TM-5: Water Demands

1.0   Introduction

Future water demands were projected based on population projections, analyses of domestic, industrial, commercial and institutional water use, and particular characteristics of wholesale customers.

Water consumption for wholesale customer and the City of Detroit was evaluated for the years 2007, 2010, 2011, and 2012 to establish the following components and characteristics:

1. Water consumption by user sector:

    - Domestic

    - Major Industrial

    - Industrial, Commercial and Institutional

    - Non-revenue

2. Patterns of water consumption

    - Maximum day (summer season) diurnal pattern

    - Average day (non-summer months) diurnal pattern

The total service area population is not projected to change substantially over the planning period.

However, certain wholesale customers will see substantial increases, while some remain relatively constant and some decline. The type of change that is forecast is either an increase or decrease in population, and stable or declining per capita water consumption.

Therefore, in order to predict future water use, the existing water use for the City of Detroit and each wholesale customer was disaggregated to its fundamental components of domestic water use, major industrial users, industrial, commercial and institutional use, and non-revenue water. Future estimates of water use for each community were then made based on projected population, projected types of employment and numbers of employees.

Due to the seasonal nature of outdoor irrigation water demands, two periods of the year are defined:

    - Peak Season (operationally for the transmission system May to September, highest demands typically in June, July and August

    - Non-Peak (operationally October to April)

Maximum day water demands for 2035 will be estimated by increasing the recorded 2012 maximum day demands using ratios of future to current population and employment data. Further detail on the approach is presented below.

TM-3 in the Phase 1 Interim Report describes the development of the following modeling parameters:

1. 2012 Average Day Recorded Demand

2. 2012 Maximum Day Recorded Demand

3. Maximum Day 24-hour Demand Pattern for Each Customer

The use of these parameters is discussed in the methodology below.

2.0   Calculation of Future Demands

2.1   Step 1. Determine the Basic Components of Current Water Demand

The 2012 Average Day Recorded Demand was "dissected" for each wholesale customer to establish four basic components of the current demand:

- Domestic Use

- Major Industrial Users (over 25,000 gallons per day)

- Institutional, Commercial and Industrial Use

- Nonrevenue Water (includes fire flows and other public uses)

Each of these basic components was calculated as described below.

2.1   Domestic Use

A cross-section of residential indoor retail water accounts was analyzed to calculate existing domestic indoor water use. A total of 9 groups of residential accounts were analyzed in Detroit, Rochester Hills, Macomb Township, and Novi. These accounts ranged from 58 to 77 GPCD and the average of all accounts is 65 GPCD for indoor residential water use, based on an analysis of recent residential water use in Detroit and several suburbs. See **Table 2-1**.

Table 2-1: Domestic Indoor Water Use – Sampling of Individual Retail Account Data

Customer	GPCD	Billing Data Timeframe	Persons Per Household	Comments
Macomb Township	59	1/8/13-4/9/13	3.0	~100 accounts in 10 different subdivisions across Macomb Twp.
Novi	72	2/1/13-4/30/13	2.47	100 accounts (excluded two accounts that showed 0 GPCD and 5 GPCD-w/ these 2 included; average is 70 GPCD)
Rochester Hills	69	1/1/13-3/31/13	2.51	Average of 414 single-family homes of values ranging from $300,000 to $1,000,000
RH-Butler Ridge	77.1	1/1/13-3/31/13	2.51	69 single-family homes that have home values between $700,000 and $1,000,000

Table 2-1: Domestic Indoor Water Use – Sampling of Individual Retail Account Data

Customer	GPCD	Billing Data Timeframe	Persons Per Household	Comments
RH- Clear Creek 3&4	67.6	1/1/13-3/31/13	2.51	103 single-family homes that have home values between $400,000 and $550,000
RH-Country Club Village	67.2	1/1/13-3/31/13	2.51	242 single-family homes that have home values between $300,000 and $400,000
Farmington Hills	73.6	1/1/13-12/31/13	2.38	Based on total residential volume for entire year 2013/Population
Keego Harbor	59	1/1/13-12/31/13	2.3	Based on total residential volume for entire year 2013/Population
Royal Oak Twp.	59	1/1/13-12/31/13	2.36	Based on total residential volume for entire year 2013/Population
Detroit	58	1/1/13-3/31/13	2.54	Multi-family accounts also included but specified the persons per household accordingly
Average	**65**	**GPCD**		

2.1.2   Major Industrial Users

Major industrial users are defined as individual locations that use 25,000 gallons of water or more per day. Major industrial users are a subset of the industrial, commercial and institutional water demands described previously. However, because of the size of this individual water demand, these users were identified separately.

DWSD maintains a list of these users in its service area. The list is maintained by the Industrial Pretreatment Group in the Wastewater Division, and the list is called "Significant Industrial Users" (SIU). This list includes industry that meets the threshold for water use, as well as some industry with special wastewater characteristics, but lower daily water use.

Water demand projections were based on industries identified in the 2014 update of DWSD's Significant Industrial User list.

For those wholesale customers that are not located in the DWSD wastewater service area, the major industrial users were identified by the customer on its Technical Data Request form. See Appendix TM-15 for additional information.

2.1.3   Institutional, Commercial and Industrial Use

Industrial, commercial, and institutional (ICI) water demands for Detroit and each wholesale customer were estimated based on projections of the number of employees and types of businesses in each municipality. SEMCOG maintains projections on numbers of employees and types of businesses for each municipality.

The North American Industrial Classification System (NAICS) provides a classification system for all types of business, which range from heavy industry, to retail commercial, professional services, schools, hospitals, among others. The NAICS classifications were used to establish an average daily water use per employee, as shown in **Table 2-2**. Typical water demands for most businesses range from 20 gallons per employee per day to 200 gallons per employee per day, depending on the type of business. Lower numbers and higher numbers apply for certain types of businesses.

Table 2-2: Representative Statistics on Annual Water Use by Industrial Classification

Code	Type of Industry	Gallons per Employee per Day
111	Crop Production	119.9
113	Forestry and Logging	103.8
115	Support Activities for Agriculture and Forestry	112.3
213	Support Activities for Mining	255.2
221	Utilities	28.4
236	Construction of Buildings	50.3
237	Heavy and Civil Engineering Construction	175.8
238	Specialty Trade Contractors	13.7
311	Food Manufacturing	185.5
312	Beverage and Tobacco Product Manufacturing	631.3
313	Textile Mills	868.8
314	Textile Product Mills	47.6
315	Apparel Manufacturing	27.6
316	Leather and Allied Product Manufacturing	89.1
321	Wood Product Manufacturing	51.2
322	Paper Manufacturing	786.4
323	Printing and Related Support Activities	33.1
324	Petroleum and Coal Products Manufacturing	1049.0
325	Chemical Manufacturing	223.1
326	Plastics and Rubber Products Manufacturing	133.8
327	Nonmetallic Mineral Product Manufacturing	239.1
331	Primary Metal Manufacturing	170.8
332	Fabricated Metal Product Manufacturing	190.7
333	Machinery Manufacturing	73.3
334	Computer and Electronic Product Manufacturing	83.2
335	Electrical Equipment, Appliance, and Component Manufacturing	104.3
336	Transportation Equipment Manufacturing	118.1
337	Furniture and Related Product Manufacturing	72.7
339	Miscellaneous Manufacturing	59.1
425	Wholesale Electronic Markets and Agents and Brokers	25.0
441	Motor Vehicle and Parts Dealers	30.8
442	Furniture and Home Furnishings Stores	31.2
443	Electronics and Appliance Stores	22.7
444	Building Material and Garden Equipment and Supplies Dealers	37.1

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Table 2-2: Representative Statistics on Annual Water Use by Industrial Classification

Code	Type of Industry	Gallons per Employee per Day
445	Food and Beverage Stores	82.2
446	Health and Personal Care Stores	21.5
447	Gasoline Stations	342.6
448	Clothing and Clothing Accessories Stores	58.4
451	Sporting Goods, Hobby, Book, and Music Stores	62.1
452	General Merchandise Stores	36.5
453	Miscellaneous Store Retailers	66.1
454	Nonstore Retailers	61.4
482	Rail Transportation	140.2
483	Water Transportation	2318.2
484	Truck Transportation	23.1
485	Transit and Ground Passenger Transportation	24.0
486	Pipeline Transportation	24.0
488	Support Activities for Transportation	102.1
491	Postal Service	35.6
492	Couriers and Messengers	13.4
493	Warehousing and Storage	216.0
511	Publishing Industries (except Internet)	29.0
512	Motion Picture and Sound Recording Industries	37.8
515	Broadcasting (except Internet)	53.3
516	Internet Publishing and Broadcasting	39.9
517	Telecommunications	35.2
518	Internet Service Providers, Web Search Portals, and Data Processing Services	48.8
519	Other Information Services	101.0
521	Monetary Authorities-Central Bank	50.5
522	Credit Intermediation and Related Activities	44.2
523	Securities, Commodity Contracts, and Other Financial Investments and Related Activities	136.1
524	Insurance Carriers and Related Activities	94.9
525	Funds, Trusts, and Other Financial Vehicles	48.5
531	Real Estate	225.3
532	Rental and Leasing Services	89.7
541	Professional, Scientific, and Technical Services	62.1
551	Management of Companies and Enterprises	39.3
561	Administrative and Support Services	46.7
562	Waste Management and Remediation Services	28.2
611	Educational Services	104.6
621	Ambulatory Health Care Services	142.0
622	Hospitals	74.6
623	Nursing and Residential Care Facilities	115.6
624	Social Assistance	65.0

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Table 2-2: Representative Statistics on Annual Water Use by Industrial Classification

Code	Type of Industry	Gallons per Employee per Day
711	Performing Arts, Spectator Sports, and Related Industries	33.0
712	Museums, Historical Sites, and Similar Institutions	247.4
713	Amusement, Gambling, and Recreation Industries	638.9
721	Accommodation	213.4
722	Food Services and Drinking Places	86.2
811	Repair and Maintenance	141.1
812	Personal and Laundry Services	262.1
813	Religious, Grantmaking, Civic, Professional, and Similar Organizations	59.8
814	Private Households	81.0
921	Executive, Legislative, and Other General Government Support	99.0
922	Justice, Public Order, and Safety Activities	17.8
923	Administration of Human Resource Programs	76.9
924	Administration of Environmental Quality Programs	79.0
925	Administration of Housing Programs, Urban Planning, and Community Development	201.7
926	Administration of Economic Programs	138.6
927	Space Research and Technology	161.0
928	National Security and International Affairs	62.1

The ICI demands were calculated after subtracting Residential Use and Major Industrial Users from the 2012 Average Day Recorded Water Demand. ICI was calculated based on an assumption that NRW= 15%. We will look for ICI to be in the range of 20 to 70 GPED, and will determine if the GPED average is reasonable based on the mix of types of employment in the customer's service area.

Nonrevenue Water (NRW) was calculated for several wholesale customers who provided sufficient information to compute NRW. Based on the findings, an average wholesale customer NRW of 15% NRW was used as an initial estimate, but this was adjusted, if necessary, based on the age of the customer's system and based on reasonable ICI based on actual employment mix.

2.2 Step 2. Extrapolate the Basic Components of Water Demand to 2035

Each of the basic components of current water demand will be projected to the year 2035 as described below:

- Residential Use. For the maximum day model, the 65 GPCD was held constant over the planning period. The residential use trends should be assessed again in 2020 and 2025.

- Major Industrial Users. It is likely that the major water users in each municipality will change over the next 20 years. For the maximum day 2035 model, it was assumed that current major users, or their equivalent, stay in place. We will recommend in the master plan that a new survey of major industrial users be conducted in 2020 and 2025 to update future projections.

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- Institutional, Commercial and Industrial (ICI). The average GPED number for each customer was multiplied by SEMCOG's estimate for employment within the customer community in 2035. Note that SEMCOG's projections show an employment increase of 6 percent to 18 percent for most customer communities, plus an increase of 6 percent in Detroit.

- Nonrevenue Water (NRW). The NRW calculated for 2012 is held the same in 2035. Future demand management scenarios, where NRW is lower based on goals established by DWSD and individual wholesale customers, are discussed in Chapter 4.

2.3 Step 3. Convert the Basic Components of 2035 Demand to Maximum Day Demand

All of the basic components of water demand discussed in Steps 1 and 2 apply to annualized daily demand over a full calendar year. These numbers in Steps 1 and 2 do not include seasonal outdoor irrigation. Based on peaking factors in recent years of maximum day to average day in the DWSD system, a factor to 1.5 to 2.0 during the summer months is typical.

The conversion of the basic components of 2035 demand to average day was as follows:

- Establish Average Day Demand. The calculated basic components in 2035 as representative of average day "base" demand in 2035. In this context, the term "base" applies to the 24-hour average demand for an average day diurnal water demand pattern.

2.3.1 Extrapolation to Maximum Day Demand

Extrapolation to maximum day demand was completed as follows:

- Used the 2012 ratio of the Maximum Day Demand to the Average Day Demand for each wholesale customer to establish a factor to apply to the 2035 base demand.

- Used the individual wholesale customer's maximum day patterns, as established in Technical Memorandum 3, as applicable for 2035. However, if a wholesale customer is planning to implement storage, then the maximum day demand pattern was revised to account for the proposed storage.

- For Detroit and Dearborn, the maximum day to average day demand factor based on Metco/AECOM 2011 models.

- Fire Flow Demand. Fire flow demands are not explicitly established within wholesale customer contracts. In general, fire flow demands can be met within the limit of wholesale customer contracts which are based on maximum day flows. An extreme fire event on a summer day with maximum water use would qualify as an emergency management situation where water use restrictions would be imposed. The master plan will not explicitly model fire flow demands for wholesale customers, but will consider fire protection with the overall analysis of emergency management.

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