

Section 4 | **Projected Water Demands**

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Projected Water Demands

This section presents water demand projections through 2050 for the Hampton Roads region. Demand projections and the methodology and assumptions applied to estimate water demands are provided for:

- Publicly-owned CWSs,
- Privately-owned CWSs,
- Self-supplied water users reporting use over 300,000 gallons per month, and
- Self-supplied users with estimated use under 300,000 gallons per month.

Publicly-Owned CWSs

Assumptions and Methodology

Most of the water users in the Hampton Roads region are served by publicly-owned CWSs. Publicly-owned CWSs serve the majority of the population in the Peninsula and Southside sub-regions, whereas most users in the Western Tidewater sub-region are self-supplied.

For the purposes of this plan, demand projections for publicly-owned CWSs were either developed by HRPDC staff or provided by the utility departments of localities.

HRPDC developed water demand projections for the Cities of Franklin, Hampton, Newport News, Portsmouth, and Poquoson, the Counties of Gloucester, James City, Surry, and York, and the Towns of Smithfield and Windsor. HRPDC's projected water demands for these large systems are based on the following information:

1. Population projections developed by HRPDC with the Regional Economic Models, Inc. (REMI) software. The REMI model projections were developed for the long-term regional transportation plans.

2. Estimates of the portion of each locality's population served by publicly-owned CWSs (see Table 4-1).
3. Average per capita water use in each locality, based on 2004-2008 water use (see Table 4-2).

As described in Section 1, "Existing Sources," several publicly-owned CWSs purchase water from other systems in the Hampton Roads region. In the development of demand projections, particular attention was given to avoid double-counting or omitting demand components affected by water sales.

The Cities of Chesapeake, Norfolk, Suffolk, Virginia Beach, and Williamsburg and the Counties of Isle of Wight and Southampton provided water demand projections through 2050. The demand projections of these large local utilities are based on specific assumptions and data deemed appropriate for use by the departments, including historic use and safe yield studies.



Photo: Lake Gaston, city-data.com

Table 4-1: Percentage of Population Served by Publicly-Owned CWSs by Decade

	2010	2020	2030	2040	2050		2010	2020	2030	2040	2050
Peninsula Sub-Region											
York-James Peninsula						Western Tidewater Sub-region					
Hampton	100%	100%	100%	100%	100%	Franklin	100%	100%	100%	100%	100%
James City County	76%	79%	81%	83%	84%	Isle of Wight County	22%	39%	48%	56%	61%
Newport News	100%	100%	100%	100%	100%	Smithfield	98%	98%	98%	98%	98%
Poquoson	100%	100%	100%	100%	100%	Windsor	98%	98%	98%	98%	98%
Williamsburg	100%	100%	100%	100%	100%	Southampton County	9%	9%	9%	9%	8%
York County	95%	96%	97%	98%	98%	Capron ¹	1%	1%	1%	1%	1%
Middle Peninsula						Courtland ¹	7%	6%	6%	6%	6%
Gloucester County	37%	42%	46%	49%	52%	Ivor ¹	2%	2%	2%	2%	2%
Southside Sub-Region						Surry County	0%	0%	0%	0%	0%
Chesapeake	88%	89%	89%	89%	89%	Claremont ²	11%	11%	11%	11%	11%
Norfolk	100%	100%	100%	100%	100%	Dendron ²	5%	5%	5%	5%	5%
Portsmouth	100%	100%	100%	100%	100%	Surry Town ²	8%	10%	10%	10%	10%
Suffolk	78%	83%	86%	98%	99%						
Virginia Beach	97%	97%	97%	97%	97%						

1. Percentage of Southampton County population.

2. Percentage of Surry County population.

Table 4-2: 2004 to 2008 Average Per-Capita Water Use

Locality	Water Service Provider	Per-Capita Water Use (gpcpd)*	Locality	Water Service Provider	Per-Capita Water Use (gpcpd)*
City of Franklin	City of Franklin	133	James City County	James City Service Authority	106
City of Hampton	Newport News Waterworks	112	Surry County	Incorporated Town CWSs ¹	100
City of Newport News	Newport News Waterworks	112	Town of Smithfield	Town of Smithfield	141
City of Portsmouth	City of Portsmouth	112	Town of Windsor	Town of Windsor	102
City of Poquoson	Newport News Waterworks	112	York County	Newport News Waterworks	112
Gloucester County	Gloucester County	82			

*The average per-capita water use from 2004 to 2008 was used to develop HRPDC's water demand projections for publicly-owned CWSs for localities listed in table.

Other localities provided water demand projections developed by the locality's public utility.

¹ Incorporated Towns of Claremont, Dendron, and Surry

As noted earlier, there are existing contracts for water sales between localities. To provide consistent projections across the region, the projected water demands for the Cities of Franklin, Newport News, Norfolk, and Portsmouth and the Town of Windsor do not include the volumes of water that these utilities are contractually obligated to sell to other localities.

The demands for small publicly-owned CWSs are based on more detailed analysis included in the respective system's groundwater withdrawal permits. For example, the Town of Capron provided estimated water demands for each of the 20 non-residential accounts served by the Town's water system. Since groundwater withdrawal permits only provide 10-year projections, per capita use estimates and county growth rates were used to project demands to 2050.

Projected Demand

Water demands for publicly-owned CWS are projected to increase by almost 44% from 177.7 mgd to 256.9 mgd by 2050. Figure 4-1 shows the total and relative projected water demands of publicly-owned CWSs throughout Hampton Roads. Locality demand projections are included in Attachment 1.

Southside sub-region publicly-owned CWSs contribute the largest projected demand. By 2050, the demands of these systems will total approximately 165.5 mgd, or 64% of the total projected water demand for all publicly-owned CWSs in Hampton Roads.

Peninsula sub-region publicly-owned CWS demand is also expected to increase by approximately 40% over the planning period, as the population in this area continues to grow. By 2050, the combined demand for the York-James and Middle Peninsulas is projected at 80.0 mgd, which is approximately 31% of the total projected water demand for publicly-owned CWSs in Hampton Roads.

Compared to the other sub-regions, publicly-owned CWS demand in the Western Tidewater sub-region appears relatively small. However,

by 2050, the sub-region's population is expected to almost triple, and the associated water demand will cause an increase in publicly-owned CWS demand of more than 178% compared to 2010.

In general, the projected increase in water demands of publicly-owned CWSs are caused by population growth and, in some areas, the planned expansion of publicly-owned CWS service areas. Table 4-3 shows the population projected to be served by publicly-owned CWSs by decade.

Figure 4-1: Projected Water Demands for Publicly-Owned CWSs

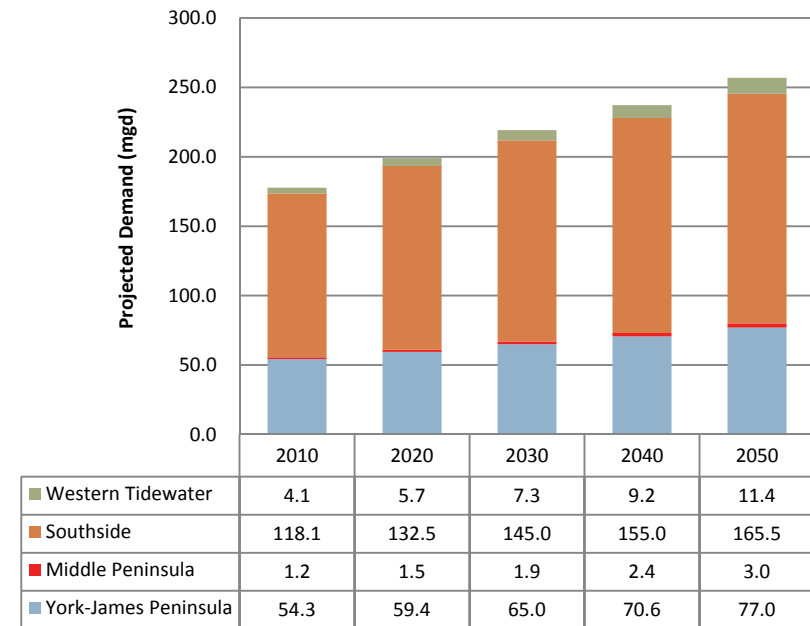


Table 4-3: Population and Percentage of Population Served by Publicly-Owned CWSs by Decade

	2010	2020	2030	2040	2050		2010	2020	2030	2040	2050
Peninsula Sub-Region						Western Tidewater Sub-Region					
York-James Peninsula						Franklin	8,678 100%	9,687 100%	10,813 100%	12,071 100%	13,475 100%
Hampton	146,960 100%	150,137 100%	153,382 100%	156,698 100%	160,085 100%	Isle of Wight County ²	6,090 22%	13,400 39%	21,416 48%	31,488 56%	44,190 61%
James City County	48,924 76%	63,370 79%	81,401 81%	103,908 83%	132,000 84%	Smithfield	7,927 98%	9,951 98%	12,492 98%	15,682 98%	19,685 98%
Newport News	185,760 100%	197,082 100%	209,093 100%	221,836 100%	235,356 100%	Windsor	2,517 98%	2,921 98%	3,390 98%	3,394 98%	4,566 98%
Poquoson	12,258 100%	13,333 100%	14,504 100%	15,777 100%	17,161 100%	Southampton County	1,777 9%	2,010 9%	2,301 9%	2,507 9%	2,758 8%
Williamsburg ¹	16,600 100%	17,700 100%	19,000 100%	19,000 100%	19,000 100%	Capron ³	178 1%	218 1%	251 1%	288 1%	332 1%
York County	62,867 95%	71,762 96%	81,802 97%	93,238 98%	105,188 98%	Courtland ³	1,258 7%	1,356 6%	1,559 6%	1,794 6%	2,063 6%
Middle Peninsula						Ivor ³	403 2%	507 2%	583 2%	671 2%	771 2%
Gloucester County	14,140 37%	18,551 42%	23,689 46%	29,675 49%	36,649 52%	Surry County	0 0%	0 0%	0 0%	0 0%	0 0%
Southside Sub-Region						Claremont ⁴	786 11%	862 11%	947 11%	1,039 11%	1,141 11%
Chesapeake	240,087 88%	282,566 89%	325,045 89%	367,524 89%	410,003 89%	Dendron ⁴	360 5%	395 5%	434 5%	476 5%	523 5%
Norfolk	236,703 100%	238,236 100%	239,780 100%	241,333 100%	242,897 100%	Surry Town ⁴	545 8%	817 10%	897 10%	985 10%	1,081 10%
Portsmouth	99,537 100%	101,576 100%	103,656 100%	105,779 100%	107,945 100%						
Suffolk	74,717 78%	105,491 83%	136,898 86%	186,808 98%	219,411 99%						
Virginia Beach	425,317 97%	437,492 97%	450,015 97%	462,897 97%	476,147 97%						
						Hampton Roads Total	1,590,575 91%	1,735,554 91%	1,889,164 91%	2,072,069 92%	2,249,709 92%

1. Williamsburg provided projections of population and percentage of population served by publicly-owned CWSs.

2. Isle of Wight's population served by publicly-owned CWSs includes 480 County residents (Gatling Pointe system) served by Smithfield's publicly-owned CWS.

3. Percentage of Southampton County population.

4. Percentage of Surry County population. Surry County does not have a publicly-owned CWS; publicly-owned CWSs are operated by the incorporated towns.

Table 4-4 shows the projected demands for publicly-owned CWSs disaggregated into water use categories. Use in each category was projected based on the 2007 proportion of use in each category, except for the unaccounted for water (UAW) in the Western Tidewater sub-region, which was estimated at 10% as none of the systems in the Western Tidewater sub-region reported UAW. Projected demands shown in Table 4-4 are for finished water.

Production losses in addition to the projected demands vary by sub-region, as indicated in the table notes.

There is not enough information on trends in residential, commercial, industrial, and military use to further refine use projections across these categories. Future updates to the regional water supply plan may focus on additional analysis of disaggregated use.

Table 4-4: Projected Public Water Demands for 2050 Disaggregated into Use Categories

	Percentage of Use in each Sub-Region							Projected PWS Demand in each Sub-Region (mgd)						
	Residential	CIL	Heavy Industrial	Military	Other	UAW	Total	Residential	CIL	Heavy Industrial	Military	Other	UAW	Total
Peninsula														
York-James Peninsula ¹	50.7%	21.4%	17.0%	5.5%	0.1%	5.3%	100%	39.0	16.5	13.1	4.2	0.1	4.1	77.0
Middle Peninsula ²	60.7%	23.9%	0.0%	0.0%	5.3%	9.8%	100%	1.8	0.7	0.0	0.0	0.2	0.3	3.0
Southside ³	59.7%	19.2%	2.0%	5.8%	1.9%	11.5%	100%	98.8	31.8	3.3	9.6	3.1	19.0	165.5
Western Tidewater ⁴	80.1%	9.7%	0.2%	0.0%	0.0%	10.0%	100%	9.1	1.1	0.2	0.0	0.0	1.1	11.4
Total								148.8	50.1	16.4	13.8	3.4	24.5	256.9
Percentage of 2050 PWS Demand Projected for Hampton Roads Region:								58%	20%	6%	5%	1%	10%	100%

1. Production losses are estimated to be an additional 7.6% of use.
2. Production losses are estimated to be an additional 29.5% of use.
3. Production losses are estimated to be an additional 6.6% of use.
4. Production losses are estimated to be an additional 2% of use based on future RO plant and water from Western Tidewater Authority.

Privately-Owned CWSs

Assumptions and Methodology

There are 61 privately-owned CWSs operating in the Hampton Roads region. Most of these systems, described earlier in Section 1, serve less than 500 customers in neighborhoods that are built-out. Water demands for these systems are expected to remain constant at 2007 water use levels over the planning period, as there is no data to support changes in use patterns.

The Lawnes Point system, located in Isle of Wight County, is the only privately-owned CWS where growth is assumed, and water

demands are therefore anticipated to increase. This residential development was established in 2010 and approximately 150 lots remain available for construction of homes.

As discussed earlier, some areas are anticipated to experience an increase in the percentage of the population served by publicly-owned CWSs. Isle of Wight County anticipates that some of the privately-owned systems located in the publicly-owned CWS service area will eventually switch to public water service. Table 4-5 summarizes the population in each sub-region expected to be served by privately-owned CWSs through 2050.

Table 4-5: Projected Population Served by Privately-Owned CWSs

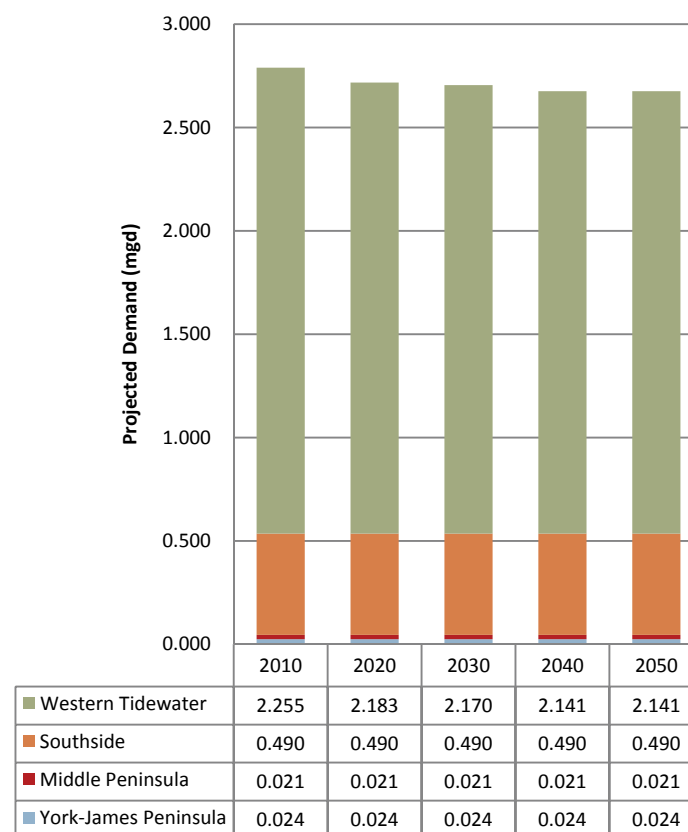
Sub-region	2010		2020		2030		2040		2050	
	Population	%	Population	%	Population	%	Population	%	Population	%
Peninsula										
York-James Peninsula	435	0.1	435	0.1	435	0.1	435	0.1	435	0.1
Middle Peninsula	300	0.8	300	0.7	300	0.6	300	0.5	300	0.4
Southside	7,489	0.7	7,489	0.6	7,489	0.6	7,489	0.5	7,489	0.5
Western Tidewater	7,096	9.8	6,501	7.6	6,299	6.1	6,174	5.0	6,174	4.2

Projected Demand

Figure 4-2 illustrates the projected demands for privately-owned CWSs through 2050. In general, no significant changes in water use are expected for privately-owned CWSs across the region, however, demand is anticipated to decrease slightly in the Western Tidewater sub-region reflective of private-systems opting to switch to public water service. Water demands for privately-owned CWS in the Peninsula and Southside sub-regions are expected to remain constant primarily because development patterns have already established urbanized areas served by publicly-owned CWSs.

The privately-owned CWS demands are not shown in terms of disaggregated use categories because these systems only serve residential users. Production losses are negligible, as water from area groundwater sources requires minimal treatment. Estimates of UAW losses are not available.

Figure 4-2: Projected Water Demand for Privately-Owned CWS



Large Self-Supplied Water Users

Assumptions and Methodology

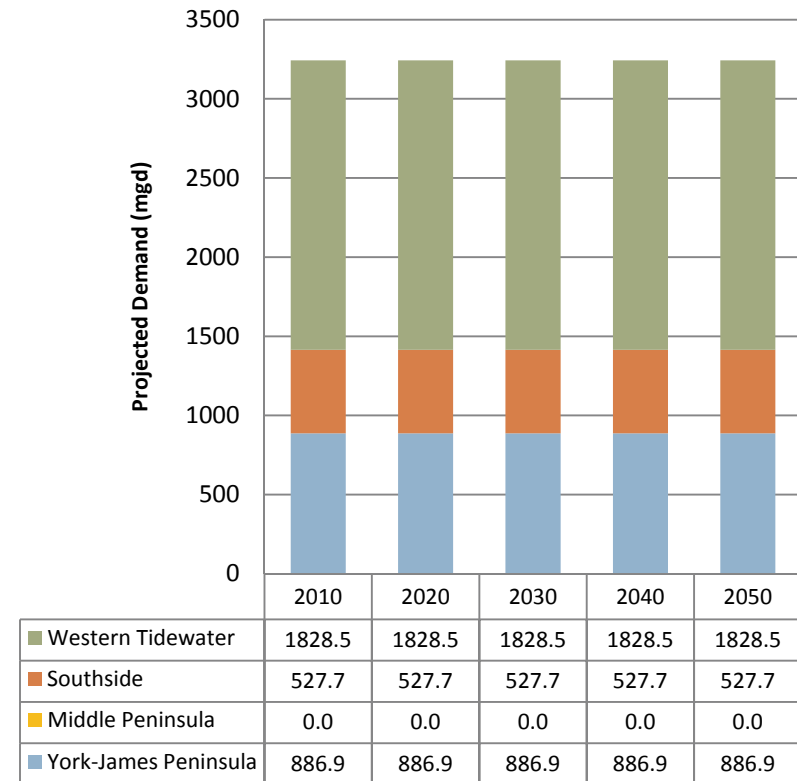
For the duration of the planning period, water use by large self-supplied users (those reporting water use of more than 300,000 gallons per month) is not expected to increase from the amounts reported for 2007. For the purposes of this plan, demand for large self-supplied users was equated to amount of use reported for 2007.

In 2009, International Paper announced that the Franklin mill would be closing and groundwater wells would stop pumping in 2010. However, IP's DEQ Ground Water Withdrawal Permit remained effective as of January 2011, and the permitted withdrawal amount was not decreased. It is possible that IP's groundwater permit may be transferred to another business. No additional information was readily available to predict changes in the demands of large self-supplied users at the time this plan was developed.

Projected Demand

No increases in demands are anticipated for large self-supplied users reporting water use of more than 300,000 gallons per month (see Figure 4-3). Change in demands for these users is difficult to predict because of the magnitude of water involved. It is difficult to anticipate a large user moving into or out of the Hampton Roads region.

Figure 4-3: Projected Water Demands for Large Self-Supplied Users (use > 300,000 gallons per month)



Small Self-Supplied Water Users

Assumptions and Methodology

Small self-supplied users are those estimated to use less than 300,000 gallons of water per month. Small users include owners of private business and residential wells who are not required to report water withdrawals to DEQ unless they withdraw more than 300,000 gallons per month. Therefore, water use projections for these small users must be estimated based on existing guidelines and surrogate information.

The future water demands of private business well users are expected to remain constant at 2007 water use estimates for the duration of the planning period, as there is no data to support changes in use patterns. The 2007 water use by small businesses was estimated

based on the “Commonwealth of Virginia Guidance for Conducting a Comprehensive Public Drinking Water Supply Needs Assessment”.

The future water demands of private residential well users are projected based on a per capita water use factor and the population served by private residential wells. The per capita water use factor of 75 gallons per person per day is based on the USGS study “Private Domestic–Well Characteristics and the Distribution of Domestic Withdrawals among Aquifers in the Virginia Coastal Plain.” The population served by residential wells is estimated as the population that is not served by publicly- or privately-owned CWSs, based on the REMI population projections. Table 4-6 summarizes the population in each sub-region expected to be served by private residential wells.

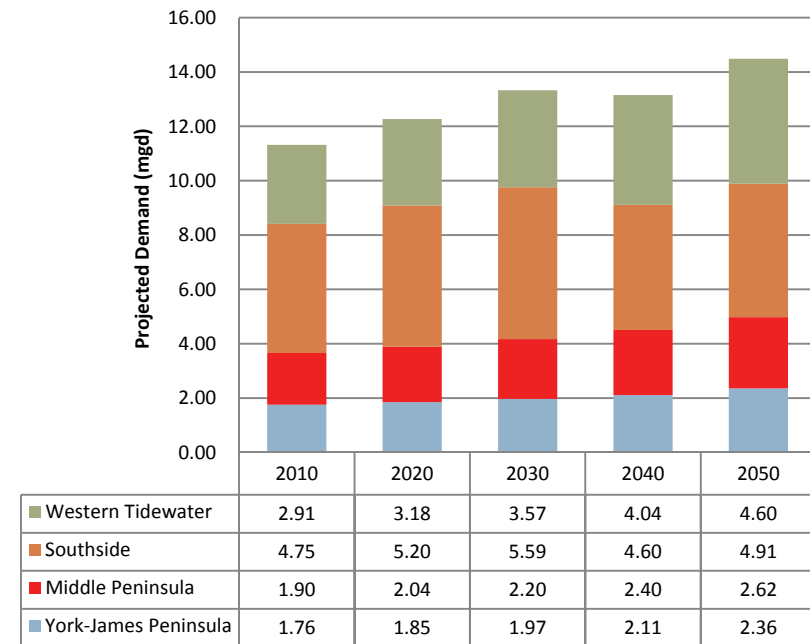
Table 4-6: Projected Population Served by Private Residential Wells

Sub-region	2010		2020		2030		2040		2050	
	Population	%	Population	%	Population	%	Population	%	Population	%
Peninsula										
York-James Peninsula	18,704	3.8	19,907	3.7	21,451	3.7	23,324	3.7	26,689	3.8
Middle Peninsula	23,754	62.2	25,644	57.6	27,846	53.7	30,411	50.4	33,400	47.5
Southside	58,089	5.1	64,001	5.2	69,292	5.2	56,090	3.9	60,207	4.0
Western Tidewater	35,255	48.4	38,861	44.4	44,024	41.8	50,339	39.5	57,868	37.4

Projected Demand

Projected demands for small self-supplied users is largely dependent on population growth outside publicly-owned CWS service areas. Figure 4-4 shows the projected demand for small self-supplied business and residential well users. Small self-supplied user demand in the Southside sub-region is projected to increase by 20%. Small self-supplied user demands attributed to the Western Tidewater and Peninsula sub-regions are predicted to increase by approximately 60% and 36%, respectively, by 2050.

Figure 4-4: Projected Water Demands for Small Self-Supplied Users (use < 300,000 gal/month)



Projected Demands Across the Region

Demand across the Hampton Roads region is expected to increase considerably as the population continues to grow. Figure 4-5 shows the projected demand for publicly- and privately-owned CWSs in Hampton Roads through 2050. The Southside sub-region has the largest 2050 projected CWS demand of approximately 165.9 mgd, followed by the Peninsula sub-region at 80.0 (York-James Peninsula demand is 77.0 mgd), and the Western Tidewater sub-region at 13.5 mgd.

Figure 4-6 shows the projected water demands in Hampton Roads for publicly-owned CWS, privately-owned CWS, and small self-supplied users (estimated use less than 300,000 gallons per month). Demand from publicly-owned CWSs is anticipated to increase by about 44% from 177.7 mgd to 256.9 mgd by 2050. Approximately 92% of the 2050 regional projected water demand in these 3 demand sectors is attributed to publicly-owned CWSs; it is likely that the majority of future development will occur within CWS service areas.

A slight decrease in demand from privately-owned CWSs is expected, as some privately-owned systems opt for service from publicly-owned systems and development occurs in publicly-owned CWS service areas.

Demand from small self-supplied users will increase by 27% from 11.3 mgd to 14.5 mgd by 2050; most of this increase is attributed to the Southside sub-region. As previously stated, projecting demand for large self-supplied water users (usage greater than 300,000 gallons per month) is difficult as it is challenging to anticipate large users moving into and out of the Hampton Roads area.

The projected water demands for all Hampton Roads region CWSs and small self-supplied users are summarized in Table 4-7. The table also shows the demands for non-consumptive use by large self-supplied users (those withdrawing more than 300,000 gallons per month). Refer to Figures 4-5 and 4-6 for illustration of the projected increase in demands for consumptive uses of water.

Figure 4-5: Projected Water Demands for Public and Private CWSs through 2050

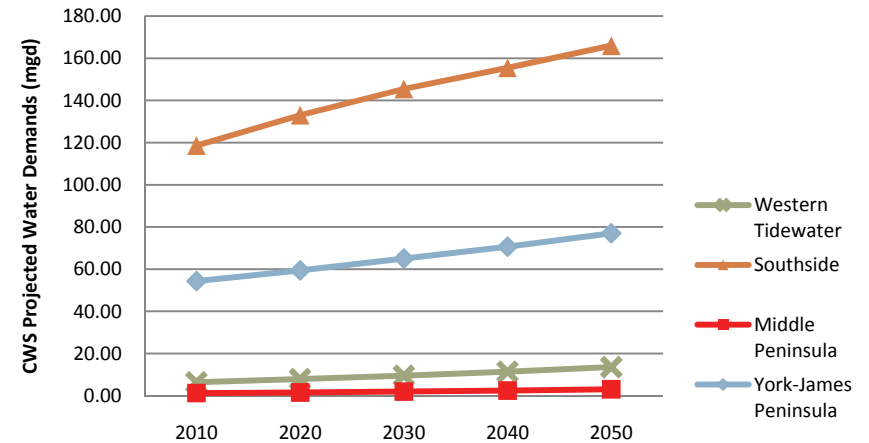


Figure 4-6: Projected Water Demands for Publicly- and Privately-Owned CWSs and Small Self-Supplied Users (use<300,000 gal/month)

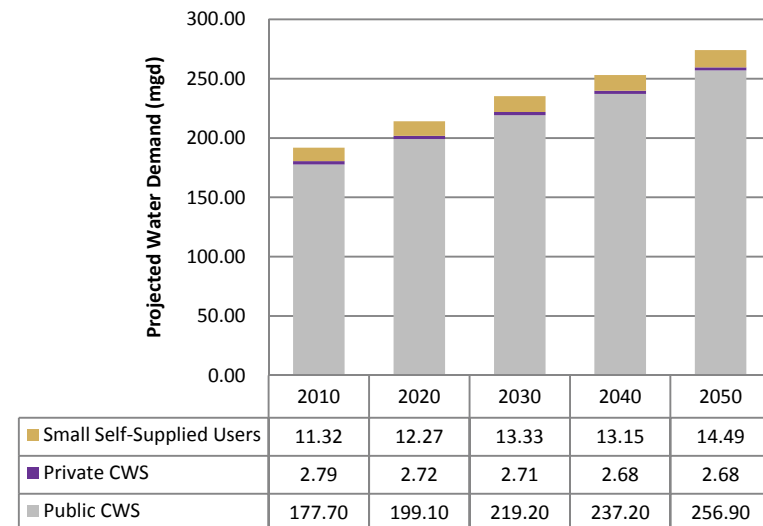


Table 4-7: Hampton Roads 2010 to 2050 Projected Water Demands
(all figures in mgd)

Year	Public Water Systems				Private CWS				Small Self-Supplied Users (use <300,000 gal/month)				Large Self-Supplied Users (use >300,000 gal/month)				Total			
	York-James Peninsula	Middle Peninsula	Southside	Western Tidewater	York-James Peninsula	Middle Peninsula	Southside	Western Tidewater	York-James Peninsula	Middle Peninsula	Southside	Western Tidewater	York-James Peninsula	Middle Peninsula	Southside	Western Tidewater	York-James Peninsula	Middle Peninsula	Southside	Western Tidewater
2010	54.3	1.2	118.1	4.1	0.024	0.021	0.490	2.255	1.8	1.9	4.8	2.9	886.9	0.0	527.7	1828.5	943.0	3.1	651.0	1837.8
2020	59.4	1.5	132.5	5.7	0.024	0.021	0.490	2.183	1.9	2.0	5.2	3.2	886.9	0.0	527.7	1828.5	948.2	3.6	665.9	1839.6
2030	65.0	1.9	145.0	7.3	0.024	0.021	0.490	2.170	2.0	2.2	5.6	3.6	886.9	0.0	527.7	1828.5	953.9	4.1	678.8	1841.5
2040	70.6	2.4	155.0	9.2	0.024	0.021	0.490	2.141	2.1	2.4	4.6	4.0	886.9	0.0	527.7	1828.5	959.6	4.8	687.8	1843.9
2050	77.0	3.0	165.5	11.4	0.024	0.021	0.490	2.141	2.4	2.6	4.9	4.6	886.9	0.0	527.7	1828.5	966.3	5.6	698.6	1846.6

Potential Additional Demands on Publicly-Owned CWSs

The percentage of the population served by publicly-owned CWSs is anticipated to increase partly because some privately-owned CWSs and self-supplied users may choose to switch to public water service. To evaluate the impact of the switch in service and to estimate the potential additional water demand on publicly-owned CWSs, the 2007 water use by privately-owned CWSs and self-supplied users was categorized as either inside or outside the service areas of publicly-owned CWSs (see Table 4-8). Since minimal change is anticipated in water use by privately-owned CWSs and self-supplied users over the planning period, the 2007 use totals were used as a surrogate for demand.

It is estimated that an additional demand of 3.78 mgd could be added to the projected demands for publicly-owned CWSs across the region by 2050. The assumptions used to develop the estimated additional demands shown in Table 4-8 are described below.

Privately-Owned CWSs

All of the privately-owned CWSs located within existing service areas of publicly-owned CWSs are considered likely to hook up to public water service by 2050; these system demands are included in the estimate of potential additional demands for publicly-owned CWSs. Three privately-owned water systems located within future expansion areas of publicly-owned CWSs were also included in the estimate:

- R&L Trailer Park in Gloucester County
- Sunray Artesian Water Supply in Chesapeake
- Sunray Water Company in Chesapeake

Small Self-Supplied Users

Small self-supplied users (use < 300,000 gal/month) include both businesses and homes. It was assumed that 25% of the demands of self-supplied businesses are likely to be met by hook ups to public water before 2050. Since very few self-supplied homes are located within publicly-owned CWS service areas, the number of self-supplied residences that could potentially switch to public water is considered negligible.

Large Self-Supplied Users

Of the large self-supplied users (withdrawing more than 300,000 gal/month) located within the publicly-owned CWS service areas, the following users are considered unlikely to hook up to public water service:

- Northrup Grumman Shipbuilding
- Yorktown Fossil Power Plant
- Chesapeake Energy Center
- International Paper Franklin Mill
- Dominion Power Nuclear Power Plant

These commercial and industrial users have demands totaling approximately 1,360 mgd and are currently supplied by groundwater withdrawals and surface water withdrawals from the Elizabeth, James, and York Rivers. The majority of surface water withdrawals are returned to the respective source rivers.

The demands of the five users listed above cannot be supported by publicly-owned CWSs; therefore, their demands were not included in Table 4-8.

The demands of other large self-supplied users located within publicly-owned CWS service areas total 13.4 mgd. For Table 4-8, it was estimated that 25% of this demand is likely to be met through hook ups to public water before 2050.

Table 4-8: Potential Additional Water Demands for Publicly-Owned CWS
(all figures in mgd)

	2007 Water Use Privately-Owned CWS (mgd)		2007 Water Use Small Self-Supplied Business Users (Use < 300,000 gal/month (mgd))		2007 Water Use Large Self-Supplied Users (Use > 300,000 gal/month (mgd))	
	Inside Public CWS Service Area	Outside Public CWS Service Area	Inside Public CWS Service Area	Outside Public CWS Service Area	Inside Public CWS Service Area	Outside Public CWS Service Area
York-James Peninsula	0.007	0.011	0.214	0.926	1.497	0.00
Middle Peninsula	0.000	0.049	0.002	1.836	0.000	0.000
Southside	0.139	0.354	0.264	4.379	4.066	2.850
Western Tidewater	0.162	1.600	0.228	2.626	7.840	1.350
Total	0.308	2.014	0.708	9.767	13.403	4.200
Potential Additional Demand for Publicly- Owned CWSs*	0.308	0.049	0.177	0.000	3.351	0.000

* This estimate is based on the assumption that 100% of the demands of privately-owned CWSs, 25% of the demands of small self-supplied business users, and 25% of the demands of large self-supplied users located within the service areas of publicly-owned CWSs will opt to connect to public water service at some time during the planning period.