, health services.

Unique features: Located at confluence of three rivers.


**Major resilience milestones:**

- Reduced combined sewerage overflows through watershed scale management
- Built a diversified portfolio of green and grey infrastructure
- Incentivized homeowners to replace and lateral connections to sewer system

## Executive Summary

Milwaukee is a leader in climate change adaptation. An increase in extreme storm events have motivated the Milwaukee Metropolitan Sewerage District (sewerage district), City of Milwaukee Office of Environmental Sustainability (sustainability office), and The Water Council (water council) to build a network of programs that engage the public to build resilience to climate change. Building political capital for adaptation following various crises, these organizations have focused on shared resources to empower the private sector and community residents and to build adaptive capacity in Milwaukee.

Milwaukee is an indigenous word for "gathering place by the water."[1] The largest city in the state of Wisconsin, Milwaukee sits along Lake Michigan at the confluence of three rivers: the Menomonee, the Kinnickinnic, and the Milwaukee. The City of Milwaukee is the largest of 28 communities in the Milwaukee metropolitan area, with a population of around 600,000 and a total area of 96.80 square miles, of which, 0.68 square miles are water.[2] Milwaukee's access to water is a great opportunity, but it presents challenges for stormwater and wastewater management as well as beach quality.

**Projected Climate Impacts**

Climate change is predicted to increase storm frequency and intensity in the U.S. Midwest region.[3] The number, duration, and volume of combined sewerage overflows (CSOs) are expected to increase as well. Milwaukee is predicted to experience a 25- to 37-percent increase in the frequency of storm events by 2050. According to the Wisconsin Initiative on Climate Change Impacts, by the middle of the century annual average temperatures will warm by two to seven degrees Fahrenheit, and large storms during fall and winter will become more frequent. Secondary impacts will include decreases in the quantity and quality of water resources and natural habitats, increases in soil erosion, and changes in agriculture, human health, and infrastructure.

Milwaukee is already experiencing impacts. In May 2004 Milwaukee experienced 8.9 inches of rain, the most in 110 years.[4] This storm caused a 1.565-billion-gallon CSO. In June 2008, Milwaukee observed 12.27 inches of rain, setting a new maximum-rainfall record for any month.[5] On July 22, 2010, seven inches of rain fell, causing flash flooding that closed the airport, created giant sinkholes, and flooded basements.[6] Over two billion gallons of untreated water were discharged into the Milwaukee River and Lake Michigan watersheds in a CSO event. With estimated damage of $30 million, this was the most expensive weather event in Milwaukee's history.[7]

**Milwaukee Metropolitan Sewerage District**

This regional government agency provides water reclamation and quality protection services to 28 communities with a population of 1.1 million, which enables it to facilitate regional communication and collaboration. [8]

MMSD's "whole watershed" approach allows for water quality management at multiple points, from rural upstream to urban to discharge. Its use of green infrastructure and partnerships with the private sector help stop or slow stormwater before it enters the system, reducing CSO risks. Partnerships with rural municipalities help the agricultural sector reduce nutrient loading into the watershed. As a nexus among different jurisdictions, the agency has pushed conversations toward climate action and adaptation strategies.

MMSD has been able to deploy its cross jurisdictional organizational structure to adapt to climate change at the watershed scale.

Milwaukee's preparation for climate change has been integrated into their sustainability vision, planning, and projects. Their success can be seen in a number of projects around sustainability—green infrastructure, energy efficiency, and overall social and economic resilience. Documented here are the main lessons learned along with examples of the projects executed in Milwaukee.

## Turning Crisis into Momentum for Action

Major storm events and the foreclosure crisis are two examples in which Milwaukee catalyzed crisis moments into climate action. The city and the sewerage district used the 2010 storms crisis to build the political capital necessary for addressing climate change in two areas: the funding of green infrastructure; and financing enabling homeowner to rebuild the lateral pipe structures that connect pipes in houses to the storm system.

Between 2008 and 2010, almost 16,000 properties in Milwaukee went into foreclosure.[11] A new city plan identifies financing that allows qualified home buyers to purchase and rehabilitate existing, vacant homes with energy-efficient measures. Vacant housing that is reoccupied instead of demolished contributes to the sustainability of neighborhoods.[12]

"You have this foreclosure crisis and it's terrible," says Erick Shambarger, the deputy director for the sustainability office. "But on the flip side, it is freeing up lands for something else."

## Sharing Resources to Build Consensus

Momentum and consensus for climate action have been built by focusing the attention of political leadership, the grassroots, and the private sector on shared resources and the shared watershed—the Lake Michigan coastal area where Greater Milwaukee is situated.

The result is a culture of regional collaboration. For example, non-profit organizations have taken up the sustainability office's framework of job development and neighborhood health and safety improvements. The Water Council's help in forming academic-private partnerships is moving Milwaukee forward as a world water hub, with research, education, technology development, and industry sectors coming together under one roof. In addition, the "ReFresh Milwaukee" campaign, developed by the sustainability office, is growing Milwaukee's "cluster of energy-efficient and clean tech companies to create local jobs and exports."[13]

The sewerage district is collaborating with municipalities, nonprofits, and the public to increase access to funds that can help protect water resources. [14] "We helped the region understand that in order to either save money or protect our watershed, we all needed to work together," says Kevin Shafer, executive director of the sewerage district. Its plan identifies the facilities, programs, operational

**City of Milwaukee Office of Environmental Sustainability**

This office was created by Mayor Tom Barrett in 2006. [9] It has streamlined sustainability work by integrating various Department of Public Health, Department of Neighborhood, and Area Healthcare Alliance projects.

The mayor-appointed Milwaukee Green Team organized the mission of the sustainability office around four key adaptation issues: stormwater; smart energy policies; green jobs and the green economy; and an implementation strategy across issues and sectors.


Green Infrastructure in the 30th St. Corridor supported by MMSD (Photo: 1000 Friends of Wisconsin)

improvements, and policies required by the year 2020 to meet the existing regulatory framework and permitting requirements.[15]

The sewerage district also partners on innovative approaches and projects such as watershed-based permits, river restorations, and green infrastructure. Their partners include the Southeast Wisconsin Watershed Trust and the Southeastern Wisconsin Regional Planning Commission. As far back as 2003, the Best Management Practices Partnership Program was created by the district to provide matching funds for green infrastructure projects. This funding cuts across sectors to implement green infrastructure quickly that benefits the watershed and builds climate resilience.

**Community and Private-Sector Empowerment**

Milwaukee engages the public in planning and implementing efforts for adaptation. For instance, the "ReFresh Milwaukee" plan has been a call to action around a community-endorsed and collaborative set of goals and strategies. This bottom-up, community-centered approach empowered area residents to provide direction and set priorities toward making their neighborhoods better places. In 2012, the Green Team surveyed 1,011 residents and gathered input on issues and priorities (the survey can be found in the *ReFresh Milwaukee* report appendix). The team then reached out to an additional 435 residents by hosting five formal town halls and more than 30 focus groups. The team chair also received 85 business comments through partnerships with trade groups and area businesses.

In order to give property owners the incentive to maintain the lateral structures that feed into sewers, the sewerage district uses a combination of approaches. One approach, the "basement connection," informs people on how pipes work, how to prevent flooding, and how people can maintain or replace home pipes.[16] The office of environmental sustainability is also working with private property owners to maintain private lateral structures.[17]

The office sought to increase participation in green roof implementation by stressing the importance of project density and making residents aware of their neighbors' participation. At the conclusion of the laterals project, the office increased participation from 60 percent to 90 percent by facilitating conversations between neighbors.

Green infrastructure has been used as a main strategy to help protect basements, sewers, and area water quality during rain events through the collection and filtration of stormwater. On a city scale, the sewerage district has promoted bioswales along city streets and has used porous pavers in parking lots, driveways, and sidewalks. (Porous pavers help reduce overflow by increasing the permeability of land surface.) To encourage public participation in using green infrastructure, the district partnered with the Fresh Coast 740 program to offer technical assistance and financing to small-scale green infrastructure projects. This mosaic of projects created the collective impact benefitting Milwaukee today. [18]

### The Water Council

This council was established in 2008 to harness the strength of Milwaukee as one of the major hubs for water research and industry around the world. 10 It attracts companies from around the world to address water issues by developing business models for companies to locate in Milwaukee. With a membership of more than 150 water technology companies as well as partnerships with local schools, it has accelerated communication among business and academia, facilitated economic development, and attracted expertise in adaptation planning.

Messaging is framed around themes of "environmental friendliness" and "cost-effectiveness" to trigger both extrinsic and intrinsic motivation. The sustainability office has formed its vision for sustainability on base condition outcomes. [19] For example, when introducing green buildings, the message was framed around how implementation would create job opportunities, support education, and promote human health. Most essential in messaging is focusing on the benefits that people can experience directly. The sewerage district's messaging strategy echoes this direct-benefit focus. Their climate action work is framed around reduced costs to ratepayers.

## Conclusion

Milwaukee's extensive climate adaptation efforts are due in large part to its ability to collaborate across municipal boundaries and agencies. The "whole watershed" approach and shared messaging has allowed the sewerage district, sustainability office, and water council to parlay various crises into opportunities for public collaboration and action. A shared consensus among community members and the private sector, and a mosaic of climate adaptation efforts, have created a Milwaukee more resilient to climate change that is ultimately a better place to live. According to Kevin Shafer of the sewerage district, "When the city wins, we win. When the suburbs win, we win. And when all of us win, the climate wins."

**References:**


[1] Darrell Brown, "Water Technology: An Interview with Dean Amhaus, President and Chief Executive Officer, The Water Council," *Leaders Online*, April/May/June 2014, www.leadersmag.com/issues/2014.2_Apr/Wisconsin/LEADERS-Dean-Amhaus-The-Water-Council.html.
[2] U.S. Census Bureau http://quickfacts.census.gov/qfd/states/55/55079.html
[3] Sandra McLellan, et al., "The Impact of Climate Change on CSOs and SSOs in Milwaukee Watersheds," 2011, http://home.freshwater.uwm.edu/mclellanlab/files/2012/07/Impact-of-climate-change-on-CSO-MKE.pdf.
[4] Preston Cole, et al., *The Milwaukee Green Team's Report to Mayor Tom Barrett*, 2005, www.city.milwaukee.gov/ImageLibrary/Groups/cityGreenTeam/documents/88841_LowRes.pdf.
[5] "Top Weather Events of 2008 (A Year of Extremes!)," NOAA National Weather Service Central Region Headquarters, 2008, www.crh.noaa.gov/images/mkx/climate/2008/top-weather-events-of-2008.pdf.
[6] "Flash Flooding/Heavy Rain Event & Tornado Outbreak July 22, 2010,"National Weather Service Central Region Headquarters, www.crh.noaa.gov/mkx/?n=072210_severe.
[7] Ibid.
[8] "About Us," Milwaukee Metropolitan Sewerage District, www.mmsd.com/about/about-us.
[9] "About Us," Environmental Sustainability, Official Website of City of Milwaukee, www/city.milwaukee.gov/sustainability/About-Us.htm#.U_3ukfldWi9.
[10] "About," The Water Council, www.thewatercouncil.com/about.
[11] "Foreclosure in Milwaukee: Progress and Challenges," Milwaukee Department of City Development and Department of Neighborhood Services, 2011, www.sewrpc.org/SEWRPCFiles/HousingPlan/Files/foreclosure-in-milw-progress-and-challenges.pdf.
[12] Ibid.
[13] *ReFresh Milwaukee: A Vision for Community Sustainability*, City of Milwaukee Sustainability Plan 2013 – 2023, page 23, www.city.milwaukee.gov/ReFreshMKE_PlanFinal_Web.pdf?.
[14] *Milwaukee Metropolitan Sewerage District Sustainable Water Reclamation*, 2012, www.mmsd.com/-/media/MMSD/Documents/Sustainability/Sustainability%20Plan.pdf.
[15] "2020 Water Quality Initiative," Milwaukee Metropolitan Sewerage District, www.mmsd.com/waterquality/2020-water-quality-initiative.
[16] *Refresh Milwaukee: A Vision for Community Sustainability*, City of Milwaukee Sustainability Plan 2013-2023.
[17] *Refresh Milwaukee: A Vision for Community Sustainability*, City of Milwaukee Sustainability Plan 2013-2023.
[18] Fresh Coast 740, www.freshcoast740.com.
[19] *Refresh Milwaukee: A Vision for Community Sustainability*, City of Milwaukee Sustainability Plan 2013-2023, image, page 14.