INDUSTRIAL WATER CONSERVATION IN THE NORTH AND EAST METRO GROUNDWATER MANAGEMENT AREA

DATA RESEARCH REPORT

METROPOLITAN COUNCIL

December 15, 2015

A report detailing research involving the compilation and analysis of available data sets for industrial water use In the north and east metro groundwater management area (GWMA) of the Twin Cities.

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Introduction

The Minnesota Technical Assistance Program (MnTAP) at the University of Minnesota, School of Public Health, Division of Environmental Health Sciences in Minneapolis identified opportunities through this research for industrial water use conservation for target sectors in the north and east metro groundwater management area (GWMA) of the Twin Cities metro area.

This report provides the background needed for the strategic identification of industry sectors for water conservation technical assistance. Detailed research was conducted in order to categorize and quantify industrial sector use of water from all sources, and groundwater within the GWMA by numbers of businesses, water volumes, and other criteria.

Data from four sources was analyzed. The DNR Water Appropriations Permit Program- Active Permit Information database, (State Water Use Data System (SWUDS)), and the DNR Supplemental Use database, the Metropolitan Council Environmental Services (MCES) Industrial Discharges Water Demand database, as well as National Pollutant Discharge Elimination System (NPDES) permit information available from the Minnesota Pollution Control Agency (MPCA) were used to identify industrial users with individual permits. Industries without any of these permits were identified through publicly available municipal (city) water top ten largest user data.

Analysis of these data sets provided MnTAP the ability to group industry sectors by numbers of businesses, water volumes, area proximity, and other criteria. This organization of information helped optimize project planning for water conservation technical outreach and additional assistance efforts.

Background

MnTAP work began with understanding the GWMA geographic boundary as originally delineated by the DNR and presented to the public at the Shoreview Community Center on January 8, 2014. This boundary was subsequently revised in a correspondence dated March 6, 2014 to add the natural hydrologic boundary of the Mississippi River (***Appendix A***).

Data from four databases were used in the research:

- The DNR State Water Use Data System (SWUDS), which identifies permits issued for large water appropriations defined as more than 10,000 gallons per day, or one million gallons per year. Users without permits are not included in this data.
- The DNR Supplemental Use Database, which incorporates water use information from municipalities, provides a breakdown of a city's water use into Residential, Commercial, Industrial, Agricultural, or Other use.
- The Metropolitan Council Environmental Services Industrial Waste Division Database containing facilities that discharge industrial wastewater to the sanitary sewer system.
- The National Pollutant Discharge Elimination System (NPDES) data containing all users with permits that allow direct discharge to surface waters.

A complete analysis of data was done for 2011 and 2012. Data from 2013 is presented where available.

Additional MCES databases helped to provide a more complete picture of water provided by wells and city supplies. This data also provided some insight to water use when sub-categories such as irrigation

were included in the data. A water balance (supply and usage) was also often helpful in matching up water use.

Original data gathering included the broadest inclusion of business types located in the GWMA. The MCES project manager then helped to refine what types of business should be classified as industrial per the stated focus of the project.

The research analysis outlined in this report presents water use in the GWMA in layers, beginning with the broadest perspective and narrowing to those business types that have been identified as significant water users. Conclusions are drawn regarding the reliability of the different data sets, data quality, what missing data might infer. Top industry sectors are being targeted for technical assistance, best management practice information and outreach, and offerings of intern project support.

Project research methodology

The research process used to gather and investigate industrial water use in the GWMA included the following steps:

Definition of the working area-

> The working area includes all of Ramsey and Washington Counties, eight cities in southern Anoka County, and Hennepin County on the east side of the Mississippi, which includes a portion of Minneapolis, Columbia Heights and Hilltop. Geographically, this area is bounded on the west by the Mississippi River, the east by the St. Croix River, the south by the Dakota County boundary, and the north by the Washington County boundary. The northwest boundary is defined by cities in Anoka County bordering the counties of Ramsey, Washington and Hennepin including the cities of Fridley, Blaine and Columbus.

Identification of industries located in the GWMA:

> The zip codes and city names associated with businesses and industries in the GWMA-bounded region were identified using Zip Code boundary maps and United States Zip Codes.

Data analysis initiation:

> Water use obtained from the DNR Water Appropriations Permit Program-Active Permit Information database included only permits in the counties of Ramsey, Washington, Anoka, and Hennepin.
>
> Data was received directly from the DNR, employing a shape filter on geographic information system (GIS) maps to narrow the database entries roughly to those in the GWMA. Entries that were in the cities list were then automatically included. Because only part of Minneapolis is in the GWMA, companies in that city were individually mapped to ensure they fell within the working boundary. Data was then grouped under company names and tabulated by permit number to determine total annual amount of water withdrawn for each permit.
>
> Data was also obtained from the DNR in the form of a survey from the municipal water suppliers on their top ten water users. This data was incomplete due to five missing municipalities. In addition, the information was not matched to the same analysis year cycle due to information reported only on a staggered 10-year timeframe. While informative, this data was finally used solely for the purpose of obtaining 20 additional company names to contact that were not available in any of the other databases.

MCES data was filtered for companies in the GWMA. Entries were then compared to those in the DNR database by company name, water amounts used, and water source. To avoid duplication, entries from the DNR database were then deleted if they were already in the MCES database.

A combination of Google maps and the MPCA What's in my Neighborhood? website was used to confirm that the companies in all the data sets were located within the GWMA. Information about surface water discharge and significant industrial users was reviewed to find companies missing from other data sources. Combining three sets of data, including DNR data of facility water appropriation, MCES data of facility water use and sewer discharge, and MPCA data of facility water discharge resulted in the identification of an additional 24 companies. These additions were in the DNR databases, but not in the MCES database. No additional companies were found using the NPDES database.

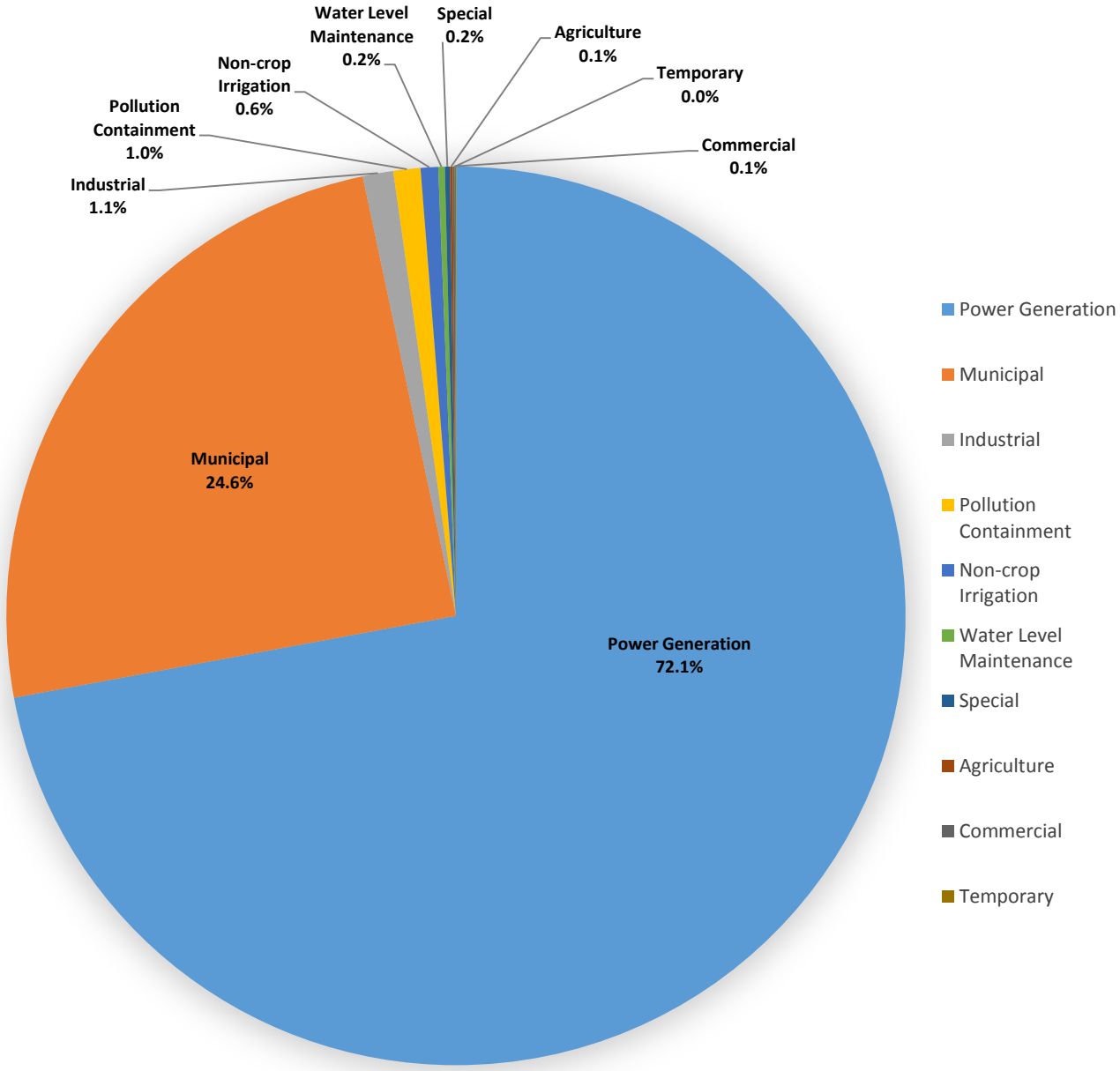
Depending on the database, businesses were classified either by North American Industrial Classification System (NAICS) numbers, Standard Industrial Classification (SIC) codes or an industry description and water use. All classifications were used to sort companies into industry sectors.

GWMA overall water use

The overall water use in the GWMA includes the municipalities that supply water to smaller businesses and industry, and residences as well as separate permitted users. Total use from all sources provides a high-level perspective on the overall use of water in the GWMA.

Figure 1 illustrates an accounted-for 2012 total of approximately 290 billion gallons of water from all sources, including surface water and groundwater. Power generation is the largest water use when considering all sources, but the vast majority of power generation uses surface water which is returned to the rivers from which it is withdrawn. The next largest category is municipal water use, which will be discussed in greater detail below.

Figure 1. 2012 GWMA total water use of 290 billion gallons of water from both groundwater and surface water sources.



Source:
DNR SWUDS groundwater permits database
Total groundwater and surface water use represents 290 billion gallons

DNR water appropriations permits are required for withdrawals greater than 10,000 gallons a day or one million gallons per year. These permits are assigned a use code that describes the purpose of the water use. For example, DNR use code 211 would be a permit for municipal water uses. The DNR use codes were categorized as shown below to generate Figure 1 and Figure 2.

- Municipal (DNR use codes 211, 212, 214, 216, 217, 219)
- Commercial (DNR use codes 213, 214)
- Power generation (DNR use codes: 221, 222, 223, 224, 225, 226, 229

  and air conditioning: 231, 232, 233, 234, 235, 238, 239)
- Industrial (DNR use codes 241, 242, 243, 244, 245, 246, 247, 248, 249, 272, 273)
- Temporary (DNR use codes 251, 252, 253, 254, 256, 257, 258, 259)
- Water level maintenance (DNR use codes 261, 262, 263, 264, 265, 266, 269)
- Pollution containment (DNR use code 271)
- Special (DNR use codes 274, 276, 277, 279)
- Non-crop irrigation (DNR use codes 281, 282, 283, 284, 285, 286, 289)
- Agriculture (DNR use codes 275 ,290, 296)

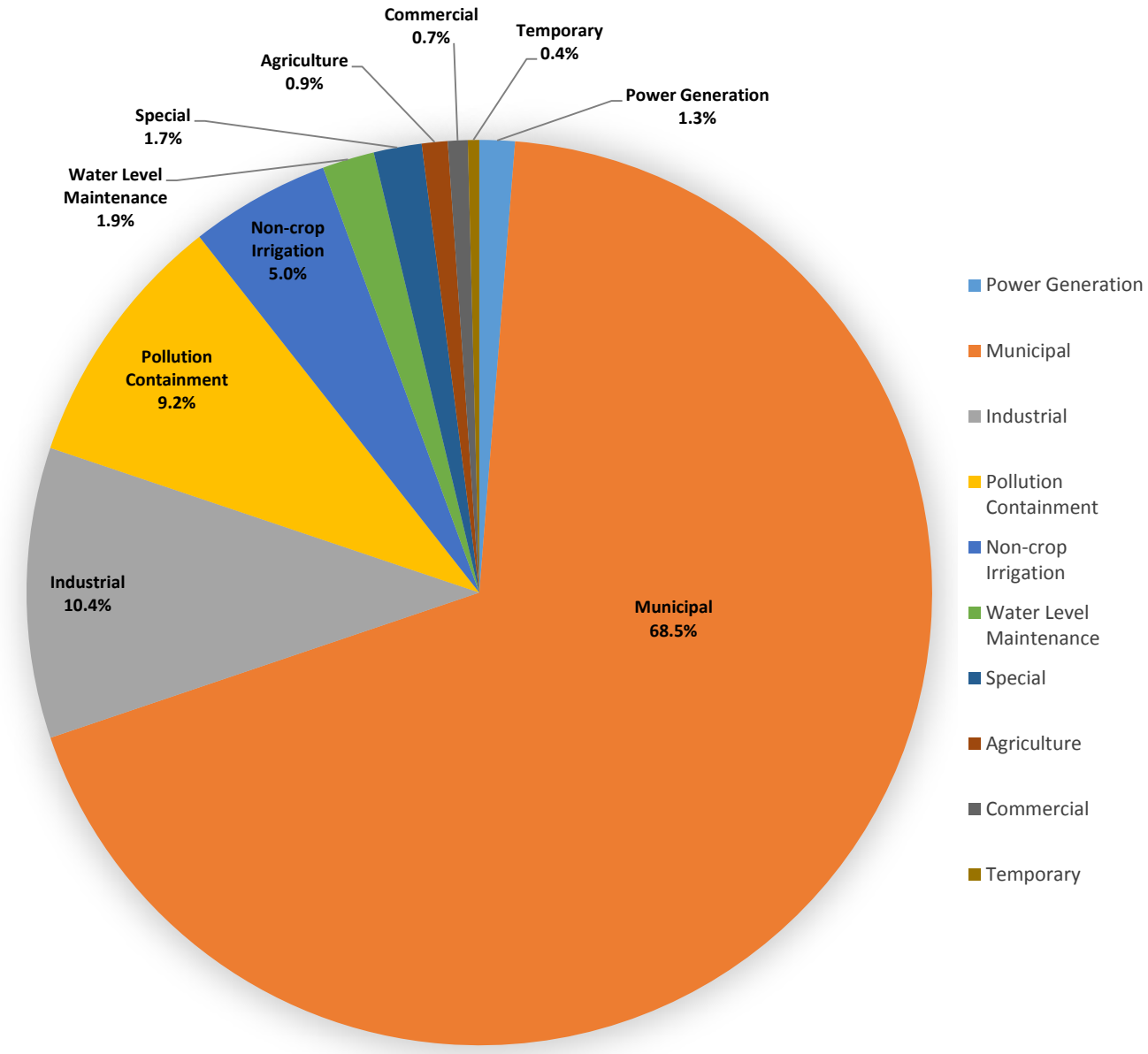
Figure 1 illustrates 2012 GWMA total water use of 290 billion gallons from both groundwater and surface water sources.

Figure 2 identifies 2012 GWMA water use from groundwater sources only, totaling 30 billion gallons of water. This amount is 10.5% of the total water use of 290 billion gallons from all sources found in Figure 1. The difference of 260 billion gallons represents water supplies from other sources (primarily surface water).

Separating groundwater use from total water use accurately identifies categories actually using groundwater, which was the objective of this research.

The contrast between total water use and groundwater use is notable in the percentage change from Figure 1 to Figure 2 in the relative amounts of water used, for example, for power generation, and by municipalities.

Figure 2. 2012 GWMA water use of 30 billion gallons of water from groundwater sources.



Source:
DNR SWUDS groundwater permits database
Total groundwater use represents 30 billion gallons

Full data sets comparing 2011 and 2012 are located in ***Appendix B.***

Data quality

Data was compared both within the DNR Supplemental Use database, and between the DNR Supplemental Use and DNR SWUDS databases.

The DNR Supplemental Use Database classifies community water distribution sales into one of five categories: Residential, Commercial, Industrial, Agricultural, and Other, and includes reported total sales amounts in gallons. The individual sales amounts in these categories were summed and compared to the total sales reported to check for accuracy. The difference in adding up individual sales and reported sales totals of all municipal providers in the GWMA in the DNR Supplemental Use Database was relatively small (5% or 688 million gallons of water). Over-counting and under-counting tended to cancel the other. Individual city results are shown in ***Appendix C***.

Data was also compared between the SWUDS and the DNR Supplemental Use databases. The SWUDS pumped amounts were similar to city recordkeeping in the DNR Supplemental Use data referencing the total amount of groundwater withdrawn. No data discrepancies were found.

Data interpretation[1]

Appropriations and other regulatory permit tracking, while subject to reporting errors and omissions, are the most straight-forward accounting of water use. However, in the case of municipal water suppliers, those totals do not provide detailed breakdowns of the portion of water use by municipality-serviced businesses and industries. Accounting for the business and industrial use of municipal water supplies proved to be challenging but necessary to further delineate water use across certain categories.

The DNR Supplemental Use Database provides a breakdown of how much of the municipal water is used for commercial, industrial, agricultural and other purposes. The municipal water use breakdown was derived from using the DNR Supplemental Use Database, and not the SWUDS database because the Supplemental Use Database was the only source available providing the category breakdown of overall municipal usage.

The Supplemental Use Database divided the water sold (distributed) into five categories:

- Residential
- Commercial
- Industrial
- Agricultural
- Other

Supplemental use data for 2011 and 2012 is located in ***Appendix D.***

St. Paul and Minneapolis water data was first analyzed to clarify how much of the water used in those cities is sourced from the Mississippi River. This surface water use information was then removed in Figure 3 to show only groundwater sources used in the various municipal use categories**.** In addition, approximately 10% of the water supply in St. Paul is from groundwater according to the 2009 Ramsey County Groundwater Protection Plan (page 17), https://www.co.ramsey.mn.us/cd/docs/Ramsey%20County%20Groundwater%20Protection%20Plan.pdf

The 10% St. Paul groundwater amount was not included in Figure 3 because it appeared the data combined industrial with commercial users.

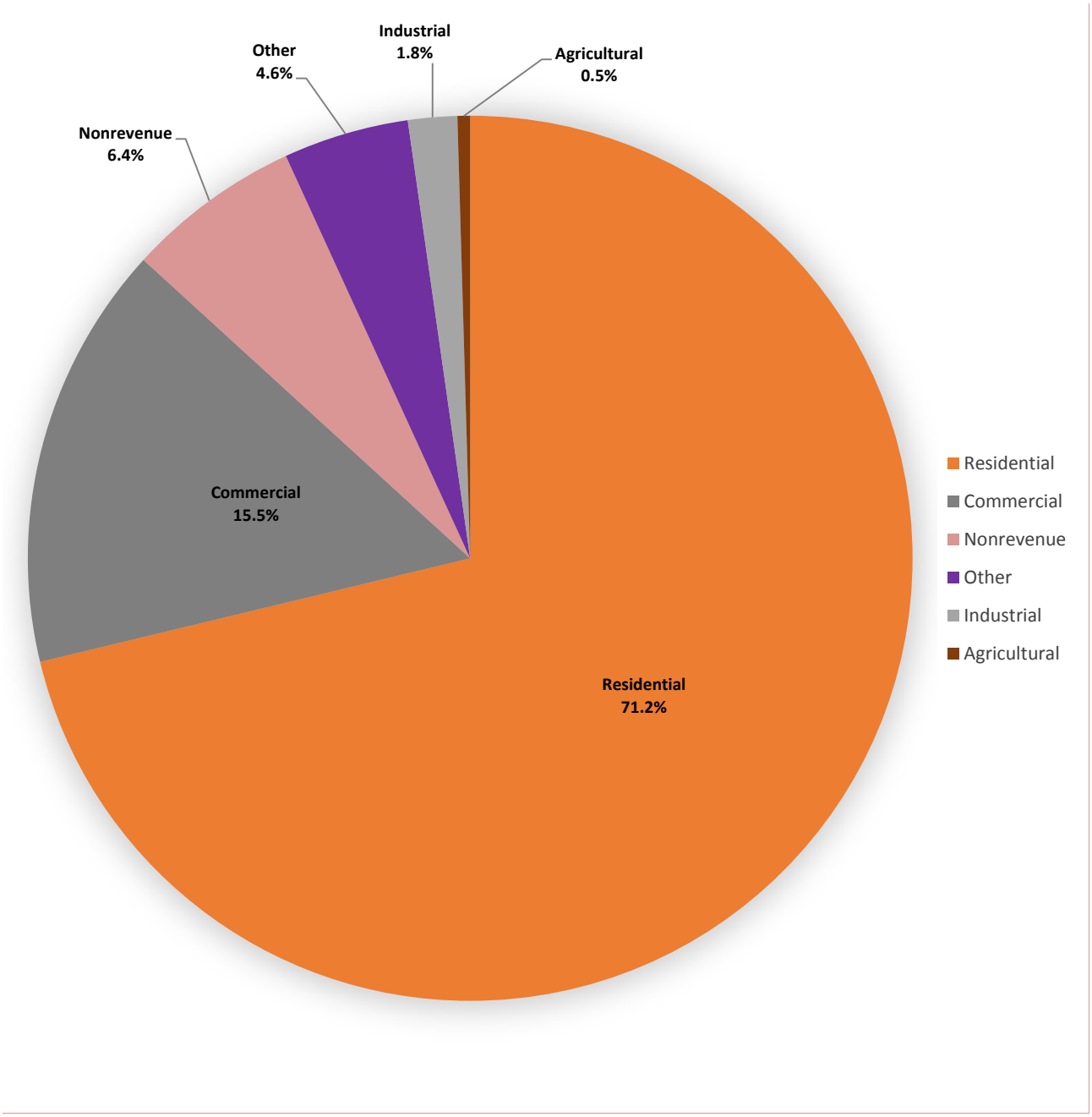
[1] Two separate methodologies were used to try and correlate and normalize data. See ***Appendix C***.

Figure 2 shows 68.5% of the groundwater in 2012 is pumped by municipal water utilities, or approximately 20.9 billion gallons of water. Figure 3 illustrates the breakdown of the 68.5% municipal supply into the Supplemental Use Database categories.

- 71.2% for Residential use
- 15.5% for Commercial use
- 1.8% for Industrial use
- 0.5% for Agricultural use
- 6.4% Nonrevenue
- 4.6% Other

The breakdown illustrated in Figure 3 identifies 18.4 billion gallons of water use and not 20.9 billion gallons because of not including Minneapolis and St Paul sales to other municipalities and missing municipality data. Nonetheless, it provides a more accurate categorization of water use and may allow for a more effective targeting of industrial water users as well as future outreach to other sectors.

Figure 3. 2012 municipal groundwater use of 18.4 billion gallons of water excluding St. Paul and Minneapolis and other cities with surface water use.



Source:
DNR Supplemental Use Database
Total groundwater used by 27 reporting municipalities represented in Figure 3 is 18.4 billion gallons. This excludes Minneapolis and St. Paul.
Cities missing 2012 data in the Figure 3 analysis are Blaine, Fridley and Lake Elmo.
The following additional eight cities were not included because they purchase water from either St. Paul or Minneapolis, which use mostly or all surface water sources:

- Arden Hills
- Columbia Heights
- Falcon Heights
- Lauderdale
- Lilydale
- Little Canada

- Maplewood
- Roseville

Communities that were also excluded because they do not have public water utilities and purchase their water from other municipalities were Afton, Dellwood, and Scandia.

Figure 3 is significant because it illustrates the breakdown of the municipal water use into Residential, Commercial, Industrial and Agricultural uses. Without this breakdown, one might incorrectly classify all municipal water use as being residential. However, many businesses purchase their water from a city.

The Nonrevenue category in Figure 3 representing 6.4% of municipal groundwater use illustrates the difference between the amount of water pumped and the amount actually sold by the city. Possible reasons for this difference may be unsold water flushed from the system, system leaks, loss from water purification, and meter issues. Water used by the city for its own purposes may also be in this category if not specifically identified in the Other category.

Groundwater withdrawals in the SWUDS and the DNR Supplemental Use databases for cities that had entries in both databases for 2011 and 2012, and a city-by-city description of the Other category are found in ***Appendix E***.

Data interpretation results

Water use distribution illustrated in Figure 2 and Figure 3 are combined into Figure 4 to provide a more detailed view of GWMA groundwater use.

Figure 4 shows the detailed breakdown of 30 billion gallons of groundwater use in the GWMA, including the municipal water use subdivided and categorized into its component parts e.g., Residential, Commercial, Industrial, Agricultural, Nonrevenue, and Other. Percentage changes were obtained by using distributions in Figure 3 to refine municipal categories to draw out the hidden components of Residential, Commercial, Industrial, Agricultural, Nonrevenue, and Other use in the municipal water category. By refining municipal water use into these subcategories, a more accurate quantification of how water is used emerged.

Several changes from Figure 2 to the more comprehensive Figure 4 are evident:

- Industrial use allocation increased from 10.4% in Figure 2 to 11.6% in Figure 4.

  Industrial groundwater use shown in Figure 4 provides a more comprehensive use picture since this figure includes industrial purchase of water through municipal sources in addition to industries with DNR water appropriation permits. In 2012, industries used 11.6% of the 30 billion gallon GWMA groundwater supply or 3.5 billion gallons of water.

- Commercial use allocation changed substantially from 0.7% to 11.4% in Figure 4.

  Commercial use of 11.4% or 3.4 billion gallons of water is substantially increased over the previous 0.7% in Figure 2. However, uncertainty is introduced due to the method by which cities classify commercial use. For example, some cities classify housing rental complexes as commercial while others might classify housing rental complexes as residential.

- Residential use comprises 48.8% of municipal water pumped.

  The Municipal graph (Figure 3) is divided into Residential, Commercial, Industrial, Agricultural, Nonrevenue and Other categories.

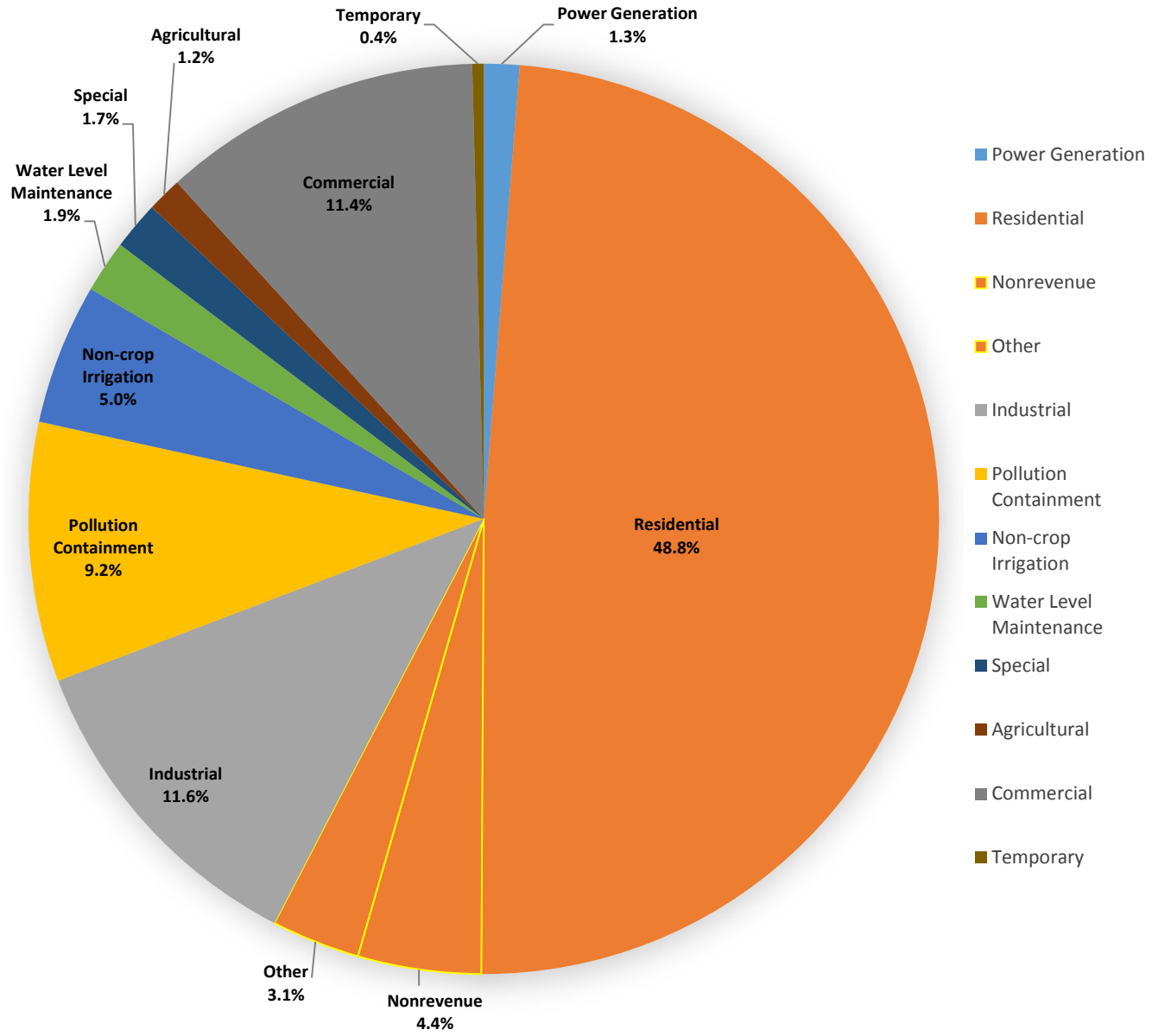
Together, Nonrevenue and Other amounts total 11% or about 2 billion gallons of water. Depending on the city and the year, some examples of water use in these categories include sales to institutions, churches, and public entities, hydrant flushing, street cleaning, irrigation, and rink flooding.

The Municipal water use in Figure 2 when categorized to break out Commercial (10.7%), Industrial (1.2%), Agriculture (0.3%), Nonrevenue (4.4%), and Other (3.1%) results in Residential use of 48.8% or 14.9 billion gallons of water as shown in Figure 4.

The summary of adjusted use categories for the North and East GWMA illustrated in Figure 4 is shown below:

- Residential use (14.9 billion gallons)
- Commercial use (3.5 billion gallons)
- Industrial use (3.5 billion gallons)
- Agricultural use (0.4 billion gallons)
- Nonrevenue (1.2 billion gallons)
- Other (0.84 billion gallons)

Figure 4. 2012 groundwater use of 30 billion gallons including industries with separate DNR appropriations permits and the complete categorization of municipal water pumped.



Source:

DNR SWUDS groundwater appropriations permits and DNR Supplemental Use Database

Total groundwater represented is 30 billion gallons

Chart allocates Municipal use into Residential, Industrial, Commercial, Agricultural, Nonrevenue and Other categories

Nonrevenue category is approximately 1.2 billion gallons of water

Other category is approximately 0.84 billion gallons of water

Selection of industrial water use sectors

The project focus called for the strategic identification of industry sectors using groundwater for water conservation technical assistance. In consultation with the MCES project manager, the full list of identified permit users was refined based on whether or not a facility was classified as industrial.

Targeted industry sectors included manufacturing, mining, research and development (R&D), transportation, and waste management/remediation. Some companies in the services and support services sectors were also included, as explained below.

The working definition derived for industrial referred to sectors engaged in a tangible unit product being produced. As a result, certain industry sectors were excluded because they did not fit this definition of industrial use. These excluded sectors were entertainment, services (including educational, automotive repair, healthcare, gas and convenience stores), private equities, public administration (including correctional facilities), wholesalers, and utilities with the exception of power generation.

For example, ski slopes, which were classified in the entertainment sector, were considered an industry where revenues can be generated. However, it was not considered an industrial water user because no tangible products for sale were produced. Thus, any industry that offered services as its product was excluded.

Water use descriptions were also employed in industrial classification decision making, and some excluded businesses were added to the included list. For example, one candidate organization was classified as an educational service; however, some of the operations were for agriculture or power generation. In these instances, such businesses were included in sector targets because of how the water was used.

In another example, messenger/delivery services were excluded, except where vehicle wash water could be included. In the same manner, the transportation sector was included because although transportation is a service and no goods are produced, vehicles are cleaned and washed on a large-scale, industrial basis.

Included sectors and sub-classifications are outlined in Table 1. Sectors in **BOLD RED CAPS** signify disparities across sector(s), where some specific organizations in a sector were included while some were excluded. The excluded sectors are identified in Table 2.

Table 1. Included candidate industry sector sort.

	Candidate sectors		
	Manufacturing		
	Building materials	Miscellaneous	Plastics
	Chemicals	Non-metallic (rubber, glass, concrete)	Plastics & Rubber
	Electronics	Office furniture	Primary metals
	Food products	Paper/packaging	Printed products
	Industrial machinery	Petroleum products	R & D
	Medical products	Pharmaceuticals	Surgical & Medical
	Metal products	Photofinishing	
	Mining		
	Sand & Gravel	Limestone	
	Other Services		
	Plastics		
	Research & Development		
	Multi-sector	**AQUACULTURE**	
	Services		
	Dry cleaning	**LOCAL MESSENGER/ DELIVER**	**WATER TREATMENT**
	EDUCATIONAL SERVICES	**RENTAL & LEASING**	
	Support Services		
	PRINTED PRODUCTS		
	Transportation		
	Ground transit	Line Haul Railroads	
	Inland Water Freight Transport	Petroleum products	
	Utilities		
	Electric	**NATURAL GAS**	
	Waste Management & Remediation		
	Materials recovery	Waste Treatment & Disposal	
	Wholesaler		
	CHEMICALS		

Table 2. Excluded sectors.

	Excluded sectors		
	Entertainment		
	Fishing and Dining	Ski Slope	Zoo
	Other Services		
	Transportation		
	Private equities		
	Public Administration		
	AQUACULTURE	Correctional Institutions	
	Services		
	Automotive	Funeral home/services	**RENTAL AND LEASING**
	Automotive repair	Healthcare	**WATER SERVICES**
	EDUCATIONAL SERVICES	**LOCAL MESSENGER/ DELIVERY**	
	Support Services		
	PRINTED PRODUCTS		
	Utilities		
	NATURAL GAS	Sewerage Systems	Water Supply
	Wholesaler		
	CHEMICALS	Food products	Petroleum products

Industrial total water use sector targets

2011 to 2013 aggregated total water use from surface and groundwater sources within the GWMA by selected industry sectors are represented in Table 3.

Table 3. Industry sector total water use from all sources (surface and groundwater) 2011-2013.

	Number of companies	Billion gallons (2013)	Billion gallons (2012)	Billion gallons (2011)
Manufacturing	**186**	**3.8**	**3.7**	**3.8**
Building materials	3	0.2	0.2	0.1
Chemicals	12	1.2	1.1	1.2
Electronics	12	0.2	0.2	0.2
Food products	36	0.5	0.5	0.5
Industrial machinery	2	<0.001	<0.01	<0.01
Medical products	6	<0.1	<0.1	<0.1
Metal products	80	0.4	0.4	0.4
Miscellaneous	1	<0.01	<0.01	<0.01
Non-metallic (rubber, glass, concrete)	3	<0.01	<0.01	<0.01
Office furniture	1	<0.0001	<0.0001	<0.0001
Paper/packaging	9	0.6	0.5	0.5
Petroleum products	1	0.7	0.7	0.7
Pharmaceuticals	1	<0.001	<0.001	<0.001
Photofinishing	1	0	0	<0.001
Plastics	1	<.01	<.01	<.01
Plastics & Rubber	1	0	0	0
Primary metals	2	0.1	0.1	0.1
Printed products	12	<0.1	<0.1	<0.1
R & D	1	<0.01	<0.01	<0.01
Surgical & Medical	1	<0.01	<0.01	0
Mining	**8**	**0.1**	**0.1**	**0.1**
Sand & Gravel	7	0.1	0.1	0.1
Limestone	1	<0.001	<0.01	0
Other Services	**1**	**<0.01**	**<0.01**	**<0.01**
Plastics	1	<0.01	<0.01	<0.01
Research & Development	**4**	**0.3**	**0.3**	**0.3**
Services	**10**	**0.2**	**0.1**	**0.2**
Dry cleaning	4	0.2	0.1	0.2
Educational Services	3	<0.01	<0.01	<0.01
Local messenger/deliver	1	<0.01	<0.01	<0.01
Rental & Leasing	1	<0.001	<0.001	<0.001
Water Treatment	1	<0.001	<0.001	<0.001
Support Services	**2**	**<0.01**	**<0.01**	**<0.01**
Printed products	2	<0.01	<0.01	<0.01

	Number of companies	Billion gallons (2013)	Billion gallons (2012)	Billion gallons (2011)
Transportation	**7**	**<0.1**	**<0.1**	**<0.1**
Ground transit	2	<0.01	<0.01	<0.01
Inland Water Freight	2	<0.0001	<0.0001	<0.01
Line Haul Railroads	2	<0.01	<0.1	<0.1
Petroleum products	1	<0.001	<0.001	<0.001
Utilities	**8**	**0.3**	**0.3**	**0.2**
Electric	6	0.3	0.3	0.2
Natural gas	2	<0.1	<0.1	<0.1
Waste Management & Remediation	**4**	**<0.1**	**<0.1**	**<0.1**
Materials recovery	2	<0.01	<0.01	<0.01
Waste Treatment & Disposal	2	<0.1	<0.1	<0.1
Wholesaler	**1**	**<0.01**	**<0.01**	**<0.01**
Chemicals	1	<0.01	<0.01	<0.01
TOTAL	**231**	**4.7**	**4.6**	**4.7**

Table 3 identifies 231 industrial companies that use water from all sources (both surface water and groundwater). There are 184 industries using groundwater-only sources.

As identified in **Selection of industrial water use sectors** above, certain industries were excluded because their water use was deemed not used for industrial purposes since no tangible product was produced. Of the excluded companies, 97% of the water was used by the utilities sector, in particular, 93% by municipal water suppliers and 4% by sewage treatment facilities.

Water use data for included and excluded individual facilities is found in ***Appendix F.***

A map (***Appendix G***) of target and excluded locations in the GWMA was generated with ArcGIS online (arcGIS.com/home). The boundary designating the GWMA was drawn on the base map. An Excel.cvs extension spreadsheet file with addresses was downloaded and mapped. Green dots represent targeted companies that met the definition criteria and red dots represent companies that were excluded. Project conservation work will emphasize providing assistance across the GMWA, even though the majority of the target businesses are in the western portion of the area.

Determination of industrial groundwater use

The research goals of this project were aimed at identifying, categorizing, and quantifying three to five industrial sectors' groundwater use within the GWMA by numbers of businesses, water volumes, and other criteria with the intent of providing technical outreach for water conservation.

The identification of industry groundwater-only use required analysis of the three categories of water sources used in the GWMA: groundwater from privately owned wells, water mixtures of groundwater and municipal sources, and water from municipal sources. To identify industrial groundwater users only, the water source in addition to the city location of the business was used.

Companies that did not have a well permit in the cities of Columbia Heights, Hilltop and Minneapolis were classified as using 100% river water sources because the City of Minneapolis serves these communities and the water source is the Mississippi River.

Companies that did not have a well permit and were located in the cities of Arden Hills, Falcon Heights, Lauderdale, Little Canada, Maplewood, Roseville, and customers of St. Paul Regional Water Services were considered marginal groundwater users. For analysis purposes, 10% of total water use from groundwater sources was factored in, based on percentage groundwater supply disclosure information excerpted from the 2009 Ramsey County Groundwater Protection Plan.

All other companies with well permits, or companies on municipal water sourced strictly from municipal wells, or companies with a combination of well and municipal well-sourced water were classified as using 100% groundwater sources.

The distribution of industrial water sources is illustrated in a GWMA boundary map shown in ***Appendix H.*** As might be expected, sites located away from the river water distribution network are 100% dependent on groundwater sources, either through their cities or private wells. Note that some businesses on municipal water supplied from river sources also have their own private wells.

Research outcomes and conclusions

Groundwater use across all industries comprises 11.6% of the total groundwater use of 30 billion gallons, or 3.5 billion gallons of water, as shown in Figure 4.

Water use by 85% of industries using 100% groundwater sources in the GMWA equals 3.02 billion gallons. The remaining 510 million gallons (14.4%) of water use can be attributed to industries served by St. Paul Regional Water Services because a small percentage of their water supply is from groundwater sources.

Adding an estimated 10% groundwater (as identified in the 2009 Ramsey County Groundwater Protection Plan) supplied by St. Paul Regional Water Services brings the calculated groundwater use to 3.6 billion gallons, or 1.7% over the estimated groundwater use of 3.5 billion gallons. Two possible reasons can explain the discrepancy. The first explanation is that 10% is too high a percent attributed to St. Paul Regional Water Services groundwater supply. The actual percentage of groundwater use fluctuates and 10% is just an estimation. The second possible reason is that industrial use was higher than was calculated in Figure 3 due to mis-categorization by the municipalities.

A small percentage of the 184 industries identified from Table 3 use a large majority of the industrial groundwater. Approximately 85% of the 3.5 billion gallons of groundwater used by industrial facilities is used by roughly 10% of the industrial facilities in the GWMA (18 companies) as shown in the right half of Table 4 below.

Table 4. 2013 breakdown of top 85% of industrial water use by sector in GWMA comparing water use from all water sources (surface and groundwater) vs. groundwater sources

	Industrial water use from all sources(2013)			Industrial water use from groundwater sources (2013)		
Manufacturing	**Number of companies**	**Total water (billion gallons)**	**Total water used (%)**	**Number of companies**	**Total groundwater (billion gallons)**	**Total groundwater used (%)**
Building Materials	1	0.2	3.4	1	0.2	4.4
Chemicals	2	1.1	23.5	1	1.1	29.7
Electronics	1	0.1	2.2	1	0.1	2.2
Food Products	4	0.3	7.0	2	0.2	5.4
Medical Products	1	<0.1	0.5			
Metal Products	5	0.2	4.0	3	0.1	3.3
Paper Products	1	0.5	11.0	1	0.4	10.2
Petroleum Products	1	0.7	14.7	1	0.7	19.0
Primary Metals	1	0.1	1.8	1	0.1	2.1
Mining						
Sand & Gravel	2	0.1	1.3	2	0.1	1.7
R&D						
Multi-sector	1	0.3	5.9	1	<0.1	0.8
Aquaculture	1	<0.1	0.8	1	<0.1	1.1
Services						
Laundry & Dry	3	0.1	3.0	1	0.1	2.1
Utilities						
Electric	4	0.2	4.9	2	0.1	2.3
Natural gas	1	<0.1	0.6			
TOTAL	**29**	**4.0**	**84.4**	**18**	**3.5**	**84.3**

Six target industry sectors emerge when reviewing the GWMA industrial groundwater use outlined in Table 4:

- Building Materials
- Chemicals
- Food Products
- Paper products
- Petroleum products
- Electric utilities

The six target industry sectors are identified [♦] and highlighted in yellow in Table 5 below.

Table 5. Target industry sector groundwater users for 2011-2013

	2013 industrial groundwater use		2012 industrial groundwater use		2011 industrial groundwater use	
	Number of companies	Industrial groundwater used (%)	Number of companies	Industrial groundwater used (%)	Number of companies	Industrial groundwater used (%)
Manufacturing						
♦Building Materials	1	4.4	1	4.4	1	3.4
♦Chemicals	1	29.7	1	27.7	1	30.2
Electronics	1	2.2	1	2.5	2	3.3
♦Food Products	2	5.4	3	6.2	3	5.2
Metal Products	3	3.3	2	2.9	2	1.9
♦Paper Products	1	10.2	1	9.4	1	9.1
♦Petroleum Products	1	19.0	1	19.9	1	19.1
Primary Metals	1	2.1	1	2.1	1	2.4
Mining						
Sand & Gravel	2	1.7	2	2.0	1	1.3
R&D						
Aquaculture	1	1.1			1	1.1
Multisector	1	0.8	1	0.7		
Services						
Laundry & Dry cleaning	1	2.1	2	2.8	2	1.9
Utilities						
♦Electric	2	2.3	2	2.7	1	1.7
Natural Gas					1	0.8
TOTAL	**18**	**84.3**	**18**	**83.3**	**18**	**81.4**

The eight target facilities in six industry sectors in 2013 represent a selection of consistently high groundwater users that would likely have substantial water conservation opportunities appropriate for in-depth assistance focus.

Conclusions and next steps

This report illustrates the impact and complexity of water distribution and use in the GWMA. Compiling multiple sources of information has revealed, for example, that significant water user details are masked within larger categories like municipal sector water distribution data.

A small number of facilities in five industry sectors emerged as candidates for the greatest potential industrial water conservation impact in the GWMA. A minimum of three to five in the industrial use sector will be engaged to develop and implement an active water conservation plan with actionable reduction goals. Any additional sectors coming forward with interest in water conservation will also be engaged.

MnTAP staff site assessments and staff-supported intern projects will be emphasized in water conservation strategies with the target companies in those sectors. Objectives will include company priorities and accountability surrounding water conservation opportunities, the feasibility and justification of cost-effective changes, and the companies' willingness to move ahead with water conservation implementation.

It is likely that target facilities will have multiple cost-effective water reduction or reuse options to pursue that will be outlined in the form of assessment reports and implementation assistance.

Future work can include benchmarking and standardization of water use in product production. This will be useful for both tracking improved water efficiencies within a company, and determining the range of consumption within similar industries. It will also be more indicative of excessive consumption habits versus total water use numbers at a facility. By standardizing the data, one can determine excessive use operations and target them for assistance in a more focused outreach program.

Appendices

Appendix A – March 6, 2014 revision to MNDNR GWMA boundary map.

Appendix B – SWUDS data sets comparing water use in 2011 and 2012.

Appendix C – Water use data per industry sector and commentary, and attempt at sales vs water use correlation and normalization.

Appendix D – Municipality breakdown of water use in 2011 and 2012.

Appendix E - Groundwater withdrawals in the SWUDS and the DNR Supplemental Use databases for municipalities that had entries in both databases for 2011 and 2012, total water sales compared to calculated water sales for individual cities, and city definitions of the Other category.

Appendix F - Water use data for individual included and excluded sectors.

Appendix G - Annotated map of included and excluded locations in GWMA.

Appendix H - Annotated map of distribution of the included companies by their source of water use.