Appendix 2: Water Demand Projections

DATE: February 13, 2015

TO: Twin Cities Metropolitan Area Water Suppliers

FROM: Metropolitan Council Water Supply Planning Unit

SUBJECT: Water Demand Projection Methodology and Preliminary Results

This memorandum provides a summary of the methods used to project water demand for the public water supply systems in the Twin Cities Metropolitan Area. This work is being done in support of the regional Master Water Supply Plan update that is currently in progress. Presented are the data sources used, and assumptions made, in projecting water use through 2040 for each water system in the region.

Generally speaking, the method used is a per capita unit use coefficient approach for each of the municipal water utilities in the seven-county metropolitan area. This approach calculates a per capita water use for each community, based on historical water use, population data, and input received from community public water suppliers. Future water demand projections are obtained by multiplying future population projections by the estimated per capita unit use coefficient:

(Projected Water Use) = **(Projected Population)** X **(Per Capita Water Use)**

The discussion that follows describes the method used to calculate initial projections for each community. Input was also received from communities on draft projections that were distributed in October 2014. A second draft was distributed in January 2015, and a second round of comments were incorporated into the version that was used for running the regional groundwater flow model for the draft Master Water Supply Plan. Local forecasts were used in lieu of Metropolitan Council forecasts when they were provided by communities.

Historical Water Use Data

Water use data for annual use was obtained from the Minnesota Department of Natural Resources (DNR) water use database (SWUDS). The annual use data was taken from data published on the DNR website for each year between 2000 and 2010:

http://www.dnr.state.mn.us/waters/watermgmt_section/appropriations/wateruse.html

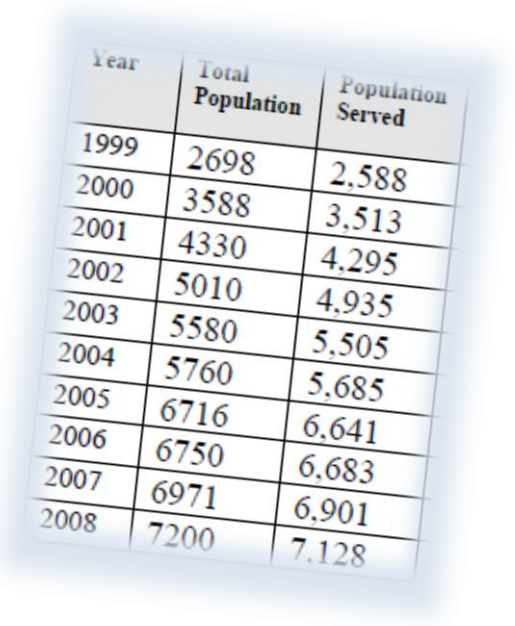
Historical Population Data

Total Population

Total population for each community was obtained from US Census data for 2000 and 2010. Total population was interpolated linearly between 2000 and 2010. Metropolitan Council population estimates were used for 2011 and 2012.

Population Served

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 were obtained from Water Supply Plans submitted to the DNR by each community. Those plans require public water suppliers to report estimates for total population of the community and population served by the water system for each of the ten years prior to plan submittal. For each year with complete data in the Water Supply Plan for 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.



Year	Total Population	Population Served
1999	2698	2,588
2000	3588	3,513
2001	4330	4,295
2002	5010	4,935
2003	5580	5,505
2004	5760	5,685
2005	6716	6,641
2006	6750	6,683
2007	6971	6,901
2008	7200	7,128

Figure 1. Example of Population Reporting from Local Water Supply Plan

Following the calculations of average unserved population, the data were manually reviewed for inconsistencies and outliers. Adjustments were also made based on local input.

The average unserved population was used to calculate an estimated population served for each year between 2003 and 2012. The estimated population served was set equal to the interpolated census total population minus the average unserved population for each community. In this way, the estimated population served is tied to the recorded census population for each community.

(Population Served) = (Interpolated Census Population) – (Average Unserved Population)

Per Capita Water Use Calculation

Total per capita water use for each community was calculated for each year between 2003 and 2012 by dividing the reported water use by the estimated population served. The per capita water use was then averaged over this ten-year period. The average per capita water use based on population served is reported in this way for each community.

(Water Use Per Person) = (Total Water Use) / (Population Served)

This value represents the total water use per capita for each community. This includes all water use in the community, including commercial, industrial, institutional, and other uses. Therefore, it is not necessarily indicative of the amount of water used in each household. This is an important distinction since a community may have a large amount of water-intensive industry that drives up the total water use per capita. Therefore, the total per capita use by itself may not be an accurate indicator of the effectiveness of conservation programs for example.

Population Forecasts

Water demand projections were based in part on population forecasts from Thrive MSP 2040, the Metropolitan Council's updated regional development framework. These forecasts are derived from macroeconomic models, and more details can be found on the Metropolitan Council website**:**

http://metrocouncil.org/Data-and-Maps/Data/Census,-Forecasts-Estimates.aspx

Unless otherwise specified by a community, forecasted population served by municipal water systems was calculated by subtracting the average population not served, as previously described, from the total population forecast for each community. It is assumed by this method that the population currently not served by the public water system in each community will remain unserved through 2040. It is also assumed that future population growth and development will be served by the public water system.

In some cases, the unserved portions of a community will become served as a water system expands its service area. This would result in a projected population served that is too low by the current method. In other cases, future population growth and development could occur in areas that are not served by a public water system. This would result in a projected population served that is too high. Therefore, these potential inaccuracies for each community should be taken into account by local planners when utilizing these projections for water system planning purposes, and local knowledge should be used to adjust these projections where possible.

Water Demand Projections

Unless otherwise specified by a community, the projected population served was multiplied by the historical average per capita water use to calculate the water demand projection for each community. This method assumes that the historical average per capita water use, as estimated for each year between 2003 and 2012, is representative of future per capita water use.

Actual per capita water use is likely to fluctuate around an average value, depending primarily on weather, but also on economic factors. Therefore, actual water use could be higher or lower than the average values calculated by the method described in this memorandum. In addition to annual fluctuation in per capita water use, there are also long-term trends in per capita water use that are emerging in some locations and within specific water use categories.

For example, the Water Research Foundation and the US Environmental Protection Agency jointly commissioned a study in 2010 to investigate trends in residential water use[1]. This work found that newer homes tend to use less water indoors, and that older homes are reducing indoor water use over time through the retrofitting of older plumbing fixtures with newer water conserving fixtures. In communities with newer development, the reduction in water use indoors may be offset by other factors such as larger lots and automatic lawn irrigation systems.

There appears to be a trend toward lower per capita water use in many communities in the metro area. This is illustrated in Figure 2, which shows the trend in per capita use between 1990 and 2012 for the City of Richfield. Similar trends can be found for many communities in the region.

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[1] Coomes P, Rockaway T, Rivard J, Kornstein B (Center for Infrastructure Research, University of Louisville, Louisville, KY). North America Residential Water Usage Trends Since 1992. Denver, CO: Water Research Foundation: 2010.

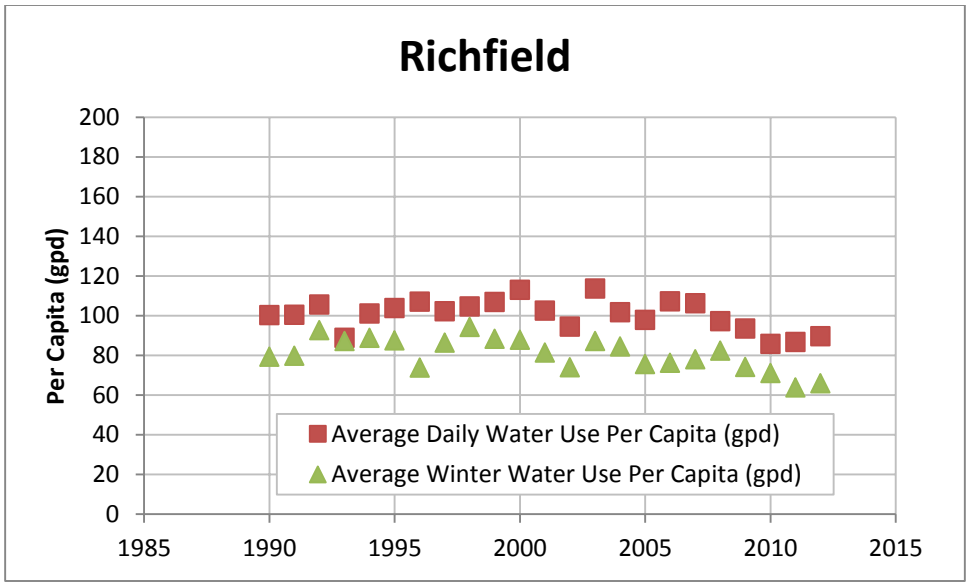


Figure 2. Historical Per Capita Water Use, 1990 – 2012, City of Richfield

While there appears to be a downward trend in this data for many communities in the region, the trend is not obvious for many other communities. Figure 3 shows the same series of data for Maple Grove, where the trend in per capita water use is not as apparent. The causes of the downward trend in some communities are not clear currently, though it could be related to more effective water conservation, economic drivers (especially in commercial water use), and/or climate. The observed trends in water use warrant further study in order to understand the causes and how they could impact future water use.

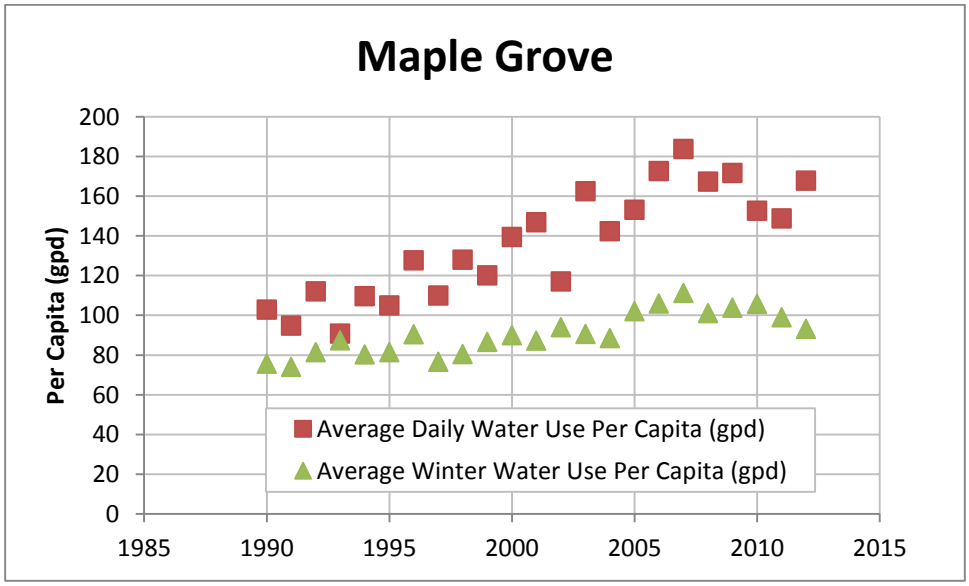


Figure 3. Historical Per Capita Water Use, 1990 – 2012, City of Maple Grove

The regional per capita water use is presented in Figure 4. As a region, there is not a significant trend in per capita water use between 1990 and 2012. However, the winter water use per capita (representing indoor water use) is declining. This has been accompanied by an increase in outdoor water use over the same time period on a per capita basis. Since 2007, there could

be a downward trend in per capita water use for the region, though it is not a significant trend in the data at this point. Communities have reported that per capita water use has continued to decline through 2013 and 2014, and that mandatory tiered rate structures that have been implemented over the last couple of years may be the cause.

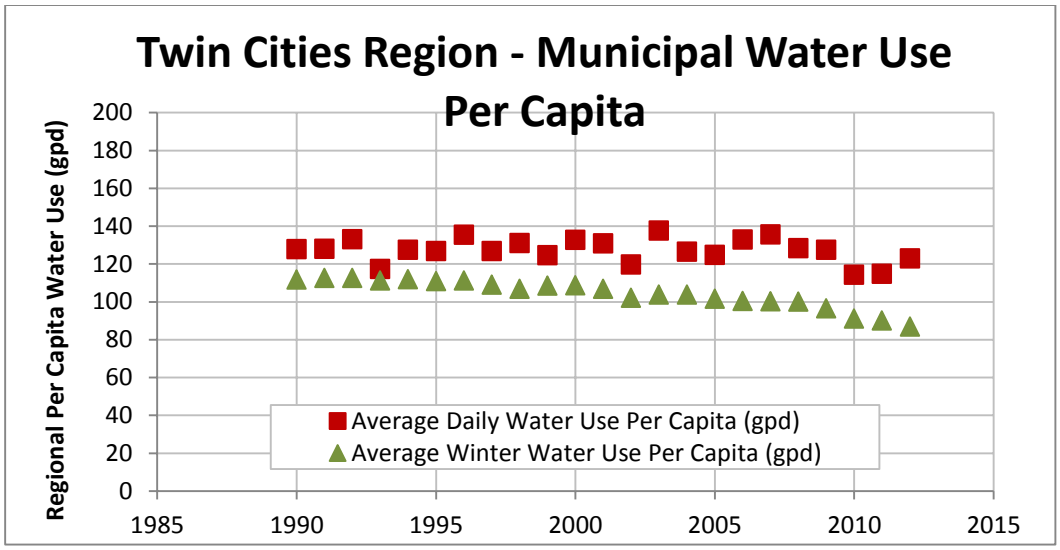


Figure 4. Historical Per Capita Water Use, 1990 – 2012, Twin Cities Metropolitan Area Public Water Systems

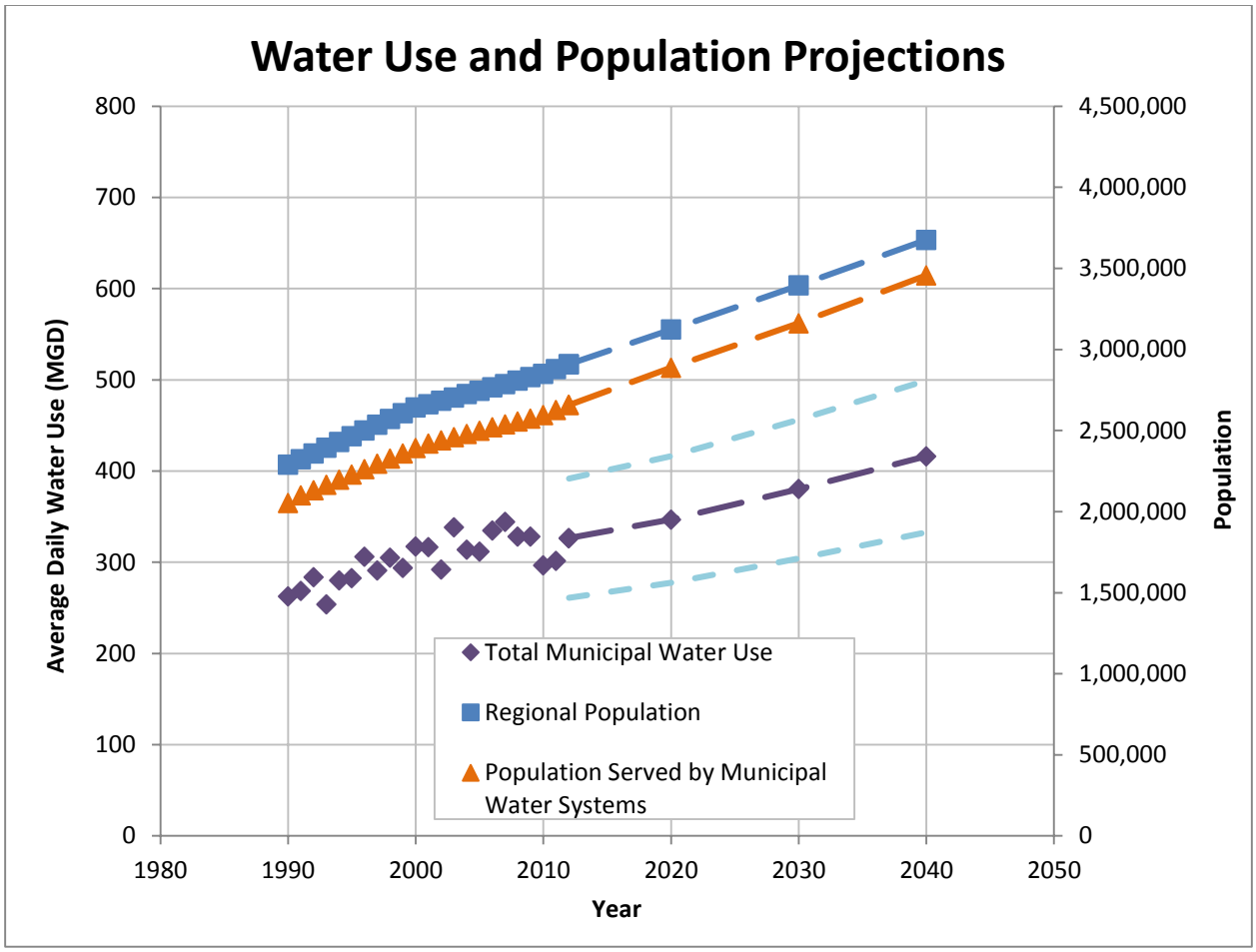
Use of Projections

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

For the purpose of groundwater flow modeling, an average value of water use is appropriate. This is especially true with steady state modeling scenarios, where annual fluctuations in well pumping are not taken into account. For local water system capacity planning, it is important to plan for higher use conditions in order to avoid water shortages. Therefore, the projections presented in the Master Water Supply Plan generally should not be used for local water system capacity planning purposes.

Results

The results of the water demand projections for each public water supplier, as calculated by the methods described in this memorandum are attached. The overall demand projection for the region is presented in Figure 5. The light blue dashed lines above and below the projection indicate a +/- 20% uncertainty in our projections. The regional groundwater model will be run with a range of conditions to understand the sensitivity of model results to demand projection inaccuracy.


Water Use and Population Projections
Average Daily Water Use (MGD)
Population
Year
800
700
600
500
400
300
200
100
0
4,500,000
4,000,000
3,500,000
3,000,000
2,500,000
2,000,000
1,500,000
1,000,000
500,000
0
1980
1990
2000
2010
2020
2030
2040
2050
Total Municipal Water Use
Regional Population
Population Served by Municipal Water Systems