MAWSAC Report (8/13/26 DRAFT)

Endnotes

The 2027 MAWSAC report to the Minnesota Legislature and Metropolitan Council taps into a deep repository of technical information created by Minnesota's and the region's public and private investments in water science and policy research.

Endnotes are still in development and will be finalized when the issue briefs and regional overview are complete. Sources that have been struck through were found as drafts were developed but not used in the current version.

Overview:

O-1: Over half of Minnesota's population lives in the Twin Cities region, according to the Minnesota State Demographic Center:

a. PopFinder for Minnesota, Counties, and Regions. https://mn.gov/admin/demography/data-by-topic/population-data/our-estimates/pop-finder1.jsp. Accessed July 30, 2026.

O-2: Recent surveys of Minnesotans highlight what they value most about water:

a. Metropolitan Council. Diverse Water Perspectives. https://metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Projects/PLANNING/Washington-County-Municipal-Water-Coalition.aspx. Accessed July 30, 2026.
b. University of Minnesota, College of Food, Agricultural and Natural Resources Sciences. Research Brief: How socially and culturally diverse Minnesotans value water. https://cfans.umn.edu/news/how-socially-and-culturally-diverse-minnesotans-value-water. Accessed July 30, 2026.

O-3: Economic development in the Twin Cities metropolitan area is well documented:

a. Greater MSP. Key Industries. https://www.greatermsp.org/doing-business-here/key-industries/. Accessed July 30, 2026.

O-4: The number of municipal community water supply systems and sources is recorded by the Minnesota Department of Health; Metropolitan Council tracks those in the Twin Cities metropolitan area:

a. Minnesota Department of Health. Drinking Water by the Numbers: For Fiscal Year 2025. https://www.health.state.mn.us/communities/environment/water/docs/waternumbers.pdf. Accessed July 30, 2026.
b. Metropolitan Council. 2050 Water Policy Plan. https://imagine2050.metrocouncil.org/media/rtxjni3c/imagine-2050-water-policy-plan-ada.pdf. Accessed July 30, 2026.

O-5: The number of privately-owned wells and a summary of municipal water supply distribution extent is periodically reviewed and reported on by the Metropolitan Area Water Supply Advisory Committee, based on data in the Minnesota Well Index:

a. Metropolitan Area Water Supply Advisory Committee. February 2022. Recommendations for Water Supply Planning in the Metro Area. https://www.lcc.mn.gov/smwp/Meetings/2022/20220304/2022-MAWSAC-Recommendations-for-Water-Supply-Planning.pdf. Accessed July 30, 2026.

O-6: The Minnesota Department of Natural Resources tracks and reports on water use by water appropriation permit holders:

a. Minnesota Department of Natural Resources. Minnesota water use data. https://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html. Accessed July 30, 2026.

O-7: Average total municipal water use per person, calculated by dividing total municipal water use in the metropolitan area by the population of the metropolitan area, has been estimated by the Metropolitan Council:

a. Metropolitan Council. September 23, 2015. Master Water Supply Plan.
b. Metropolitan Council. 2050 Water Policy Plan: Appendix G. https://imagine2050.metrocouncil.org/media/rtxjni3c/imagine-2050-water-policy-plan-ada.pdf. Accessed July 30, 2026.

O-8: Water supply planning considerations of large-volume water users are being investigated by several Minnesota organizations. For example:

a. Minnesota Clean Water Council, April 20, 2026. Policy Brief: Large-volume water users. https://www.pca.state.mn.us/sites/default/files/wq-cwc1-37.pdf. Accessed on July 30, 2026.
b. Minnesota Department of Health. June 26, 2026. Large Volume Water Users and Public Water Supply: Considerations for Evaluating New Large Volume Users in a Community.

https://www.health.state.mn.us/communities/environment/water/docs/swp/lgwaterusers.pdf. Accessed July 30, 2026.

O-9: There is growing research on the impacts of climate change in Minnesota, including on agriculture and growing seasons. For example:

a. Roop, H. A., Meyer, N., Klinger, G., Blumenfeld, K., Liess, S., Farris, A., Boulay, P., Baule, W., Andresen, J., Bendorf, J., Wilson, A. B., Nowatzke, L., Todey, D., & Ontl, T. (2024). Climate Change Impacts on Minnesota Agriculture. Ames, Iowa: United States Department of Agriculture Climate Hubs, University of Minnesota Climate Adaptation Partnership and Great Lakes Research Integrated Science Assessment. https://www.climatehubs.usda.gov/sites/default/files/Climate%20Change%20Impacts%20on%20Minnesota%20Agriculture.pdf. Accessed July 30, 2026.
b. Minnesota Department of Natural Resources. Climate trends. https://www.dnr.state.mn.us/climate/climate_change_info/climate-trends.html. Accessed July 30, 2026.

O-10: Research on contaminants of emerging concern is ongoing by Minnesota agencies. For example:

a. Minnesota Department of Health. Contaminants of Emerging Concern (CEC) Initiative. https://www.health.state.mn.us/communities/environment/risk/guidance/dwec/index.html. Accessed July 30, 2026.

O-11: While challenging, multiple organizations are working to assess the condition of water supply infrastructure in Minnesota and in the Twin Cities metropolitan region. For example:

a. Minnesota Section and Duluth Section of the Americal Society of Civil Engineers. 2026 Report Card for Minnesota's Infrastructure. https://infrastructurereportcard.org/wp-content/uploads/2026/04/minnesota-2026-report-card-full.pdf. Accessed July 30, 2026.
b. In development – Metropolitan Council assessment of water supply infrastructure in the Twin Cities metropolitan region.

Issue: Protecting water quality and source water for public health and long-term resilience

WQ-1: Several resources illustrate the status of how drinkable, swimmable, and fishable metro region waters are. For example:

a. Minnesota Pollution Control Agency. Minnesota's impaired waters list. https://www.pca.state.mn.us/air-water-land-climate/minnesotas-impaired-waters-list. Accessed June 4, 2026.

b. Minnesota Department of Agriculture. Township Testing Program. https://www.mda.state.mn.us/township-testing-program. Accessed June 4, 2026.

c. Minnesota Department of Health. Fish Consumption Guidance. https://www.health.state.mn.us/communities/environment/fish/index.html. Accessed June 4, 2026.

WQ-2: The Metropolitan Council's Water Supply Planning Atlas describes the Twin Cities metro region water sources:

a. Metropolitan Council. Water Supply Planning Atlas. https://metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Basics/Atlas.aspx. Accessed June 4, 2026.

WQ-3: These resources explore how preventing contamination at the source is more effective and affordable than relying on downstream treatment after contamination has spread:

a. Noe, Ryan; Bonnie Keeler, Terin Mayer. University of Minnesota, Science, Technology, and Environmental Policy – Humphrey's School of Public Affairs. Source Water Protection Challenges and Co-benefits. November 2021. https://www.lccmr.mn.gov/projects/2017/finals/2017_03b_final_report_source_water_protection_challenges_and_co-benefits.pdf. Accessed June 4, 2026.

b . Metropolitan Council. Protecting Source Water Areas Research Paper. January 17, 2023. https://metrocouncil.org/Wastewater-Water/Planning/2050-Water-Policy-Plan/Research/Protecting-Source-Water-Areas.aspx. Accessed June 4, 2026.

c. Saint Paul Regional Water Services. Source Water Protection. June 18, 2025. https://www.stpaul.gov/departments/saint-paul-regional-water-services/about-your-water/source-water-protection. Accessed June 4, 2026.

WQ-4: Maximum contaminant levels (MLCs) enforced by the Environmental Protection Agency (EPA) and the Minnesota Department of Health (MDH) for Per and Polyfluoroalkyl Substances (PFAS) are forcing public water suppliers to make major treatment improvements that were not planned prior to lower detection limits and are unaffordable. Most existing water treatment facilities are not equipped to treat PFAS and emerging contaminants which will require funding and/or significant adjustments to water utility rates. Protecting the environment from residual waste from PFAS that is removed by PFAS treatment facilities and disposed of at landfills remains a major challenge to prevent further contamination of groundwater systems. Additional information

a. Metropolitan Council. Water Supply Planning Atlas. https://metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Basics/Atlas.aspx. Accessed June 4, 2026

b. Metropolitan Council. 2050 Water Policy Plan. February 12, 2025. https://metrocouncil.org/Wastewater-Water/Planning/2050-Water-Policy-Plan.aspx. Accessed June 4, 2025.
c. Minnesota Department of Health. Per- and Polyfluroalkyl Substances (PFAS). https://www.health.state.mn.us/communities/environment/hazardous/topics/pfcs.html. Accessed June 4, 2026.
d. Minnesota Pollution Control Agency. Air Pollutant, Land Contaminant, Water Pollutant – PFAS. https://www.pca.state.mn.us/pollutants-and-contaminants/pfas. Accessed June 4, 2024.

WQ-5: A recent report by Minnesota water agencies summarizes the nitrate issue and work underway in Minnesota:

a. Interagency Coordinating Team (ICT) subteam on drinking water and groundwater. Working together to protect Minnesota's waters from nitrate. Minnesota Pollution Control Agency, January 2026. https://www.pca.state.mn.us/sites/default/files/wq-gen1-21.pdf. Accessed June 4, 2026.

WQ-6: Without sufficient investment in drinking water and wastewater infrastructure, households may face significantly higher costs in the future due to aging systems, infrastructure failures, and service disruptions. Minnesota's Drinking Water Revolving Fund Project Priority List gives a sense of the scale of funding needed to address aging infrastructure. This is not a complete list:

a. Minnesota Department of Health. Drinking Water Revolving Fund – Project Priority List. https://www.health.state.mn.us/communities/environment/water/dwrf/ppl.html. Accessed June 4, 2026.

WQ-7: The MPCA has summarized some of the costs and benefits of water quality standards:

a. Minnesota Pollution Control Agency. Water quality standards: Costs and benefits. https://www.pca.state.mn.us/business-with-us/water-quality-standards-costs-and-benefits. Accessed June 4, 2026.

WQ-8: Beginning in 2024, all community Public Water Supply Systems in Minnesota that utilize Operational Technology must conduct annual cybersecurity assessments:

a. Minnesota Department of Health. Assessing Security of Public Water Systems. https://www.health.state.mn.us/communities/environment/emergency/water/securityassess.html#secure. Accessed June 4, 2026.

WQ-9: Climate change research illustrates a range of potential impacts on water resources in the metro region:

a. University of Minnesota Climate Adaptation Partnership. Climate Change in Minnesota. https://climate.umn.edu/MNclimate. Accessed June 4, 2026.

Issue: Balancing water use to protect our communities, natural resources, and future growth

WS-1: Over half of Minnesota's population lives in the Twin Cities region, according to the Minnesota State Demographic Center:

a. PopFinder for Minnesota, Counties, and Regions. https://mn.gov/admin/demography/data-by-topic/population-data/our-estimates/pop-finder1.jsp. Accessed July 30, 2026.

WS-2: Economic development in the Twin Cities metropolitan area is well documented:

a. Greater MSP. Key Industries. https://www.greatermsp.org/doing-business-here/key-industries/. Accessed July 30, 2026.
b. Metropolitan Council. 2025 Regional Economic Framework. https://metrocouncil.org/Planning/2050-Regional-Economic-Framework.aspx. Accessed July 30, 2026.

WS-3: The Twin Cities metropolitan region is known for its many rivers, streams, lakes, wetlands, and springs. For example:

a. Metropolitan Council. Priority Waters List. https://metrocouncil.org/Wastewater-Water/Planning/Water-Resources-Management/Priority-Waters-List.aspx. Accessed July 30, 2026.

WS-4: The Metropolitan Council used Metro Model 3 to estimate long-term sustainable groundwater use:

a. Christianson, Evan; Ray Wuolo. "Technical Memorandum: Metro Model Pumping Optimization 3". Barr Engineering Company, Inc. April 2, 2015.
b. Metropolitan Council. September 23, 2015. Master Water Supply Plan.

WS-5: When water use by one entity impacts another or a public resource, it is called "well interference", and Minnesota has a process to resolve these situations, administered by the Department of Natural Resources:

a. Minnesota Department of Natural Resources. Well interference resolution process. https://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/interference.html. Accessed July 30, 20260.

WS-6: For more information about water use and sources, see data provided by the Minnesota Department of Natural Resources:

a. Minnesota Department of Natural Resources. Minnesota Water Use. https://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html. Accessed June 4, 2026.

WS-7: The Metropolitan Council's Water Efficiency Grant Program provides several examples of communities who have invested in improving their water efficiency and conservation programs:

a. Metropolitan Council. Water Efficiency Grant Program. https://metrocouncil.org/Wastewater-Water/Planning/Water-Supply-Planning/Grants/Water-Efficiency-Grant-Program.aspx. Accessed June 4, 2026.

Issue: Water supply infrastructure – managing aging infrastructure and long-term investment needs

I-1: An example of the range of current community drinking water infrastructure costs can be found in the Project Priority List supporting Minnesota's Drinking Water Revolving Fund.

a. Minnesota Department of Health. Drinking Water Revolving Fund – Project Priority List. https://www.health.state.mn.us/communities/environment/water/dwrf/ppl.html. Accessed June 4, 2026.

I-2: In development – The Metropolitan Council is currently working on a technical report focusing on an assessment of water supply infrastructure in the Twin Cities metropolitan region. Citation to be added when complete.

Issue: Understanding groundwater and surface water interactions for long-term water supply sustainability

Issue: The cost of water – balancing affordability, resilience, and long-term sustainability in the metro region

C-1: In development – The Metropolitan Council is currently working on a technical report focusing on water rates and affordability in the Twin Cities metropolitan region. Citation to be added when complete.

C-2: In development – The Metropolitan Council is currently working on a technical report focusing on an assessment of water supply infrastructure in the Twin Cities metropolitan region. Citation to be added when complete.