Information Item

Metropolitan Area Water Supply Technical Advisory Committee

Meeting Date: October 10, 2023

Topic

Metro Region Water Demand Projection Methodology

District(s), Member(s): All

Policy/Legal Reference: Minnesota Statutes 473.1565

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Division/Department: Environmental Services

Background

This memorandum provides a summary of the proposed method to project total water demand for the Twin Cities Metropolitan Area for municipal groundwater and surface water systems and private wells. The total water demand in the metro region includes demands from municipal water systems (surface water and groundwater systems), private high-capacity wells, and private residential water wells. This work is being done in support of the regional Metro Area Water Supply Plan update that is currently in progress.

The memorandum describes the proposed use of region-wide water demand projections and details of the proposed approach.

TAC is invited to provide input on this proposed approach.

Use of Projections

The Metropolitan Council is developing water use projections in support of the update to the regional Metro Area Water Supply Plan, currently in progress. This information will help us to generally understand the magnitude and distribution of future water use in the region. The projections also serve as an input to our groundwater modeling efforts and water supply analyses to predict resource constraints and evaluate approaches under future scenarios.

The water demand projections are intended to:

1. Assist Met Council planners and policy makers, state agencies, and community planners to plan for future growth and address regional issues. These projections can help us understand where future water demand might bump up against or exceed capacity, or where there is sufficient capacity to support growth.
2. Provide subregional and regional water demand data for Met Council's groundwater modeling projects, surface water analyses, and other studies.
3. Provide guidance for communities as they develop content for the water supply section of their comprehensive plan.

Method Overview

The total metro region's water demand is the sum of the demands from municipal water use (surface water and groundwater systems), private high capacity well use, and private residential water use. The demand projections based on this approach represent a scenario of future

water use in the years 2030, 2040, and 2050 that assumes that the water use that occurred between 2012 and 2021 is representative of how water will continue to be used in the future. The scenario also ties regional water use planning to the broader regional development framework, *Imagine 2050*, using population forecasts to be adopted for 2030, 2040, and 2050.

The total metro region water demand includes the following basic equation:

Total Metro Region Water Demand = Projected Municipal Water Use + Projected Private High Capacity Well Use + Projected Private Residential Water Use

The projection method for each type of water demand is described as follows:

Projected Municipal Water Use

The method used for projecting municipal water demand uses a total per capita unit use coefficient approach for each of the municipal water utilities in the seven-county metropolitan area. The total per capita unit use coefficient is the total gallons per capita per day water usage (TGPCD) from all water uses in a community including residential, commercial, governmental, and institutional water uses, and unaccounted for water (water leaks, unmetered uses, etc.). This approach calculates a total per capita water use for each community based on the average TGPCD that occurred from 2012-2021 and assumes that the average per capita use will remain constant over the planning horizon of the Metro Area Water Supply Plan. A variable range is applied to reflect uncertainty in demand from year to year.

Future water demand projections for municipal water systems will be obtained by multiplying future population projections by the average TGPCD water demand and a variable range factor (+/-) to account for variations in the TGPCD that occurred from 2012-2021. Using the range of annual total TGPCD demands that occurred from 2012-2021 to account for the variable water demands was recommended by MAWSAC at its August 8, 2023, meeting.

Data used in this analysis is from the MN Department of Natural Resources Permitting and Reporting System (MPARS). 2012-2021 data was used, because the 2022 MPARS groundwater pumping data had not been verified by the DNR for use in this analysis at the time of this memorandum.

The projected municipal water use includes the following equation:

Projected Municipal Water Use = [Projected Water Service Population]

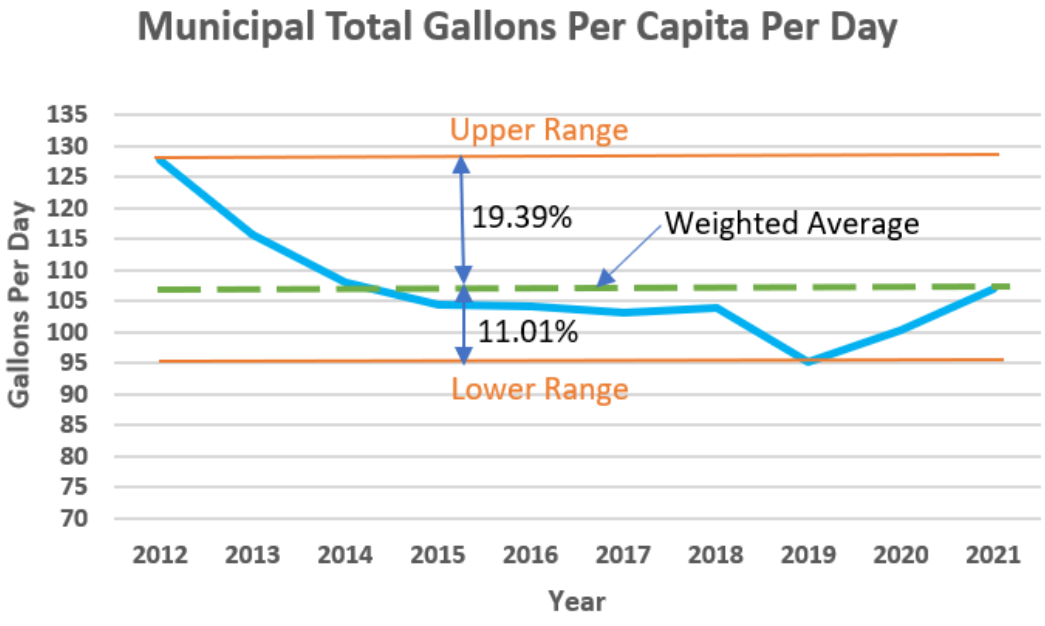
x [2012-2021 Average Total Per Capita Water Use] with a Variable Range (+/- 20%)

The average total gallons per capita per day (TGPCD) demand across the entire metro region for municipal water systems was 106.92 TGPCD from 2012-2021, based on preliminary calculations using MPARS data (see table 1 and figure 1 below). It is important to note that 106.92 TGPCD was the *average* water usage that occurred during this timeframe, and it is essential to plan for a variable range of future water demands to account for changes in TGPCD demands as occurred from 2012-2021, additional population and industrial growth beyond growth projections, changes in water efficiency, extreme weather patterns (wet and dry), and other variable conditions that could affect water demands.

Table 1. Average 2012-2021 total gallons per capita per day across the entire metro region for municipal water systems.

Year	Total GPCD (Total Usage/Service Population)
2012	127.65
2013	115.72
2014	108.04
2015	104.35
2016	104.17
2017	103.13
2018	103.83
2019	95.14
2020	100.26
2021	106.92
Range	95.14-127.65
Average (2012-2021)	106.92
% Above Average	19.39
% Below Average	-11.01

Figure 1. Average annual total gallons per capita per day across the entire metro region for municipal water systems for the years 2012-2021 (blue line). The region-wide municipal average 2012-2021 total gallons per capita per day is 106.32 (green dashed line). In 2012, average annual use was 19.39% higher than 106.92 gallons per day; in 2019, average annual use was 11.01% lower than 106.92 gallons per day (orange lines).



The highest annual TGPCD demand, 95.14 GPCD, occurred in 2012. This demand is 19.39 percent above the average TGPCD (106.92) that occurred from 2012-2021 (see table 1 and

figure 1 above). Therefore, it is recommended to use 20% for the variable upper range and to account for higher than anticipated population growth, significant increases in per capita water use from extremely dry weather conditions (extended dry periods), and other variable conditions that could increase water demands.

The lowest annual TGPCD demand, 95.14 GPCD, occurred in 2019. This demand is 11.01 percent below the average TGPCD (106.92) that occurred from 2012-2021 (see table 1 and figure 1 above). Although this percentage was lower than the variable upper range of approximately 20 percent, it is recommended to also use 20% for the variable lower range to provide consistency (same as upper range) and to account for lower than anticipated population growth, significant decreases in per capita water use from improved water efficiency, extremely wet weather conditions (extended wet periods), and other variable conditions that could decrease water demands.

In summary, a variable range of +/-20 percent is recommended to project future water demands through 2050. This will provide a reasonable planning approach to account for possible high and low extremes in water demands caused by unanticipated changes in population and industrial growth, changes in water efficiency, extreme weather conditions (extended wet and dry periods), and other variable conditions that could affect future water demands. The average TGPCD projection for municipal water use will be updated as more data becomes available and confirmed by the DNR in late 2023.

Projected Private High Capacity Well Use

Water demands from private high-capacity wells that pump more than 10,000 gallons per day or more than one million gallons per year will also be projected for the metro region for 2030, 2040, and 2050. These wells require a permit from the MN Department of Natural Resources, and annual pumping is reported in MPARS. The growth rate for this type of use will be the average annual growth rate that occurred from the permittee's total private high capacity well use from 2012-2021.

Like the assumptions made for the future municipal water demand projections, a variable range of +/-20 percent is also recommended to project future water demands from private high-capacity wells in each community. This will provide a reasonable planning approach to account for possible high and low extremes in water demands caused by unanticipated changes in changes in water efficiency, extreme weather conditions (extended wet and dry periods), and other variable conditions.

The projected private high capacity well use includes the following equation:

Projected High Capacity Wells Water Use = [Current Total Annual High-Capacity Wells' Demand] X [2012-2021 Average Annual Increase in Demand Percentage] with a Variable Range (+/- 20%)

Projected Private Residential Well Use

Water demands from non-municipal supplied populations on private wells will also be projected for the metro region for 2030, 2040, and 2050. Water use data is not included in the MPARS database for private residential wells that pump less than 10,000 gallons per day on average or less than 1-million gallons per year. Therefore, water demands will be estimated using a DNR-reported value of 55 GPCD for the private well populations (non-municipal populations) for the entire metro region. This usage rate represents the current average residential water usage rate that occurred across the entire metro region in municipal water systems (water sold), which should be very similar to the average private residential well use according to the DNR.

Like the assumptions made for the future municipal water demand projections, a variable range

of +/-20 percent is also recommended to project future water demands for non-municipal supplied populations with private wells. This will provide a reasonable planning approach to account for possible high and low extremes in water demands caused by unanticipated changes in private well population growth, changes in water efficiency, extreme weather conditions (extended wet and dry periods), and other variable conditions.

The future private well populations will be calculated by subtracting each community's projected water service population from its total projected population.

The projected private residential well use includes the following equation:

Projected Municipal Water Use = [Total Population - Water Service Population]

x [55 GPCD] with a Variable Range (+/- 20%)

Total Metro Region Water Demand

In summary, the Total Metro Region Water Demand will be calculated according to the following combined equation that accounts for each type of water use:

Total Metro Region Water Demand =

Projected Municipal Water Use = [Projected Water Service Population] X [2012-2021 Average Municipal Total Per Capita Water Use] X 365 Days with a Variable Range (+/- 20%)

+

Projected Private High Capacity Wells Water Use = [Current Total Annual High Capacity Wells Demand] X [2012-2021 Average Annual Increase Percentage in Demand] with a Variable Range (+/- 20%)

+

Projected Private Residential Wells Water Use = [Total Population - Water Service Population] X [55 GPCD] X 365 Days with a Variable Range (+/- 20%)

Water Use Data

Data used to support this preliminary analysis were taken from multiple sources to help consider some of the uncertainties related to projecting water demands.

- Population and land use data from Metropolitan Council growth scenarios (learn more in 7/12/23 presentation to Metropolitan Council)
- Water use data for annual use was obtained from the Minnesota Department of Natural Resources Permitting and Reporting System (MPARS). The annual use data was taken from data published on the DNR website for each year between 2012 and 2021: http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html
- DNR published on their website an estimate that the average Minnesota resident uses about 52 gallons per person per day: https://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/water-conservation-residents.html#:~:text=Indoors,clothes%20washing%2C%20faucets%20and%20leaks.

Historical Population Data
Total population for each community will be obtained from interpolated US Census data and projections to be developed by Met Council's community planners.

In many communities, there is a difference between total population and population served by the public water system. Data on population served by the public water system in each community was obtained from Water Supply Plans submitted to the DNR by each community. The population not served by the water system was calculated as the difference between the reported total population and population served. This unserved population was averaged over the number of years with complete data.

The private well population for each community will be calculated by subtracting the community's water service population from its interpolated census total population. In this way, the estimated population served is tied to the recorded census population for each community.

Per Capita Water Use Calculation
Total per capita water use for each community will be calculated for each year between 2012 and 2021 by dividing the reported water use by the estimated water service population. The per capita water use will then be averaged over this ten-year period. The average per capita water use based on population served is reported in this way for each community.

(Total Per Capita Water Use) = (Total Municipal Water Use) / (Water Service Population)

This value represents the total municipal water use per capita for each community. This includes all water use in the community, including commercial, governmental, industrial, and institutional uses, and unaccounted for water.