Section 7

Estimated Wastewater Flows

7.1 Purpose

The purpose of this section is to develop wastewater flow projections for the entire Town, including areas that are inside and outside of the Massachusetts Estuaries Project (MEP) watersheds, to be used in the development of a recommended wastewater program. A comparison of public water supply well pumping records, town billing records, and MEP water consumption estimates will be presented. Since the MEP dataset is being used to develop the nitrogen loads for the sensitive watersheds throughout town, it is most appropriate to use that dataset whenever possible. However, the MEP dataset is only available for the five nitrogen sensitive watersheds and does not cover the entire Town. The most appropriate wastewater solution will likely incorporate wastewater service areas that fall inside and outside of the MEP watersheds. The comparisons performed in this section will show that the MEP data can be used for areas inside the MEP watersheds, while the other sources of town-wide data can be used as a supplement in the areas outside of the MEP watersheds.

Using the available data, this section also presents a methodology for converting water usage to wastewater flow, estimates of seasonal flow variations, and a maximum month flow peaking factor. The estimates developed and presented in this section are intended to aid in the conceptual design and costing of Harwich wastewater treatment facilities.

7.2 Data Used

All data used for water and wastewater flow estimates including the data used in the MEP reports originates from the Town of Harwich Water Department. The Town provided annual drinking water supply well pumping records and water department billing records from 2004 to 2007, including water use data by parcel for the entire Town. Specifically, the following datasets were used in the analyses which follow:

1. Well Pumping Records

Well pumping records were obtained for 2001 to 2007 from the Water Department's annual drinking water supply well pumping reports. These pumping reports give a monthly summary of the pumping history of the 14 public water supply wells located throughout the Town.

2. Town Billing Records

Billing records were obtained from the Town's billing software and represent water consumption from 2004 to 2007 as calculated by that program. This information originates from individual water meter readings at all properties connected to the public water supply. The Town is currently in the process of installing an automatic meter reading system. However, previous annual readings are based on two manual reads per year.

3. MEP Dataset

The MEP dataset was obtained for this analysis and is applicable only to the Allen, Wychmere, Saquatucket, Pleasant Bay and Herring River watersheds. To develop the MEP dataset, the Town submitted water use records from the billing system from 2004 to 2007 to SMAST (School for Marine Science and Technology). Then, SMAST supplemented the Town's data with water use assumptions for parcels that were served by private wells. SMAST used this data in the Linked Watershed Embayment Models for eventual development into nitrogen needs for each watershed. As the models were developed, SMAST returned each database to the Town.

Since the MEP dataset will be utilized to develop Total Maximum Daily Load (TMDL) limits for the Town's embayments, that data should be used whenever possible to establish water use and wastewater flow estimates, to ensure consistency. In the areas outside of the MEP watersheds, the Town's billing records will be utilized.

7.2.1 Well Pumping Records

The Town's pumping records indicate that the Town pumped between 679 and 760 million gallons per year between 2001 and 2007. Figure 7-1 shows the average annual totals for monthly pumpage during that timeframe.

Figure 7-1
Average Annual Totals for Monthly Pumpage from the Harwich Municipal Water System between 2001 and 2007

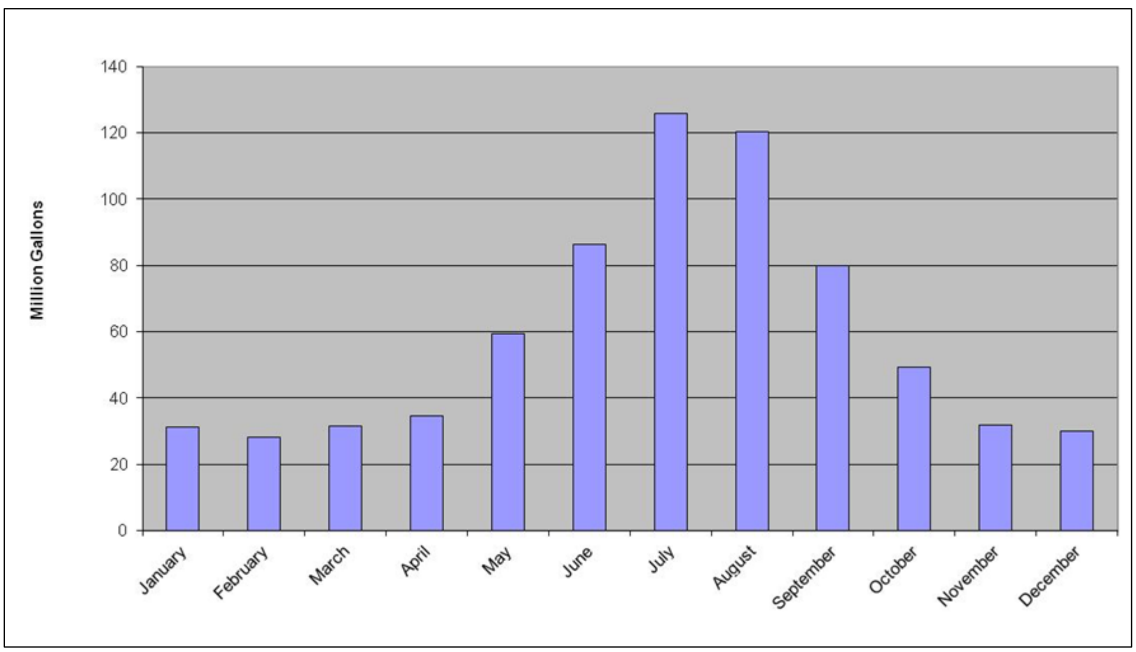

Figure 7-1 shows an expected trend indicating that the most water is used in the months of July and August. This trend is typical of water use patterns found on Cape Cod, due to seasonal population increases, and throughout the northeast due to outdoor usage in the summer months.

7.2.2 Town Billing Records

The Town's billing records were tabulated to determine the number of residential and commercial parcels throughout the Town and the average water use of the entire Town, using a 2004 to 2007 dataset. From this data, the parcels with water use have an average of 75,100 gallons/year/parcel. The Town's GIS indicates there are 8,567 parcels with water use in the entire Town, which is 88 percent of the 9,783 accounts reported in the 2007 Harwich Water Department Quality Report. Some of this discrepancy can be explained by single parcels containing multiple water meters / accounts. Table 7-1 summarizes the breakdown of water usage by land use type according to the GIS data. town-wide water use records from this dataset indicate an average residential water use of 68,000 gallons/year/parcel and an average commercial water use of 280,600 gallons/year/parcel.

Table 7-1
Town of Harwich GIS Water Use Records (2004-2007)

Land Use	Number of Parcels*	Number of Parcels With Water Use	Average Annual Water Use (GPD)	Average Water Use (GPY/Parcel)	Average Water Use (GPD/Parcel)
Town-wide	11,583	8,567	1,761,600	75,100	206
Residential	9,914	8,212	1,528,800	68,000	186
Commercial	286	208	159,900	280,600	768
Other Uses (industrial, agricultural, municipal, etc)	1,383	147	72,900	181,000	495

*Includes undeveloped parcels and parcels with private wells

According to the 2007 Harwich Water Quality Report, the average water use in the Town is estimated to be 72,500 gallons per year per account as compared to 75,100 shown above.

7.2.3 MEP Dataset

Both the Town of Harwich billing records and MEP datasets include average water use from 2004 to 2007 for each parcel in each MEP watershed. The water use data from the MEP is similar to town billing data, as expected, because it was developed directly from the billing data. There are differences in the two datasets, however, because the MEP performed additional work on the Town's billing record dataset. As an example, the MEP data makes assumptions about properties served by private wells that are not considered in the Town's database. The MEP also makes assumptions concerning water use from private wells on lots that the Town records show as vacant. Finally, the MEP dataset includes an ultimate buildout estimate that is not a part of the Town's database. Table 7-2 presents the water use data for the five MEP watersheds in Harwich. The average water use in the Allen, Wychmere, Saquatucket, Herring River and the Pleasant Bay watersheds is 59,300 gallons per year per parcel.

Table 7-2
Water Use Data for Five MEP Watersheds

Land Use	Number of Parcels	Average Annual Water Use (GPD)	Average Water Use (GPY/Parcel)	Average Water Use (GPD/Parcel)
5 MEP Watersheds	8,098	1,315,700	59,300	162
Residential	6,772	1,125,100	60,600	166
Commercial	292	121,700	152,100	417
Other	1,034	68,800	24,300	67

The MEP dataset estimates that residential water consumption is 86% of the total water consumption in the Allen, Wychmere, Saquatucket and Pleasant Bay and Herring River watersheds. Commercial water consumption is estimated at 9% of the total flow as shown in Table 7-3.

Table 7-3
Percentage of Water Use Consumption

Use	Number of Parcels	% of Total Flow
Residential	6,772	86%
Commercial	292	9%
Other	1,034	5%

7.3 Town Billing Records Compared to MEP Data

Table 7-4 presents the Town of Harwich average water use from 2004 to 2007 by watershed and parcel and the MEP average water use from 2004 to 2007 by watershed.

Table 7-4
Town of Harwich Billing Records Compared to MEP data by Watershed (2004-2007)

Watershed	Total Number of Parcels	Town Billing Records		MEP Dataset	
		Average Annual Water Use (GPD)	Average Water Use (GPD/Parcel)	Average Annual Water Use (GPD)	Average Water Use (GPD/Parcel)
Allen Harbor	358	77,832	217	69,836	195
Wychmere Harbor	123	24,117	196	23,601	192
Saquatucket	1,442	251,361	174	253,176	176
Pleasant Bay	1,932	316,351	164	296,611	154
Herring River	4,243	579,898	137	661,518	156

Overall, the datasets are very similar. For example, the Town billing records indicate an average water use of 164 gallons/parcel/day in the Pleasant Bay watershed and the MEP data shows an average residential water use of 154 gallons/parcel/day. The biggest discrepancy is in the Allen Harbor Watershed, with an average water use of 217 gallons/parcel/day and the MEP water use showing an average residential consumption of 195 gallons/parcel/day. Overall, the discrepancies are minor and, as a result, both datasets are considered to be similar and appropriate for use in wastewater planning.

7.4 MEP Watershed Buildout Water Use Estimates

The MEP developed a database that was used in the Linked Watershed Embayment Model to determine the nitrogen loads from water use throughout the watershed. In the database, both current and buildout nitrogen loads are presented for each of the MEP watersheds.

The current loads are developed from actual water use that utilizes an assumed nitrogen concentration per gallon of water used. To develop the buildout loads, the modelers looked at both the water use for both residential and commercial properties in the watersheds. For the residential properties, a maximum number of homes, or dwelling units, were assigned to each property based on the current zoning regulations for that property. As an example, an existing two acre lot with a single family home would be assigned two single family homes or dwelling units in the buildout analysis if it was located in an area with one-acre zoning since it was assumed to be possible to construct two homes on this property. Commercial properties were treated differently. A commercial property's buildout water use was developed based on the gallons of water used per square foot of building area. This flow per area for the commercial development was taken from existing flow patterns established within each particular watershed which can vary widely from watershed to watershed. The results of the buildout wastewater flow estimates are shown below in table 7-5. The wastewater flow is estimated to be 90% of water use to account for irrigation, evaporation and other losses.

Table 7-5
Existing and Buildout Wastewater Estimates

Watershed	Existing Wastewater Flow (GPD)*	Buildout Wastewater Flow (GPD)	% Flow Increase
Allen Harbor	62,900	75,000	19
Wychmere Harbor	21,200	28,100	32
Saquatucket	227,900	261,200	14
Pleasant Bay	267,000	346,900	30
Herring River	595,400	786,700	32
All MEP Watersheds	1,174,300	1,497,900	28

*Existing wastewater flow is estimated to be 90% of existing water use.

Overall the flow increase percentage for the MEP watersheds ranges from nineteen to thirty-two percent with an average increase of twenty eight percent. These increases are similar to the expected increase in wastewater flow in the final recommended plan which is twenty six percent.

7.4.1 Development of Residential Buildout Flows

The development of residential water use in the five MEP watersheds followed a simple formula based on the lot size and the maximum number of allowed single-family dwelling units per acre. This formula was used to establish a total number of dwelling units that a property could sustain based on zoning regulations.

To develop the water use per dwelling unit, existing residential water use was tabulated for the five MEP watersheds. The large amount of residential development throughout the Town of Harwich yielded a consistent data set among the five MEP watersheds that showed residential development between 148 and 181gpd per dwelling unit. This equates to approximately 2.5 people per dwelling unit at 65.8 gallons per dwelling unit. Table 7-6 presents the estimated water use per capita in the five MEP watersheds.

Table 7-6
Residential MEP Water Use Estimates

Watershed	Per Dwelling Unit Residential Water Use (GPD)	Per Capita Residential Water Use @ 2.5 People per DU (GPD)
Allen Harbor	166	66.4
Wychmere Harbor	166	66.4
Saquatucket	166	66.4
Pleasant Bay	148	59.2
Herring River	181	72.4

The water use presented above is in line with the Commonwealth of Massachusetts Executive office of Environmental Affairs and the Water Resources Commission July 2006 publication of Water Conservation Standards. The publication states that 33% of Massachusetts communities are between 65 and 80rgpcd (residential gallons per capita per day). Of the communities sampled, 23% are above 80rgpcd and 44% are below 65rgpcd.

The residential water use presented in Table 7-6 was applied to the number of dwelling units developed in the buildout analysis. This method was reviewed by the Town of Harwich Planning Department and is considered an acceptable method for estimating residential buildout.

7.4.2 Development of Commercial and Industrial Buildout Flows

The development of commercial and industrial buildout water use in Harwich utilized a formula based on the lot size and a percentage of building coverage on each lot. The commercial and industrial water use was developed from existing development which, when compared to the residential development, is a limited data set and is subject to greater variation.

The analysis considered the existing commercial water use and developed a flow per square foot of building for each of the five MEP watersheds. Table 7-7 presents the water use rate for commercial and industrial development.

Table 7-7
Commercial and Industrial MEP Water Use Estimates

Watershed	Commercial Water Use Per 1,000 square Feet of Building (GPD)	Commercial Building Coverage At Buildout	Industrial Water Use Per 1,000 square Feet of Building (GPD)	Industrial Building Coverage At Buildout
Allen Harbor	236	13.2%	78	14.5%
Wychmere Harbor	236	13.2%	78	14.5%
Saquatucket	236	13.2%	78	14.5%
Pleasant Bay	35	12.0%	35	12.0%
Herring River	236	13.2%	78	14.5%

In buildout, the MEP assumed that the commercial and industrial development in town would have a building coverage of 12.0% to 14.5% of the entire lot as presented on table 7-7. This assumed building coverage is based on both zoning setbacks and typical commercial development allowing for parking and egress and entry to the building. To arrive at a buildout water use, the undeveloped and underdeveloped lots are brought to their full development potential using the stated building coverages and water use estimates.

Unlike the residential water use estimates developed in Table 7-6, the commercial and industrial water use presented above varies significantly among the watersheds. The commercial and industrial water use developed in these estimates is dependent on the existing development of only a few hundred commercial and industrial parcels in Harwich. As a result, the estimates in the Pleasant Bay are very different than all of the other MEP watersheds.

The Harwich Planning department recognized this inconsistency early on in the CWMP planning process and decided to modify the MEP commercial buildout estimates in the recommended plan. The Planning Department utilized the MEP buildout as a starting point and then updated, for planning purposes, the commercial development to suit the Towns' needs. Those updates are presented Section 13 with the recommended plan.

7.4.3 Town-Wide Buildout Flows

Since the MEP buildout analysis only covers those areas of town within the five MEP watersheds, the Town supplemented this dataset with additional buildout flow estimates for the remainder of town. Ultimately, the buildout estimates from the MEP for areas within the applicable watersheds will be used for wastewater planning for consistency with the MEP models. In certain instances, however the Town's Planning Department modified and updated the MEP buildout estimates based on anticipated growth that was not accounted for in the MEP reports. Supplemental information for the remainder of town must then be added to the MEP dataset. The areas for which it is most critical to define buildout flows are those identified as having a high wastewater need, as presented in Section 8. These flows, with buildout updates are presented in Section 13 with regards to the recommended program for long-term wastewater management.

7.5 Adjustments for Wastewater Flow

This subsection presents adjustments to water usage values to account for flow that does not ultimately become wastewater. Specifically, a rainfall adjustment is calculated to account for irrigation in the months of July and August, and a further adjustment is then performed to account for other factors such as consumptive uses and outdoor uses aside from July/August irrigation. These estimates are developed to aid in the design of wastewater collection and treatment infrastructure during the implementation phase of this CWMP.

7.5.1 Rainfall and Irrigation Adjustment

Irrigation flow in Harwich is important to consider in the months of July and August. These two months of the summer see a significant amount of lawn and garden watering which does not enter the wastewater stream. This flow must therefore be omitted from wastewater estimates to avoid over-sizing wastewater infrastructure.

In the summer months, rainfall can have a significant effect on the amount of water used for irrigation. Three methods of estimating summer irrigation use were analyzed to determine an appropriate seasonal adjustment for water use. Each method is described below.

Irrigation Adjustment – Method 1

The first method calculates the irrigation flows for the months of July and August from public water supply well pumping data from 2001 to 2007. These data were tabulated and then compared against the rainfall data for the two-month periods. The results are shown in Table 7-8 below.

Table 7-8
Rainfall Adjustment – Method 1

Year	July – Aug. Water Use (gpd)	Rainfall (inches)
2001 (Rounded)	3,590,000	6.22 (Wet Year)
2002 (Rounded)	4,710,000	3.69
2003 (Rounded)	3,770,000	6.07 (Wet Year)
2004 (Rounded)	3,660,000	7.53 (Wet Year)
2005 (Rounded)	4,490,000	4.48
2006 (Rounded)	3,790,000	8.87 (Wet Year)
2007 (Rounded)	4,270,000	3.43
Average	4,040,000	5.76
Average Wet	3,702,500	7.17
Average Dry	4,490,000	3.87
Variance	787,500	-3.31

To quantify the amount of water used for irrigation, the average daily water use in July and August of 2001 to 2007 was considered along with the average rainfall of 5.76 inches for that two-month period. Any year that had less than 5.76 inches of rain in that period was considered dry and any year that had greater than 5.76 inches of rain in that period was considered wet. The averages of the wet years and the dry years were then compared, and the variance was calculated by subtracting the wet year average from the dry year average. The result is an increase of about 790,000 gallons per day of water use during dry summers when compared to wet summers.

Irrigation Adjustment – Method 2

The second method utilizes a simple estimate of the number of residential properties, an estimated lawn area (square footage) and an estimated irrigation rate (0.5 in/week) for the July and August irrigation period in dry years. To account for the summer water use, this method assumes that one third of the residential properties in Harwich utilize an irrigation system. There are approximately 8,500 residential properties in Harwich with an estimated lawn area of 5,000 square feet each. Using this method, it is estimated that the Town supplies 630,000 gallons per day of irrigation water use during the dry months. The result is shown in Table 7-9 below.

Table 7-9
Rainfall Adjustment – Method 2

Irrigation Estimate		
Residential Properties With Irrigation Systems	2,830	Homes
Average Lawn Area	5,000	Square Feet
Total Area	14,150,000	Square Feet
Estimated Irrigation	0.5	Inches / Week
GPD	630,000	GPD

Irrigation Adjustment – Method 3

The third method compares the amount of water that the Town pumped between the wettest and driest two-month period between 2001 and 2007. For the wettest two months, July and August of 2006 are used. 2006 was a very wet year that received 8.87 inches of rainfall in the July to August time period. Since the average weekly rainfall for this two-month period was one inch of rain per week, it is assumed that lawn sprinklers were used minimally during that time. For the driest two months, the July and August of 2007 are used. 2007 was a very dry year that received 3.43 inches of rainfall for the two-month period. Since the average weekly rainfall for this two-month period was 0.4 inches of rain per week, it is assumed that lawn sprinklers were used frequently to supplement the lack of rain. Since a typical New England lawn is estimated to require one inch of water per week, it is assumed that minimal watering took place in 2006, and significant irrigation was used in 2007 to supplement the additional 0.6 inches of week that was not seen. The difference in the July and August water use from 2006 to 2007 is 480,000 gallons per day. The result is shown in Table 7-10 below.

Table 7-10
Rainfall Adjustment – Method 3

July and August Pumpage	Type	Gallons Pumped (MG)	Gallons Pumped (GPD)
2006	Wet / 8.9”	235	3,790,000
2007	Dry / 3.4”	265	4,270,000
Difference		30	480,000

7.5.2 Recommended Irrigation Adjustment for Water Use

The three methods for determining an irrigation adjustment for water use were considered and are summarized in Table 7-11. The average of the three is approximately 630,000 gpd. The real value is likely within the range of these estimates. Because of the limited data and to be conservative, the average value will be utilized.

The recommended result is shown in Table 7-11 below.

Table 7-11
Recommended Rainfall Adjustment for Dry Years

Recommended Rainfall Adjustment for the Entire Town (July – August)		
Method 1	790,000	gpd
Method 2	630,000	gpd
Method 3	480,000	gpd
Average of Methods 1, 2, and 3	**630,000**	**gpd**

Further refinements can be made during final design as the water department gains better flow data from its new meter reading system.

Recommended Rainfall Adjustment for All Years Wet and Dry

When applying the recommended method to estimate average annual water use over the long-term, only half of the dry year rainfall adjustment will be applied. This will account for the fact that some years are wet while others are dry. During the period examined, approximately half of the years were dry. Therefore, the recommended long-term adjustment is 315,000 gpd for the months of July and August.

7.5.3 Additional Adjustment to Convert Water to Wastewater Use

In addition to the irrigation adjustment described above, an adjustment is also needed to account for other water use that does not become wastewater, such as consumption and outdoor water use aside from irrigation in the July to August period. The typical industry standard for wastewater indicates that 90 percent of domestic water use becomes wastewater in the Northern United States (Metcalf and Eddy, Wastewater Engineering, fourth edition). With a 315,000 gpd adjustment to all July and August flows, the total long-term annual water use is reduced by approximately 3 percent. Therefore, in order to reach the industry standard of a 10 percent reduction from water to wastewater use, an additional 7 percent must be deducted. This is assumed to be spread evenly across the entire year.

The 93 percent annual adjustment coupled with the irrigation adjustment for July and August of 315,000 gpd averages to the industry standard of 90 percent. This adjustment is specific to the Town of Harwich and is considered a better estimate of average wastewater flow month to month, rather than using a 90 percent reduction across the entire year.

Figure 7-2 shows a graph of water and wastewater flow in 2004 through 2007 for the portion of Harwich served by the public water supply and accounts for both seasonal irrigation in the months of July and August and the annual reduction of 93 percent. Note that this figure does not account for private sources of water.

Figure 7-2
Monthly Water Use and Wastewater Estimate – 2004 to 2007

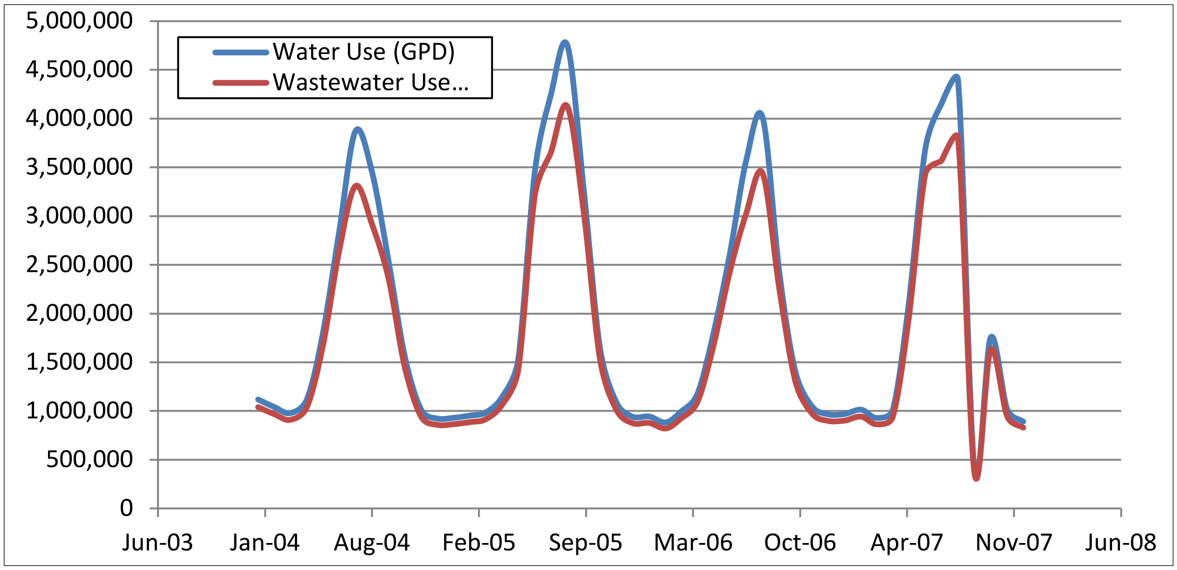

Table 7-12 shows the monthly average flow of both water and wastewater for Harwich using the 2004 to 2007 dataset and the adjustments described above. Again, these flows do not account for private sources of water.

Table 7-12
2004 to 2007 Monthly annual average water and Wastewater flow (MGD)

	January	February	March	April	May	June	July	August	September	October	November	December
Average Water Use	0.99	0.97	0.97	1.11	1.80	3.15	3.96	4.15	2.15	1.59	1.04	0.93
Average Wastewater Use	0.92	0.90	0.90	1.03	1.68	2.93	3.39	3.57	2.00	1.48	0.97	0.87

7.6 Seasonal Variations and Peaking Factors

7.6.1 Seasonal Wastewater Flow Ratios

Since daily flow data are not currently available from the Town, estimates of the high and low flow conditions that will be seen at a wastewater handling facility throughout the year are estimated here. Because Harwich is a seasonal community, the changes in flow conditions from winter to summer are large and must be carefully considered in facility design.

The predicted seasonal variations in wastewater flow were calculated by using the 2004 to 2007 well pumping data, converted to wastewater flow using the adjustments described above. The data were tabulated with the intent of acquiring seasonal wastewater ratios comparing the winter, summer, and spring/fall seasons to the total annual flow. The winter season is considered to be December to February, the summer season is considered to be June to August, and the spring/fall season includes September, October, November, March, April and May.

Table 7-13 presents the average winter, summer, spring/fall and total flow in million gallons per day, along with the seasonal ratios. These ratios are an important planning tool that can help to estimate winter and summer flow variations and aid designers in determining wastewater management strategies on a seasonal basis.

Table 7-13
Seasonal Wastewater Flow Ratios

Year	Winter Flow Average Dec - Feb (MGD)	Summer Flow Average June - Aug (MGD)	Spring/Fall Flow Average Mar-May, Sep-Nov (MGD)	Total Pumped Flow Average (MGD)	Ratio Winter Avg.: Total Flow Avg.	Ratio Summer Avg. : Total Flow Avg.	Ratio Spring/ Fall Avg. : Total Flow Avg.
2004	0.95	2.96	1.39	1.68	0.57	1.77	0.83
2005	0.88	3.66	1.49	1.88	0.47	1.95	0.79
2006	0.87	2.97	1.37	1.64	0.53	1.80	0.83
2007	0.89	3.60	1.12	1.68	0.53	2.14	0.66
Average (Rounded)	0.90	3.30	1.34	1.72	0.52	1.91	0.78

The total flow as well as the winter and summer ratios remained relatively constant from 2004 to 2007. The average total annual wastewater flow for the four year period was 1.72 MGD, with an average summer to total flow ratio of 1.91, an average winter to total flow ratio of 0.52, and an average spring/fall to total flow ratio of 0.78. The ratios shown here express a significant seasonal swing in flow from winter to summer, but are not unusual for a seasonal community like Harwich.

Figure 7-1 above showed the monthly well pumping flows in million gallons per month from 2004 to 2007. The seasonal variation of water consumption in Harwich is clearly seen in this figure. The irrigation adjustment dampens this trend to some degree, but the seasonal population increases in the summer months still result in a substantial difference in the ratios for winter versus summer.

7.6.2 Maximum Month Wastewater Flow

The ratio between maximum and average monthly flows is also an important planning tool that helps to estimate wastewater facility needs. The maximum month wastewater usage indicates the highest monthly flow expected at a wastewater collection or treatment facility. This value was estimated by using the 2004 to 2007 well pumping data, adjusted to wastewater use.

Within the four year dataset, August 2005 had the highest monthly pumpage of 147 million gallons, or 4.75 MGD. This month was used to establish the maximum month wastewater usage and peaking factor. Rainfall for this month was 0.89, which was the driest August recorded from 2004 to 2007. Therefore, the irrigation adjustment performed when considering this month alone is 630,000 gpd, estimated above as the irrigation adjustment for dry years using the average of the three methods presented. In addition, the 93 percent year-round adjustment is made to this value. These adjustments equate to 119 million gallons of wastewater flow during the month of August 2005, or 3.83 MGD. Based on this information, the following peaking factor is established:

- Average Estimated Wastewater Flow 2004 to 2007: 1.72 million gallons/day
- Maximum Month Wastewater Flow: 3.83 million gallons/day
- Maximum Month Peaking Factor for Wastewater: 2.2 million gallons/day

7.7 Summary

With an understanding of water consumption records, pumping records, wastewater flow adjustments, and seasonal swings in usage, reasonable estimates can be determined for wastewater flows. These estimates can be applied to any subset of the Town and are considered to be reliable planning level estimates of wastewater usage.

7.7.1 Town Billing Records and MEP Dataset Conclusion

From the analysis presented in Section 7.3, the Town billing data and the MEP data were determined to be similar, as expected. The two datasets are within 5% of each other and are therefore both appropriate for long term wastewater planning. For planning purposes, the MEP dataset should be used whenever possible, and any areas outside of the MEP watersheds should utilize town water billing records.

The buildout estimates in the MEP dataset are considered to be rough planning level estimates. These estimates were reviewed by the Harwich Planning Department and were adjusted accordingly. The Town has also reviewed buildout estimates for the areas outside of the MEP watersheds identified as having wastewater needs, which are presented in Section 13 for incorporation into the total wastewater flow estimates.

7.7.2 Adjustments for Wastewater Flow

The adjustments to convert water to wastewater usage, the seasonal variations in flows, and the maximum month peaking factor were developed and presented in this section to aid in the preliminary design of the Town's wastewater treatment facilities. Since Harwich is a seasonal community, the change in flow conditions from winter to summer is large and must be considered in the design of wastewater infrastructure. The adjustments developed in this section will be used in the preliminary design of proposed wastewater facilities for the Town to determine maximum and minimum flow rates and seasonal variations in wastewater flows.