

## 5.0 PROJECTED POPULATION AND WATER DEMANDS

As required by the Regulation<sup>143</sup>, a detailed analysis of water demand projections based on population growth and future land use is detailed in the following section of this Plan.

### 5.1 Past Trends

Past population trends can provide a starting point when estimating future growth and water demands for the county. As stated in the Comprehensive Plan, the county experienced relatively small fluctuations in population between 1920 and 1960. In 1920, 8,863 people lived in Goochland County. By 1970, the population had increased to more than 10,000 people. However, the county's growth significantly increased between 1970 and 2000. As indicated by the 2000 Census, the population within Goochland County had increased to 16,863. This increase in population is due to the outward development pressures from Henrico and the Richmond metropolitan area. Recent growth can also be attributed to the completion of Virginia Route 288 near Interstate 64. The following table depicts Goochland County's population growth over the past 40 years.

**Table 65: Goochland County's Past Population Trends<sup>144</sup>**

Year	Population	Average Annual Growth Rates (%)
1960	9,206	-
1970	10,069	0.900
1980	11,761	1.565
1990	14,163	1.876
2000	16,863	1.760
<b>Average Annual Growth Rate</b>		<b>1.525</b>

As shown in the table above, the average annual growth rate over the past 40 years is approximately 1.5% per year. This growth rate will be used as a reference when estimating future growth rates.

When analyzing the population in Goochland County, it is also important to take into consideration the past population trends for the surrounding counties. Their growth patterns can influence growth in different areas of Goochland County. The table below depicts the annual growth rates for the surrounding counties in comparison to Goochland County.

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<sup>143</sup> 9 VAC 25-78-100.

<sup>144</sup> U.S. Census Bureau.

**Table 66: Surrounding County Growth<sup>145</sup>**

<b>County</b>	<b>1980 Population</b>	<b>Average Annual Growth % 1980-1990</b>	<b>1990 Population</b>	<b>Average Annual Growth % 1990 -2000</b>	<b>2000 Population</b>
Goochland County	11,761	1.876	14,163	1.760	16,863
Cumberland County	7,881	-0.071	7,825	1.428	9,017
Fluvanna County	10,244	1.952	12,429	4.897	20,047
Louisa County	17,825	1.321	20,325	2.345	25,627
Powhatan County	13,062	1.613	15,328	3.856	22,377
Henrico County	180,735	1.887	217,881	1.873	262,300
Hanover County	50,398	2.306	63,306	3.149	86,320

As shown in the table above, Goochland County has experienced a mid-range growth when compared to its neighbors. Fluvanna County, to the west, has experienced a dramatic increase in population from 1990 through 2000 with an average annual growth rate of nearly 5.0%. Towards the east, the consistent growth of Henrico County has had a large effect on Goochland County as its population expands westward with the development of the Short Pump area. The average annual growth rate for Goochland County and the surrounding region was approximately 2.76% from 1990 through 2000.

## **5.2 Current Conditions**

The county's population in 2000 was 16,863, but has grown to approximately 20,085 in 2006<sup>146</sup>. For purposes of the Plan, the census tracts will be used to project population growth. The following figure depicts the five census tracts in Goochland County.

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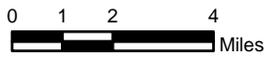
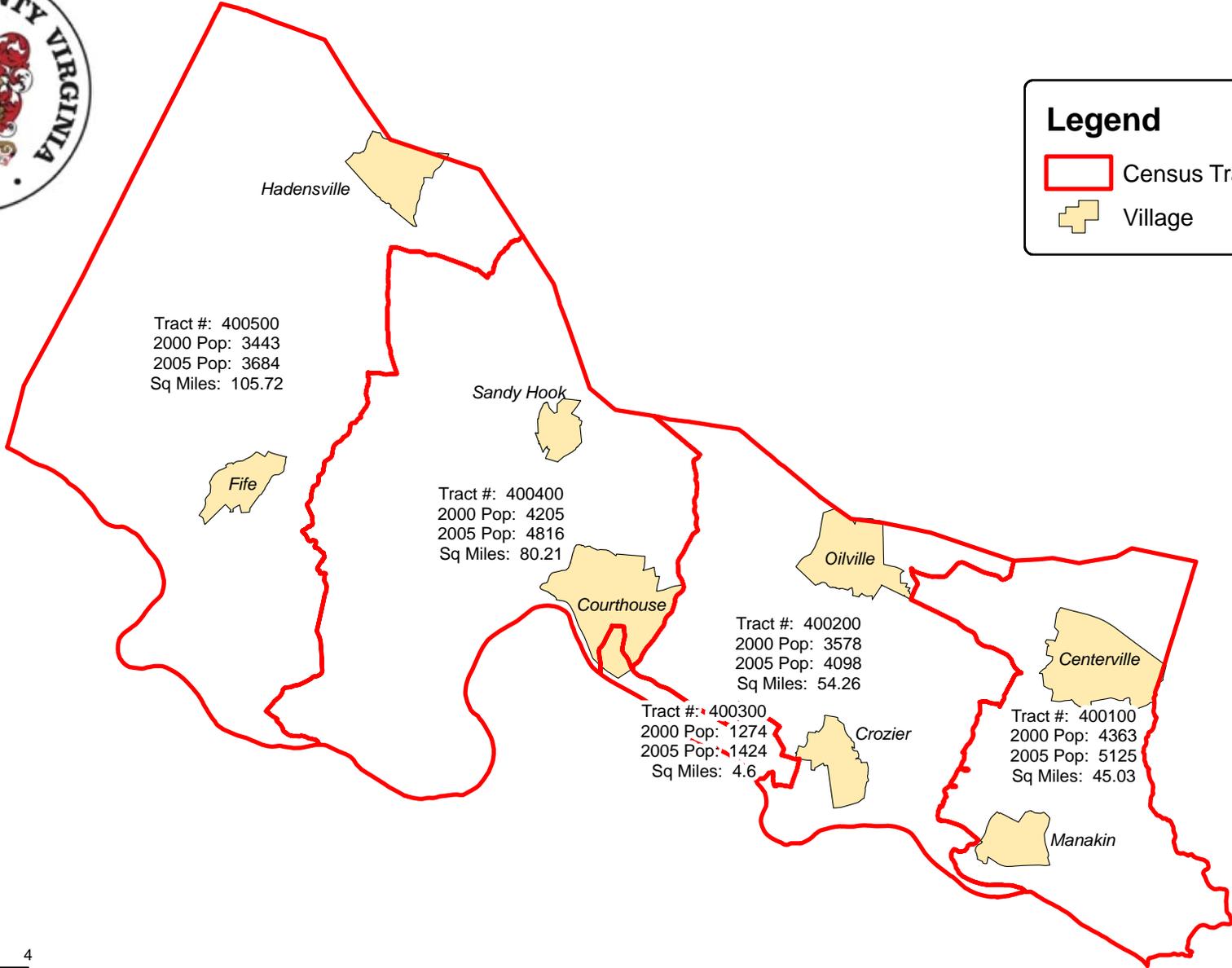
<sup>145</sup>Goochland County 2028 Comprehensive Plan.

<sup>146</sup>U.S. Census Bureau.



**Legend**

- Census Tract
- Village



Source: US Census Bureau; USGS; Goochland County



BLACKSBURG, VA CHARLOTTESVILLE, VA HAMPTON ROADS, VA RICHMOND, VA

## Census Tracts

Goochland County, Virginia

FIGURE

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DAA# R07246-01

As shown in the previous figure, Census Tract 4003 is the smallest in land area of the five census tracts. However, it is the most densely populated with 1,662 in its 4.6 square-mile area. The density, in part, is due to the presence of the James River Correctional Center. Census Tract 4001 is the second smallest in land area and has a population density of 118.1 persons per square-mile.<sup>147</sup> This region of the county is the most developed and includes the Tuckahoe Creek Service District. Further west, the remaining census tracts are less dense. The following table summarizes the estimated 2006 population distribution throughout the county.

**Table 67: Population and Distribution by Census Tract**

Census Tract	Estimated 2006 Population <sup>148</sup>	Area (Square Mile)	% of Population	Population Density (Persons/Square Mile)
4001	5,318	45.03	26.5	118.1
4002	4,275	54.26	21.3	78.8
4003	1,662	4.6	8.3	361.3
4004	5,015	80.21	25.0	62.5
4005	3,815	105.72	19.0	36.1
<b>Goochland Countywide</b>	<b>20,085</b>	<b>289.82</b>	<b>100.0</b>	<b>69.3</b>

The average population density for the entire county is approximately 69.3 persons per square mile.

### 5.3 Demand Projections Based on Population

#### 5.3.1 Goochland County and Surrounding Counties

In order to anticipate where growth will occur in Goochland County, the surrounding counties and their growth projection were analyzed. The growth surrounding Goochland County can influence the location of growth within the County. The following tables depict the Virginia Employment Commission (VEC) projected populations and annual growth rates for Goochland County and the surrounding region.

<sup>147</sup> 2000 Census.

<sup>148</sup>The Estimated 2006 Census Tract Populations are estimated based on the 2005 U.S. Census Bureau Census Tract Populations for Goochland County, Virginia Department of Health Engineering Description Sheets, and recent growth patterns.

**Table 68: Historical and Projected Population in Surrounding Counties<sup>149</sup>**

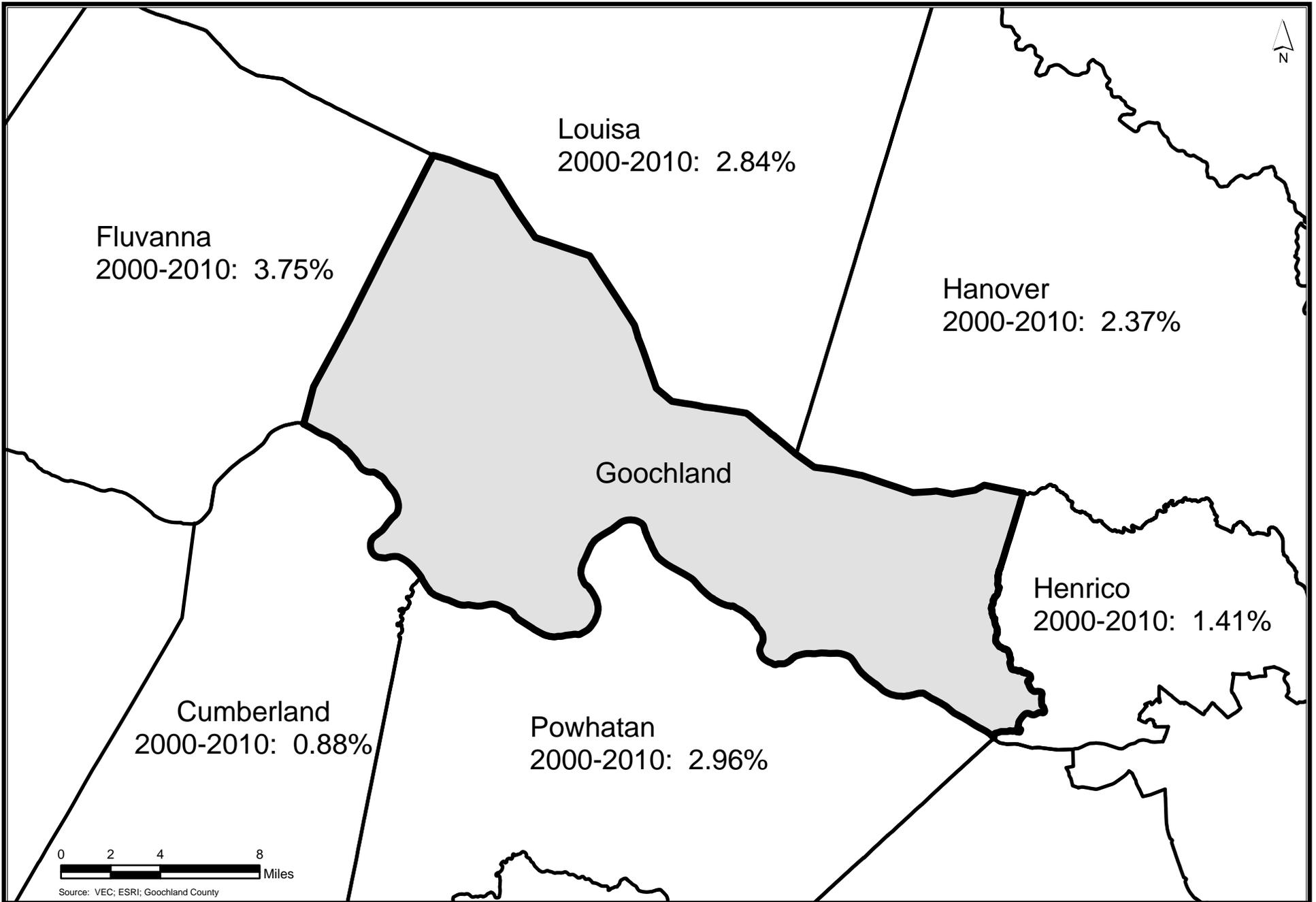
County	Population				
	1990	2000	2010	2020	2030
Goochland County	14,163	16,863	22,078	27,091	32,641
Cumberland County	7,825	9,017	9,847	10,690	11,793
Fluvanna County	12,429	20,047	28,971	37,433	47,010
Louisa County	20,325	25,627	33,923	41,889	50,739
Powhatan County	15,328	22,377	29,966	37,135	45,216
Henrico County	217,881	262,300	301,658	339,703	379,041
Hanover County	63,306	86,320	105,762	124,097	143,959

**Table 69: Historical and Projected Annual Growth Rates in Surrounding Counties**

County	Annual Growth %			
	1990-2000	2000-2010	2010-2020	2020-2030
Goochland County	1.76	2.73	2.07	1.88
Cumberland County	1.43	0.88	0.82	0.99
Fluvanna County	4.90	3.75	2.60	2.30
Louisa County	2.35	2.84	2.13	1.94
Powhatan County	3.86	2.96	2.17	1.99
Henrico County	1.87	1.41	1.19	1.10
Hanover County	3.15	2.37	1.61	1.50

With these growth projections for Goochland County and the surrounding counties, it can be anticipated that growth in Goochland County will mainly occur in the eastern region of the county. This growth is heavily influenced by the westward expansion of Henrico County development. The growth of Charlottesville in Albemarle County has encouraged growth in Fluvanna County for commuters. This growth in Fluvanna County is also anticipated to influence growth in the western region of Goochland County. Based on the Comprehensive Plan, most of the growth in the county is encouraged to occur within village limits. Area outside of the defined village boundaries is anticipated to grow more slowly with scattered rural residential development. The following figure depicts the location of the surrounding counties and the projected growth rates for each county.

<sup>149</sup> Virginia Employment Commission (VEC).



### 5.3.2 Goochland County Growth Rates

The population projections from the Virginia Employment Commission (VEC) are lower than the population projections from the Goochland County Comprehensive Plan. The table below reveals Goochland County’s projections and growth expectations within the county in comparison to the VEC projections.

**Table 70: Projected Population in Goochland County**

<b>Year</b>	<b>Comprehensive Plan<sup>150</sup></b>	<b>VEC</b>
2000	16,863	16,863
2010	22,003	22,078
2020	27,848	27,091
2030	35,787	32,641

This Plan generally follows the projections made in the Comprehensive Plan. It is believed that these projections reflect reasonable growth in Goochland County based on local knowledge. The Comprehensive Plan projects an average annual growth rate of 2.54% from 2000 through 2030. The VEC estimate predicts an annual growth of 2.23%. The following table depicts the average growth rates for both the VEC and Comprehensive Plan projections.

**Table 71: Projected Growth Rate Comparison**

<b>Year</b>	<b>Comprehensive Plan</b>	<b>VEC</b>
2000-2010	2.70	2.73
2010-2020	2.38	2.07
2020-2030	2.54	1.88
<b>Annual Average</b>	<b>2.54</b>	<b>2.23</b>

### 5.3.3 Population Projections

In order to project future population under different growth scenarios, low, mid, and high-range population projections were forecast. The mid-range projection is similar to the Comprehensive Plan population projections. The low-range projection is modeled to mirror the VEC population projections. The following table depicts the population projections and annual growth rates through 2060 for each census tract in Goochland County.

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<sup>150</sup> Goochland County 2028 Comprehensive Plan.

**Table 72: Growth Rates and Population Projections**

**Low-Range Growth Rates\***

Census Tract	Average Annual Growth Rates (%)					Projected Populations						
	2010-2020	2020-2030	2030-2040	2040-2050	2050-2060	2000	2010	2020	2030	2040	2050	2060
4001	2.40	2.40	2.70	2.70	2.70	4,363	6,228	7,895	10,008	13,063	17,051	22,257
4002	2.40	2.35	2.65	2.65	2.65	3,578	4,264	5,405	6,819	8,857	11,505	14,944
4003	1.78	1.34	1.05	0.80	0.80	1,274	706	842	962	1,068	1,157	1,253
4004	1.79	1.38	1.85	1.85	1.85	4,205	5,556	6,635	7,609	9,140	10,979	13,188
4005	1.65	1.30	1.70	1.70	1.70	3,443	4,263	5,021	5,713	6,762	8,004	9,474
Goochland County	2.07	1.89	2.26	2.27	2.30	16,863	21,017	25,798	31,111	38,891	48,695	61,114

**Mid-Range Growth Rates\*\***

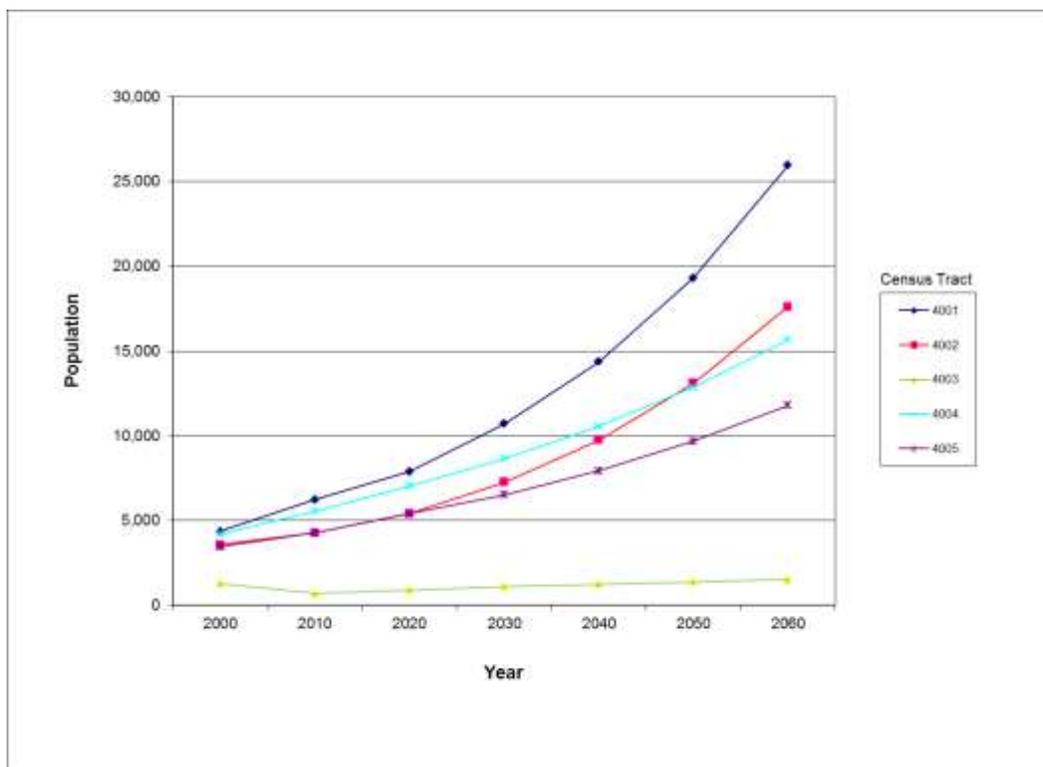
Census Tract	Average Annual Growth Rates (%)					Projected Populations						
	2010-2020	2020-2030	2030-2040	2040-2050	2050-2060	2000	2010	2020	2030	2040	2050	2060
4001	2.38	3.10	3.00	3.00	3.00	4,363	6,228	7,880	10,693	14,370	19,312	25,954
4002	2.38	3.00	3.00	3.00	3.00	3,578	4,264	5,395	7,250	9,743	13,094	17,598
4003	2.38	2.10	1.25	1.00	1.00	1,274	706	893	1,100	1,245	1,375	1,519
4004	2.38	2.10	2.00	2.00	2.00	4,205	5,556	7,029	8,653	10,548	12,858	15,674
4005	2.38	1.90	2.00	2.00	2.00	3,443	4,263	5,393	6,510	7,936	9,674	11,793
Goochland County	2.38	2.55	2.51	2.53	2.56	16,863	21,017	26,590	34,206	43,843	56,314	72,537

**High-Range Growth Rates**

Census Tract	Average Annual Growth Rates (%)					Projected Populations						
	2010-2020	2020-2030	2030-2040	2040-2050	2050-2060	2000	2010	2020	2030	2040	2050	2060
4001	2.70	3.30	3.20	3.20	3.20	4,363	6,228	8,129	11,248	15,412	21,118	28,937
4002	2.70	3.20	3.20	3.20	3.20	3,578	4,264	5,566	7,626	10,450	14,319	19,620
4003	2.60	2.30	1.45	1.20	1.20	1,274	706	913	1,146	1,323	1,491	1,679
4004	2.60	2.30	2.20	2.20	2.20	4,205	5,556	7,182	9,016	11,207	13,932	17,319
4005	2.60	2.10	2.20	2.20	2.20	3,443	4,263	5,510	6,783	8,432	10,482	13,031
Goochland County	2.65	2.75	2.72	2.74	2.77	16,863	21,017	27,300	35,818	46,825	61,342	80,586

As shown in the previous table, most of the expected growth is anticipated to occur in the eastern region of the county within Census Tracts 4001 and 4002 with an approximate mid-range annual growth rate of 3.0%. As indicated in the Comprehensive Plan, most growth is encouraged to occur in the Tuckahoe Service District, Centerville Village, River Road Community, and Manakin Village in the 4001 Census Tract. This growth is influenced by the westward growth of Henrico County and the Short Pump Area. Census Tract 4002 is also anticipated to be influenced by the westward growth of Henrico County and experience low intensity development. In this tract, most of the growth is expected to occur within the Oilville Village with some growth in the Crozier Village. According to the mid-range anticipated growth rates, the remainder of the county is anticipated to grow with an annual growth of approximately 2.0%. This area of the county is also forecast to see most of its growth within village limits due to zoning restrictions. However, Census Tract 4003 is anticipated to gradually reduce its growth rate to 1.0% due to the location of the James River Correctional Center and limited space for rural development. The following figure compares each census tract's mid-range anticipated growth rates and population projections.

**Figure 23: Mid-Range Population Projections by Census Tract<sup>151</sup>**

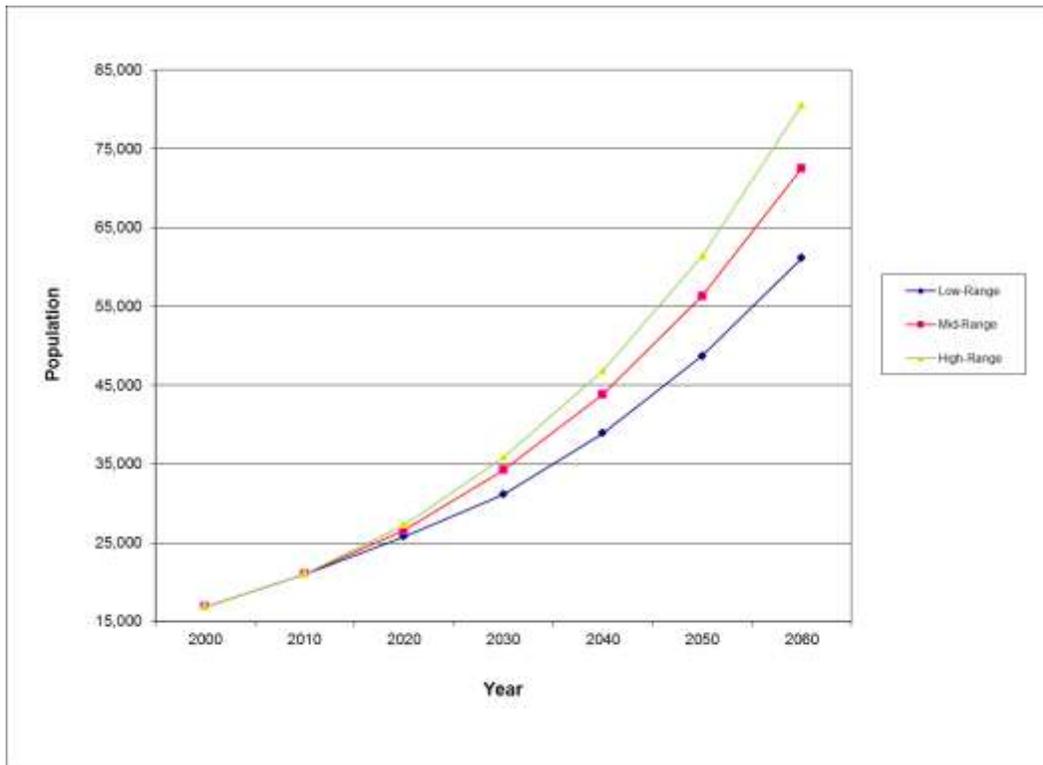


According to the mid-range projection, the projected population for the entire county in 2030 is approximately 34,206.<sup>152</sup> This estimate is based on the Comprehensive Plan, which projected a population of 35,787. By 2030, the low-range projection, which is based on the VEC projections, and the high-range projection estimate a countywide population of approximately 31,111 and 35,818, respectively. The following figure depicts the projected population in Goochland County for all growth scenarios.

<sup>151</sup> Demand projections through 2030 are based on the Goochland County 2028 Comprehensive Plan.

<sup>152</sup> Adjusted to reflect the closing of the JRCC in early 2011; adjusted July 2011.

**Figure 24: Low, Mid, and High-Range Population Projections for the Entire County**



#### 5.3.4 Daily Demand Projections

One method of estimating the future water demand is by applying a gross gallons per capita per day to the future population. The gross gallons per capita per day is estimated by applying the total water consumed for agricultural, commercial, industrial, and residential uses and dividing that water usage over every individual in the county. As detailed in Section 3.0, the gross gallons per capita per day is 248 when analyzing the total water usage in the county. For projection purposes, however, the county-wide gross gallons per capita per day will not be used, since this estimate is not specific to each census tract.

In order to estimate a water demand projection that is specific to each census tract, several assumptions needed to be made. All of the assumptions for estimating future demand projections are detailed below:

- ◆ The adjusted gross gallons per capita per day from Section 3.0, which does not include the water usage from self-supplied-non-agricultural users such as golf courses and quarries, will be used for estimating the

demands that are influenced by population growth (community and self-supplied users);

- ◆ The future demand for golf courses and quarries is not influenced by population growth. The demands for these users will not increase unless golf courses change their irrigation habits or quarries increase production. Hence, the demand for these users will remain constant throughout the planning period;
- ◆ The water usage of each golf course and quarry will be added to the census tract in which it is located;
- ◆ Based on Goochland County’s future land use, agricultural land will be slightly reduced due to commercial, industrial, and residential development. However, it is assumed that the current agricultural water usage will remain constant throughout the planning period; and
- ◆ When analyzing only the usage from community systems, most of these systems have a gross gallons per capita per day that is lower than the Virginia average of 175 gross gallons per capita per day. The only community system that exceeds the Virginia average gross gallons per day is the Eastern Goochland Water System. This system is susceptible to having a large amount of water “losses” due periodic flushing to maintain acceptable chlorine levels. With more users connecting to the Eastern Goochland Water System in the future, system flushing will not be required as frequently. Hence, demand management and conservation efforts are inherently incorporated into the future demand projections.

The following table depicts the current and future estimated gross gallons per capita per day for each census tract in Goochland County. As can be seen below, the gross gallons per capita per day for each census tract increases as more commercial and industrial users locate in the county.

**Table 73: Estimated Adjusted Gross Gallons Per Capita Day**

Census Tract	2010	2020	2030	2040	2050	2060
4001	185	190	200	210	220	230
4002	100	115	125	130	135	140
4003	253	270	270	270	270	270
4004	115	120	125	130	135	140
4005	98	105	110	115	120	125

By applying the gross gallons per capita per day to the projected population of each census tract and the assumptions above, the projected water demands for each census tract can be estimated. The following table depicts the low, mid, and high-range water demand projections for each census tract in the county through 2060.

Table 74: Average Daily Water Demand Projections Based on Population

Low-Range Demand

Census Tract	Type of Water Use	Average Daily Demand Projections (gpd)					
		2010	2020	2030	2040	2050	2060
4001	Community/Self-Supplied Residential	1,148,390	1,500,036	2,001,602	2,743,288	3,751,278	5,119,044
	Self-Supplied-Non-Agricultural	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307
	<b>Sub-Total</b>	<b>3,477,697</b>	<b>3,829,343</b>	<b>4,330,909</b>	<b>5,072,595</b>	<b>6,080,585</b>	<b>7,448,351</b>
4002	Community/Self-Supplied Residential	427,181	621,605	852,325	1,151,405	1,553,131	2,092,145
	Self-Supplied-Non-Agricultural	16,667	16,667	16,667	16,667	16,667	16,667
	<b>Sub-Total</b>	<b>443,848</b>	<b>638,272</b>	<b>868,992</b>	<b>1,168,072</b>	<b>1,569,798</b>	<b>2,108,812</b>
4003	Institutional (Goochland County)	190,739	190,739	190,739	190,739	190,739	190,739
	Institutional (Powhatan County)	559,260	559,260	559,260	559,260	559,260	559,260
	Community/Self-Supplied Residential	-	13,623	25,614	36,207	45,066	54,660
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>749,999</b>	<b>763,622</b>	<b>775,613</b>	<b>786,206</b>	<b>795,065</b>	<b>804,659</b>
4004	Community/Self-Supplied Residential	634,772	796,150	951,144	1,188,201	1,482,145	1,846,270
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>634,772</b>	<b>796,150</b>	<b>951,144</b>	<b>1,188,201</b>	<b>1,482,145</b>	<b>1,846,270</b>
4005	Community/Self-Supplied Residential	419,280	527,204	628,458	777,662	960,470	1,184,192
	Self-Supplied-Non-Agricultural	150,000	150,000	150,000	150,000	150,000	150,000
	<b>Sub-Total</b>	<b>569,280</b>	<b>677,204</b>	<b>778,458</b>	<b>927,662</b>	<b>1,110,470</b>	<b>1,334,192</b>
Countywide	Agricultural	219,616	219,616	219,616	219,616	219,616	219,616
	Self-Supplied Public Facilities and Businesses	18,701	18,701	18,701	18,701	18,701	18,701
<b>Total</b>		<b>6,113,913</b>	<b>6,942,907</b>	<b>7,943,433</b>	<b>9,381,054</b>	<b>11,276,381</b>	<b>13,780,602</b>

Mid-Range Demand

Census Tract	Type of Water Use	Average Daily Demand Projections (gpd)					
		2010	2020	2030	2040	2050	2060
4001	Community/Self-Supplied Residential	1,148,390	1,497,109	2,138,536	3,017,714	4,248,677	5,969,406
	Self-Supplied-Non-Agricultural	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307
	<b>Sub-Total</b>	<b>3,477,697</b>	<b>3,826,416</b>	<b>4,467,843</b>	<b>5,347,021</b>	<b>6,577,984</b>	<b>8,298,713</b>
4002	Community/Self-Supplied Residential	427,181	620,392	906,256	1,266,649	1,767,742	2,463,687
	Self-Supplied-Non-Agricultural	16,667	16,667	16,667	16,667	16,667	16,667
	<b>Sub-Total</b>	<b>443,848</b>	<b>637,059</b>	<b>922,923</b>	<b>1,283,316</b>	<b>1,784,409</b>	<b>2,480,354</b>
4003	Institutional (Goochland County)	190,739	190,739	190,739	190,739	190,739	190,739
	Institutional (Powhatan County)	559,260	559,260	559,260	559,260	559,260	559,260
	Community/Self-Supplied Residential	-	13,623	34,256	48,800	61,825	76,213
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>749,999</b>	<b>763,622</b>	<b>784,255</b>	<b>798,799</b>	<b>811,824</b>	<b>826,212</b>
4004	Community/Self-Supplied Residential	634,772	843,519	1,081,635	1,371,248	1,735,834	2,194,341
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>634,772</b>	<b>843,519</b>	<b>1,081,635</b>	<b>1,371,248</b>	<b>1,735,834</b>	<b>2,194,341</b>
4005	Community/Self-Supplied Residential	419,280	566,312	716,145	912,658	1,160,895	1,474,089
	Self-Supplied-Non-Agricultural	150,000	150,000	150,000	150,000	150,000	150,000
	<b>Sub-Total</b>	<b>569,280</b>	<b>716,312</b>	<b>866,145</b>	<b>1,062,658</b>	<b>1,310,895</b>	<b>1,624,089</b>
Countywide	Agricultural	219,616	219,616	219,616	219,616	219,616	219,616
	Self-Supplied Public Facilities and Businesses	18,701	18,701	18,701	18,701	18,701	18,701
<b>Total</b>		<b>6,113,913</b>	<b>7,025,245</b>	<b>8,361,118</b>	<b>10,101,358</b>	<b>12,459,263</b>	<b>15,662,025</b>

High-Range Demand

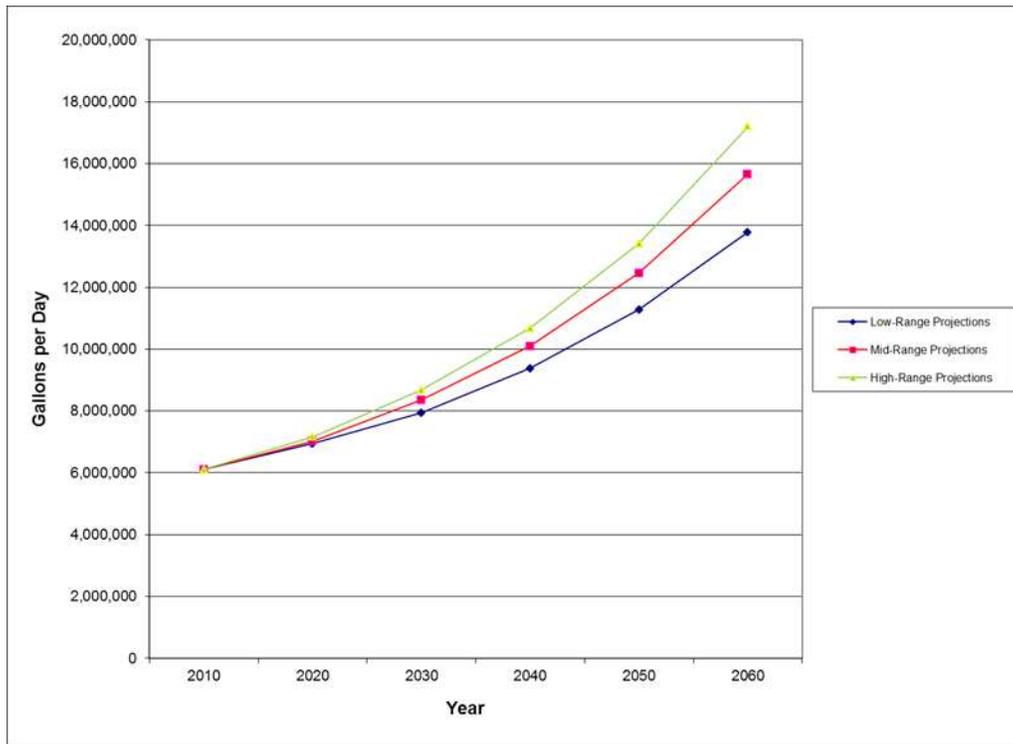
Census Tract	Type of Water Use	Average Daily Demand Projections (gpd)					
		2010	2020	2030	2040	2050	2060
4001	Community/Self-Supplied Residential	1,148,390	1,544,567	2,249,501	3,236,477	4,645,932	6,655,413
	Self-Supplied-Non-Agricultural	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307
	<b>Sub-Total</b>	<b>3,477,697</b>	<b>3,873,874</b>	<b>4,578,808</b>	<b>5,565,784</b>	<b>6,975,239</b>	<b>8,984,720</b>
4002	Community/Self-Supplied Residential	427,181	640,058	953,298	1,358,498	1,933,064	2,746,867
	Self-Supplied-Non-Agricultural	16,667	16,667	16,667	16,667	16,667	16,667
	<b>Sub-Total</b>	<b>443,848</b>	<b>656,725</b>	<b>969,965</b>	<b>1,375,165</b>	<b>1,949,731</b>	<b>2,763,534</b>
4003	Institutional (Goochland County)	190,739	190,739	190,739	190,739	190,739	190,739
	Institutional (Powhatan County)	559,260	559,260	559,260	559,260	559,260	559,260
	Community/Self-Supplied Residential	-	55,662	118,574	166,467	211,722	262,711
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>749,999</b>	<b>805,661</b>	<b>868,573</b>	<b>916,466</b>	<b>961,721</b>	<b>1,012,710</b>
4004	Community/Self-Supplied Residential	634,772	861,821	1,126,944	1,456,949	1,880,805	2,424,639
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>634,772</b>	<b>861,821</b>	<b>1,126,944</b>	<b>1,456,949</b>	<b>1,880,805</b>	<b>2,424,639</b>
4005	Community/Self-Supplied Residential	419,280	578,600	746,172	969,735	1,257,898	1,628,858
	Self-Supplied-Non-Agricultural	150,000	150,000	150,000	150,000	150,000	150,000
	<b>Sub-Total</b>	<b>569,280</b>	<b>728,600</b>	<b>896,172</b>	<b>1,119,735</b>	<b>1,407,898</b>	<b>1,778,858</b>
Countywide	Agricultural	219,616	219,616	219,616	219,616	219,616	219,616
	Self-Supplied Public Facilities and Businesses	18,701	18,700	18,700	18,700	18,700	18,700
<b>Total</b>		<b>6,113,913</b>	<b>7,164,996</b>	<b>8,678,778</b>	<b>10,672,416</b>	<b>13,413,712</b>	<b>17,202,776</b>

As shown in the previous table, the demand in each census tract is projected to grow differently and experience different water demands due to varying growth rates and estimated gross gallons per capita. By 2060, Census Tract 4001, which currently uses nearly 3.48 mgd, will require approximately 8.29 mgd according to the mid-range estimate. Census Tract 4002 will also experience a significant increase in their water demand with an anticipated demand of 2.48 mgd by 2060. Census Tract 4003 is anticipated to experience an increase in demand due to rural residential development. It is assumed that the demands for the correctional facilities in both Goochland and Powhatan County will not increase unless their facilities are expanded to house more inmates.<sup>153</sup> Census Tracts 4004 and 4005, which are the most rural areas of the county, will also increase their demands, but not as dramatically as the census tracts in the eastern portion of the county. According to the low, mid, and high-range demand estimates, by 2060 the county, as a whole, could expect a demand of approximately 13.78, 15.66 and 17.20 mgd, respectively. These demand estimates for Goochland County are depicted below.

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<sup>153</sup> At the time this report was written, DOC was tasked with studying the facilities in both Goochland and Powhatan to determine the best long-term use. The outcome of that study, could impact the future demands of this area of Goochland.

**Figure 25: Projected Total Water Demands for the Entire County**



### 5.3.5 Peak Demand Projections

The estimated peak demand projections for each census tract were established by applying a peaking factor of 1.8<sup>154</sup> to the community/self-supplied residential and institutional average daily demand projections detailed in Table 74. It is assumed the demands for self-supplied-non-agricultural, agricultural, and self-supplied public facilities and businesses are not subject to peak demands<sup>155</sup>. Hence, these water users were not adjusted by a peaking factor of 1.8. Peak demand projections can be used when designing future infrastructure and storage and when planning for future water supplies. The following table reveals the projected peak demands for each census tract in Goochland County.

<sup>154</sup> Virginia Department of Health Waterworks Regulations.

<sup>155</sup> Self-supplied-non-agricultural, agricultural, and self-supplied public users are not subject to peak demands, because of the nature of their water use.

Table 75: Peak Water Demand Projections Based on Population

Low-Range Demand

Census Tract	Type of Water Use	Peak Daily Demand Projections (gpd)					
		2010	2020	2030	2040	2050	2060
4001	Community/Self-Supplied Residential	2,067,102	2,700,065	3,602,884	4,937,919	6,752,301	9,214,280
	Self-Supplied-Non-Agricultural	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307
	<b>Sub-Total</b>	<b>4,396,409</b>	<b>5,029,372</b>	<b>5,932,191</b>	<b>7,267,226</b>	<b>9,081,608</b>	<b>11,543,587</b>
4002	Community/Self-Supplied Residential	768,926	1,118,889	1,534,185	2,072,529	2,795,636	3,765,862
	Self-Supplied-Non-Agricultural	16,667	16,667	16,667	16,667	16,667	16,667
	<b>Sub-Total</b>	<b>785,593</b>	<b>1,135,556</b>	<b>1,550,852</b>	<b>2,089,196</b>	<b>2,812,303</b>	<b>3,782,529</b>
4003	Institutional (Goochland County)	343,330	343,330	343,330	343,330	343,330	343,330
	Institutional (Powhatan County)	1,006,668	1,006,668	1,006,668	1,006,668	1,006,668	1,006,668
	Community/Self-Supplied Residential	-	24,521	46,105	65,173	81,119	98,388
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>1,349,998</b>	<b>1,374,519</b>	<b>1,396,103</b>	<b>1,415,172</b>	<b>1,431,117</b>	<b>1,448,386</b>
4004	Community/Self-Supplied Residential	1,142,590	1,433,069	1,712,059	2,138,762	2,667,861	3,323,287
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>1,142,590</b>	<b>1,433,069</b>	<b>1,712,059</b>	<b>2,138,762</b>	<b>2,667,861</b>	<b>3,323,287</b>
4005	Community/Self-Supplied Residential	754,704	948,967	1,131,225	1,399,792	1,728,846	2,131,546
	Self-Supplied-Non-Agricultural	150,000	150,000	150,000	150,000	150,000	150,000
	<b>Sub-Total</b>	<b>904,704</b>	<b>1,098,967</b>	<b>1,281,225</b>	<b>1,549,792</b>	<b>1,878,846</b>	<b>2,281,546</b>
Countywide	Agricultural	219,616	219,616	219,616	219,616	219,616	219,616
	Self-Supplied Public Facilities and Businesses	18,700	18,700	18,700	18,700	18,700	18,700
<b>Total</b>		<b>8,817,610</b>	<b>10,309,799</b>	<b>12,110,746</b>	<b>14,698,464</b>	<b>18,110,052</b>	<b>22,617,650</b>

Mid-Range Demand

Census Tract	Type of Water Use	Peak Daily Demand Projections (gpd)					
		2010	2020	2030	2040	2050	2060
4001	Community/Self-Supplied Residential	2,067,102	2,694,796	3,849,364	5,431,885	7,647,618	10,744,930
	Self-Supplied-Non-Agricultural	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307
	<b>Sub-Total</b>	<b>4,396,409</b>	<b>5,024,103</b>	<b>6,178,671</b>	<b>7,761,192</b>	<b>9,976,925</b>	<b>13,074,237</b>
4002	Community/Self-Supplied Residential	768,926	1,116,706	1,631,260	2,279,968	3,181,936	4,434,636
	Self-Supplied-Non-Agricultural	16,667	16,667	16,667	16,667	16,667	16,667
	<b>Sub-Total</b>	<b>785,593</b>	<b>1,133,373</b>	<b>1,647,927</b>	<b>2,296,635</b>	<b>3,198,603</b>	<b>4,451,303</b>
4003	Institutional (Goochland County)	343,330	343,330	343,330	343,330	343,330	343,330
	Institutional (Powhatan County)	1,006,668	1,006,668	1,006,668	1,006,668	1,006,668	1,006,668
	Community/Self-Supplied Residential	-	24,521	61,660	87,839	111,285	137,183
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>1,349,998</b>	<b>1,374,519</b>	<b>1,411,659</b>	<b>1,437,837</b>	<b>1,461,283</b>	<b>1,487,181</b>
4004	Community/Self-Supplied Residential	1,142,590	1,518,334	1,946,944	2,468,246	3,124,501	3,949,814
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>1,142,590</b>	<b>1,518,334</b>	<b>1,946,944</b>	<b>2,468,246</b>	<b>3,124,501</b>	<b>3,949,814</b>
4005	Community/Self-Supplied Residential	754,704	1,019,362	1,289,061	1,642,784	2,089,612	2,653,359
	Self-Supplied-Non-Agricultural	150,000	150,000	150,000	150,000	150,000	150,000
	<b>Sub-Total</b>	<b>904,704</b>	<b>1,169,362</b>	<b>1,439,061</b>	<b>1,792,784</b>	<b>2,239,612</b>	<b>2,803,359</b>
Countywide	Agricultural	219,616	219,616	219,616	219,616	219,616	219,616
	Self-Supplied Public Facilities and Businesses	18,700	18,700	18,700	18,700	18,700	18,700
<b>Total</b>		<b>8,817,610</b>	<b>10,458,007</b>	<b>12,862,578</b>	<b>15,995,011</b>	<b>20,239,240</b>	<b>26,004,211</b>

High-Range Demand

Census Tract	Type of Water Use	Peak Daily Demand Projections (gpd)					
		2010	2020	2030	2040	2050	2060
4001	Community/Self-Supplied Residential	2,067,102	2,780,220	4,049,102	5,825,659	8,362,678	11,979,743
	Self-Supplied-Non-Agricultural	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307	2,329,307
	<b>Sub-Total</b>	<b>4,396,409</b>	<b>5,109,527</b>	<b>6,378,409</b>	<b>8,154,966</b>	<b>10,691,985</b>	<b>14,309,050</b>
4002	Community/Self-Supplied Residential	768,926	1,152,105	1,715,936	2,445,296	3,479,516	4,944,360
	Self-Supplied-Non-Agricultural	16,667	16,667	16,667	16,667	16,667	16,667
	<b>Sub-Total</b>	<b>785,593</b>	<b>1,168,772</b>	<b>1,732,603</b>	<b>2,461,963</b>	<b>3,496,183</b>	<b>4,961,027</b>
4003	Institutional (Goochland County)	343,330	343,330	343,330	343,330	343,330	343,330
	Institutional (Powhatan County)	1,006,668	1,006,668	1,006,668	1,006,668	1,006,668	1,006,668
	Community/Self-Supplied Residential	-	100,191	213,434	299,641	381,100	472,879
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>1,349,998</b>	<b>1,450,189</b>	<b>1,563,432</b>	<b>1,649,639</b>	<b>1,731,098</b>	<b>1,822,878</b>
4004	Community/Self-Supplied Residential	1,142,590	1,551,278	2,028,499	2,622,509	3,385,450	4,364,350
	Self-Supplied-Non-Agricultural	-	-	-	-	-	-
	<b>Sub-Total</b>	<b>1,142,590</b>	<b>1,551,278</b>	<b>2,028,499</b>	<b>2,622,509</b>	<b>3,385,450</b>	<b>4,364,350</b>
4005	Community/Self-Supplied Residential	754,704	1,041,480	1,343,110	1,745,523	2,264,217	2,931,945
	Self-Supplied-Non-Agricultural	150,000	150,000	150,000	150,000	150,000	150,000
	<b>Sub-Total</b>	<b>904,704</b>	<b>1,191,480</b>	<b>1,493,110</b>	<b>1,895,523</b>	<b>2,414,217</b>	<b>3,081,945</b>
Countywide	Agricultural	219,616	219,616	219,616	219,616	219,616	219,616
	Self-Supplied Public Facilities and Businesses	18,700	18,700	18,700	18,700	18,700	18,700
<b>Total</b>		<b>8,817,610</b>	<b>10,709,561</b>	<b>13,434,369</b>	<b>17,022,916</b>	<b>21,957,249</b>	<b>28,777,566</b>

### 5.3.6 Public and Community System Demands vs. Self-Supplied Demands

When projecting demands, it is important to distinguish the demands that public and community water systems must meet. This enables the county and community systems to plan ahead and ensure that they will be able to meet future demands. The following table depicts the percentage of future demands that will be met by community water systems versus self-supplied systems.

**Table 76: Demand Percentage of Community/Self-Supplied Residential Systems**

Census Tract	Systems	Percentage of Total Community/Self Supplied Residential Usage						
		2006	2010	2020	2030	2040	2050	2060
4001	Eastern Goochland	61.4	61.4	63.4	65.4	67.4	69.4	71.4
	Manakin Farms	6.1	6.1	6.1	7.0	7.0	7.0	7.0
	Self-Supplied Residential	32.5	32.5	30.5	27.6	25.6	23.6	21.6
4002	Crozier	1.9	2.0	2.5	3.0	4.0	6.0	8.0
	Oilville	-	-	2.0	7.0	15.0	25.0	35.0
	Self-Supplied Residential	98.1	98.0	95.5	90.0	81.0	69.0	57.0
4003	James River Correctional Center	100.0	92.0	96.0	94.0	92.0	90.0	88.0
	Self-Supplied Residential	0.0	8.0	4.0	6.0	8.0	10.0	12.0
4004	Courthouse	22.7	25.0	20.0	25.0	30.0	35.0	40.0
	Jenkins Trailer Park	0.5	0.6	0.5	0.5	0.4	0.4	0.3
	Meadows Nursing Center	1.6	2.0	1.6	1.3	1.0	0.8	0.7
	Self-Supplied Residential	75.3	72.5	77.9	73.3	68.6	63.9	59.1
4005	Elk Hill Farm	1.3	1.8	2.0	1.7	1.4	1.1	0.9
	Self-Supplied Residential	98.7	98.3	98.0	98.3	98.6	98.9	99.1

As shown above, it is anticipated that the future demands throughout the county will become more centralized and shift away from self-supplied residential users and towards village centers and service districts. According to the Comprehensive Plan, “numerous areas of the county are [currently] experiencing water shortages to one degree or another and it is inevitable that this condition will persist and intensify especially within the county’s urbanizing areas. Further, it is highly unlikely that intense industrial development and higher density residential development will be able to occur without public or centralized water systems.”<sup>156</sup>

<sup>156</sup> Goochland County 2028 Comprehensive Plan.

With these limitations, it can be anticipated that the existing community systems will have to expand their service areas or new centralized community systems will have to develop in order to sustain future demands. It is anticipated that the major development areas of Manakin and Oilville will develop or have access to a centralized public or community system within the next twenty years. The following table depicts the future demands for each existing and future community system in Goochland County.

**Table 77: Demand Projections for Each Community System\***

Census Tract	2006 Community/Self-Supplied Usage (gpd)	Systems	Community/Self Supplied Residential Demand Predictions (gpd)					
			2010	2020	2030	2040	2050	2060
4001	1,148,390	Eastern Goochland	705,000	949,022	1,398,395	2,033,646	2,948,169	4,261,576
		Manakin Farms	70,190	91,504	149,697	211,240	297,407	417,858
		Self-Supplied Residential	373,200	456,583	590,443	772,828	1,003,100	1,289,971
4002	427,181	Crozier	7,981	15,510	27,188	50,666	106,065	197,095
		Oilville	-	12,408	63,438	189,997	441,936	862,290
		Self-Supplied Residential	419,200	592,474	815,630	1,025,986	1,219,742	1,404,301
4003	749,999	James River Correctional Center	749,999	749,999	749,999	749,999	749,999	749,999
		Self-Supplied Residential	0	13,623	34,256	48,800	61,825	76,213
4004	634,772	Courthouse	144,000	168,704	270,409	411,374	607,542	877,736
		Jenkins Trailer Park	2,923	4,218	4,867	5,485	6,075	6,583
		Meadows Nursing Center	9,849	13,496	14,061	13,712	13,887	14,263
		Self-Supplied Residential	478,000	657,101	792,298	940,676	1,108,330	1,295,758
4005	419,280	Elk Hill Farm	5,480	11,326	12,174	12,777	12,770	13,267
		Self-Supplied Residential	413,800	554,986	703,971	899,881	1,148,126	1,460,822

\* Community system demand projections are based on the Future Demand Percentages from Table 76 and the mid-range community/self-supplied residential demand

## 5.4 Demand Projections Based on Land Use

Another method of estimating the future demands is by analyzing the future land use. The following sections detail the water demand projections for each village and the rural regions in Goochland County based on future land use.

### 5.4.1 Future Land Use

Anticipated growth in Goochland County will have a substantial impact on the existing way of life in the area, including current land uses, the environment, the provision of services and facilities for its people and the overall quality of life. It is the county's goal to preserve its rural character and discourage growth outside of village boundaries. According to the Comprehensive Plan, rural preservation can be achieved by encouraging growth within the villages and designated growth areas rather than allowing random development along roadway corridors and into environmentally sensitive areas. This rural preservation land will be beneficial as a groundwater recharge area and nutrient and sediment filter from developed areas.

The Comprehensive Plan defines Major Village and Rural Villages according to their existing land uses and development potential. Major Villages are more populated communities where more residential, commercial, and other land uses are integrated. The established Major Villages in the county are Goochland Courthouse and Centerville; Oilville and Manakin are emerging Major Villages. Rural Villages feature primarily low density residential uses but may include small areas zoned for limited commercial uses serving the surrounding rural area. The Rural Villages in the county are Crozier, Hadensville, Sandy Hook, and George's Tavern-Fife.<sup>157</sup>

Major Villages will serve as "designated growth areas" where new development should be encouraged and concentrated. The amount of growth that can be accommodated will vary depending upon the capacity of public sewer and water

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<sup>157</sup> Goochland County 2028 Comprehensive Plan.

services. At this time, only the Centerville, Courthouse, and the River Road Community, along with the Tuckahoe Creek Service District, offer public sewer and water service. Therefore, they are expected to be primary development areas within the county for the next twenty years. Due to current development trends, and in part, to the likelihood of having access to the public sewer and water within the next twenty years, Oilville and Manakin are also considered Major Villages.

#### 5.4.2 Village Land Use Demand Projections

In order to determine the total future water demand based on the projected land use from the Comprehensive Plan, each designated village and established growth areas must be analyzed. The following table uses the land use predictions from the Comprehensive Plan and details the future water demand for each village and established areas of growth at “build-out.”<sup>158</sup>

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<sup>158</sup> For purposes of the Plan, “build-out” is defined as the maximum flow which corresponds to the future land use defined in the 2028 Comprehensive Plan.

**Table 78: Land Use Demand Projections for Villages and Established Growth Areas**

Land Use	Land Area (acres)	Percent Developable (%)	Unit Flow Rate (gpd/acre)	Build-Out Flow (mgd)
<b>Eastern Goochland (Tuckahoe Creek Service District, Centerville Village, Manakin Village, River Road Community)</b>				
Residential (2.5/acre)	1,112	100	800	0.89
Residential (1.0/acre)	4,093	100	320	1.31
Residential (0.5/acre)	261	100	160	0.04
Residential (0.3/acre)	2,030	100	110	0.22
Commercial	833	100	1,500	1.25
Industrial	1,530	100	2,000	3.06
Office/Lt. Industrial	3,300	100	2,000	6.60
Mixed Use	2,985	100	800	2.39
Recreation	1,918	100	400	0.77
<b>Sub-Total Flow</b>				<b>15.76</b>
<b>Hadensville</b>				
Residential (0.5/acre)	917	100	160	0.15
Commercial	212	100	1,500	0.32
Industrial	432	100	2,300	0.99
<b>Sub-Total Flow</b>				<b>1.46</b>
<b>Oilville Village</b>				
Residential (0.5/acre)	1,157	100	160	0.19
Mixed Use, No Retail	340	100	800	0.27
Commercial	301	100	1,500	0.45
Industrial	276	100	2,300	0.63
<b>Sub-Total Flow</b>				<b>1.54</b>
<b>Sandy Hook Village</b>				
Residential (0.5/acre)	756	100	160	0.12
Commercial	18	100	1,500	0.03
<b>Sub-Total Flow</b>				<b>0.15</b>
<b>George's Tavern-Fife Village</b>				
Residential (0.5/acre)	1,102	100	160	0.18
Commercial	30	100	1,500	0.05
<b>Sub-Total Flow</b>				<b>0.22</b>
<b>Crozier Village</b>				
Residential (0.5/acre)	1,254	100	160	0.20
Commercial	32	100	1,500	0.05
<b>Sub-Total Flow</b>				<b>0.25</b>
<b>Courthouse Village</b>				
Residential (0.5/acre)	2,713	100	160	0.43
Institutional	302	100	1,500	0.45
Mixed Use	485	100	800	0.39
Commercial	205	100	1,500	0.31
<b>Sub-Total Flow</b>				<b>1.58</b>
<b>Total Build-Out Flow</b>				<b>20.96</b>

### 5.4.3 Eastern Goochland

According to the Comprehensive Plan, the Eastern Goochland area, which incorporates the Tuckahoe Creek Service District, Centerville Village, Manakin Village, and the River Road Community, is anticipated to incorporate approximately 18,062 acres and have a future demand reaching 15.76 mgd at build-out. According to this estimate, the Eastern Goochland area is projected to have an average demand of approximately 873 gpd/acre. The West Creek Industrial/Office Park will have the greatest demands; projected to be 6.60 mgd. It is projected that other industrial and commercial developments will require approximately 4.31 mgd. The residential land use in this area will have a variety of dwelling densities a projected demand of 2.5 mgd. **Figure 26** and **Figure 27** show the future land use of the Eastern Goochland area.

### 5.4.4 Hadensville Village

The Hadensville Village boundaries, according to the 2003 Comprehensive Plan, are expected to incorporate approximately 1,561 acres of land<sup>159</sup>. This village is anticipated to have a demand of approximately 1.46 mgd with the majority of the demand from industrial and commercial use. The Hadensville Village is projected to have an average demand of approximately 934 gpd/acre. The residential development in the Hadensville Village is projected to have a demand of approximately 0.15 mgd. **Figure 28** shows the anticipated future land use for the Hadensville Village area.

### 5.4.5 Oilville Village

According to the Comprehensive Plan, the Oilville Village is anticipated to incorporate approximately 2,074 acres<sup>160</sup>. The majority of the land is anticipated to be used for residential development of 2-acre lots. This residential development in Oilville Village is projected to have a demand of 0.19 mgd. Commercial, industrial, and mixed land uses are projected to have demands of approximately

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<sup>159</sup>Goochland County 2028 Comprehensive Plan.

<sup>160</sup>Goochland County 2028 Comprehensive Plan.

1.36 mgd. In total, the Oilville Village is projected to have an estimated future demand of 1.54 mgd and an average demand of approximately 744 gpd/acre. **Figure 29** shows the anticipated future land use for the Oilville Village area.

#### 5.4.6 Sandy Hook Village

According to the Comprehensive Plan, the Sandy Hook Village is anticipated to incorporate nearly 774 acres within its village boundaries.<sup>161</sup> The majority of the village is anticipated to be used for residential development, which has an estimated future demand of approximately 0.12 mgd. The projected commercial development is anticipated to have a demand of approximately 0.03 mgd. In total, the Sandy Hook Village is projected to have a demand of approximately 0.15 mgd and an average demand of approximately 191 gpd/acre. **Figure 30** reveals the anticipated future land use for the Sandy Hook Village area.

#### 5.4.7 George's Tavern-Fife Village

According to the Comprehensive Plan, The George's Tavern-Fife Village is projected to incorporate approximately 1,132 acres.<sup>162</sup> Residential development is anticipated to use the majority of the land within the village boundaries and have an estimated demand of 0.18 mgd. The commercial development in the center of the village is anticipated to have a demand of approximately 0.05 mgd. In total, the George's Tavern-Fife Village is anticipated to have demand of approximately 0.22 mgd and an average demand of approximately 196 gpd/acre. **Figure 31** reveals the anticipated future land use for the George's Tavern-Fife Village area.

#### 5.4.8 Crozier Village

According to the Comprehensive Plan, the Crozier Village is anticipated to incorporate approximately 1,286 acres and have a total future demand of approximately 0.25 mgd.<sup>163</sup> According to this estimate, the Crozier Village is projected to have an average demand of approximately 193 gpd/acre. The

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<sup>161</sup> Goochland County 2028 Comprehensive Plan.

<sup>162</sup> Goochland County 2028 Comprehensive Plan.

<sup>163</sup> Goochland County 2028 Comprehensive Plan.

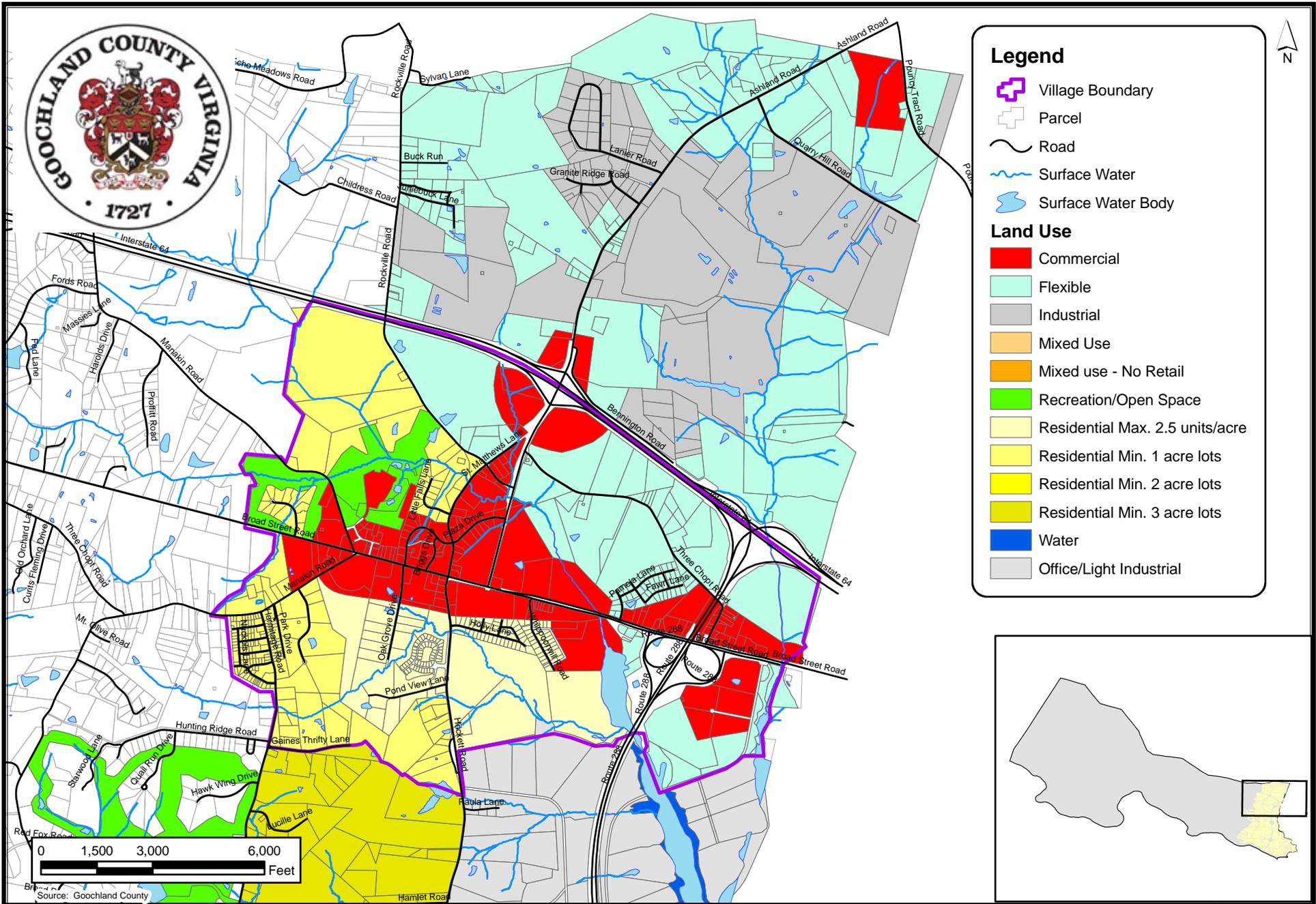
majority of the demand is anticipated to serve residential development. Commercial development is anticipated to incorporate only 32 acres in the village and has an estimated future demand of approximately 0.05 mgd. **Figure 32** reveals the anticipated future land use for Crozier Village area.

#### 5.4.9 Courthouse Village

According to the Comprehensive Plan, the Courthouse Village is anticipated to incorporate approximately 3,705 acres.<sup>164</sup> The Courthouse Village is anticipated to have a future demand of approximately 1.58 mgd. According to this estimate, the Courthouse Village is projected to have an average demand of approximately 427 gpd/acre. The majority of the projected demand, 0.76 mgd, is expected to serve commercial and industrial growth. The residential development, which is anticipated to incorporate nearly 2,713 acres, is expected to have a demand of approximately 0.43 mgd. **Figure 33** reveals the anticipated future land use for Courthouse Village area.

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<sup>164</sup> Goochland County 2028 Comprehensive Plan.

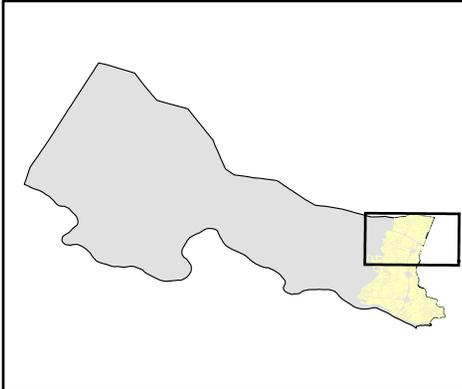


**Legend**

- Village Boundary
- Parcel
- Road
- Surface Water
- Surface Water Body

**Land Use**

- Commercial
- Flexible
- Industrial
- Mixed Use
- Mixed use - No Retail
- Recreation/Open Space
- Residential Max. 2.5 units/acre
- Residential Min. 1 acre lots
- Residential Min. 2 acre lots
- Residential Min. 3 acre lots
- Water
- Office/Light Industrial



0 1,500 3,000 6,000 Feet

Source: Goochland County

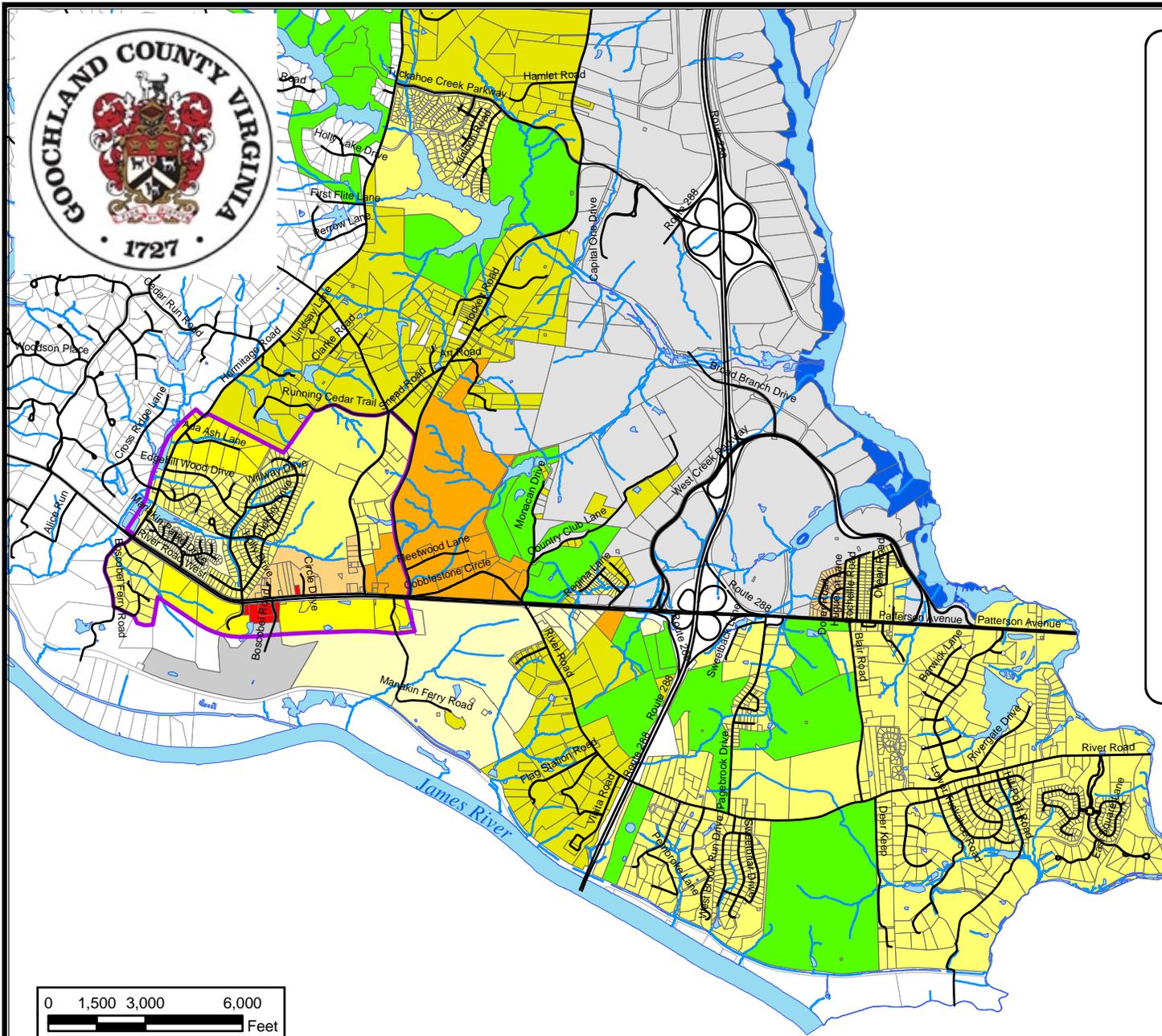
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**Eastern Goochland (North)**  
**Future Land Use**  
Goochland County, Virginia

FIGURE  
26

DAA# R07246-01

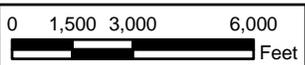


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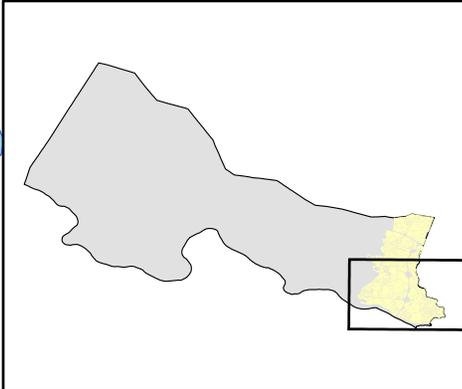
- Village Boundary
- Parcel
- Road
- Surface Water
- Surface Water Body

**Land Use**

- Commercial
- Flexible
- Industrial
- Mixed Use
- Mixed use - No Retail
- Recreation/Open Space
- Residential Max. 2.5 units/acre
- Residential Min. 1 acre lots
- Residential Min. 2 acre lots
- Residential Min. 3 acre lots
- Water
- Office/Light Industrial



Source: Goochland County



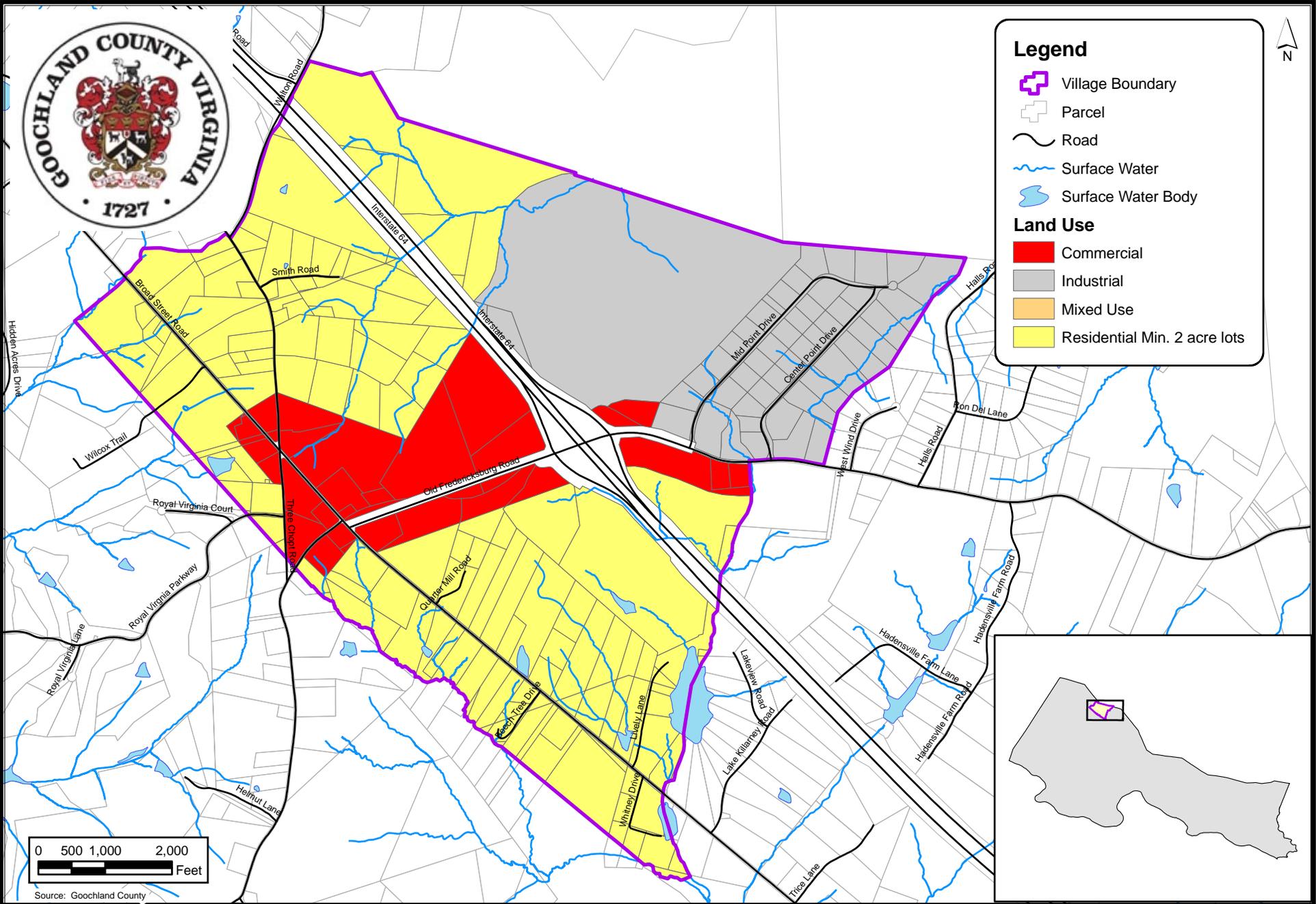


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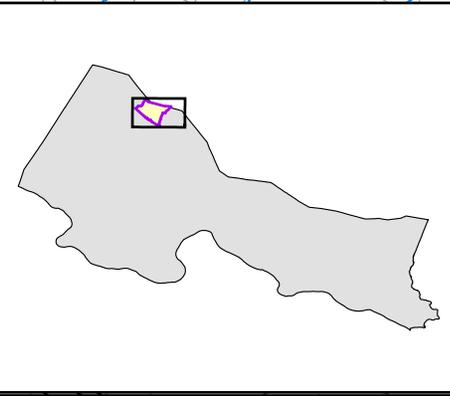
- Village Boundary
- Parcel
- Road
- Surface Water
- Surface Water Body

**Land Use**

- Commercial
- Industrial
- Mixed Use
- Residential Min. 2 acre lots



Source: Goochland County



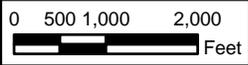
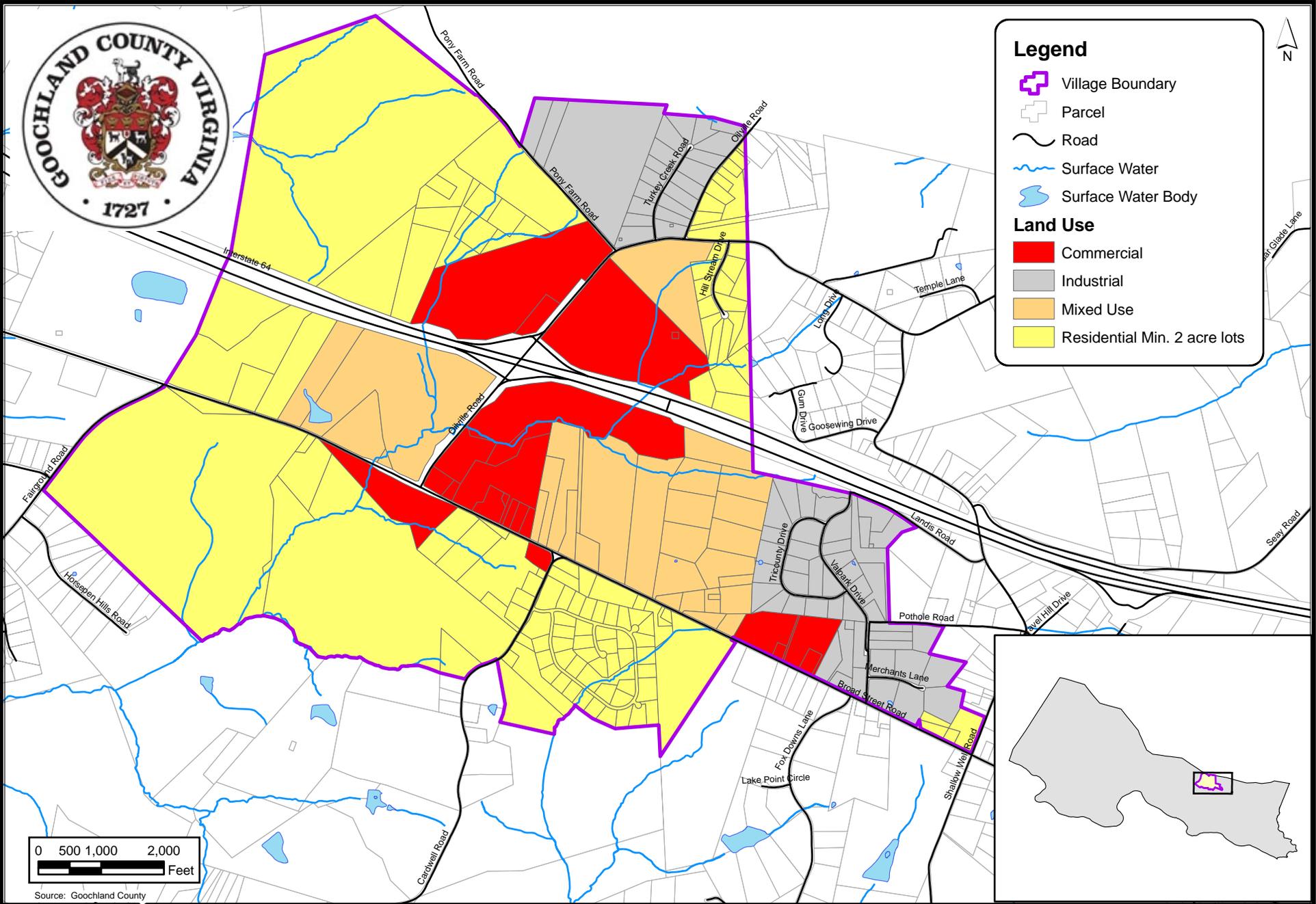


**Legend**

- Village Boundary
- Parcel
- Road
- Surface Water
- Surface Water Body

**Land Use**

- Commercial
- Industrial
- Mixed Use
- Residential Min. 2 acre lots



Source: Goochland County

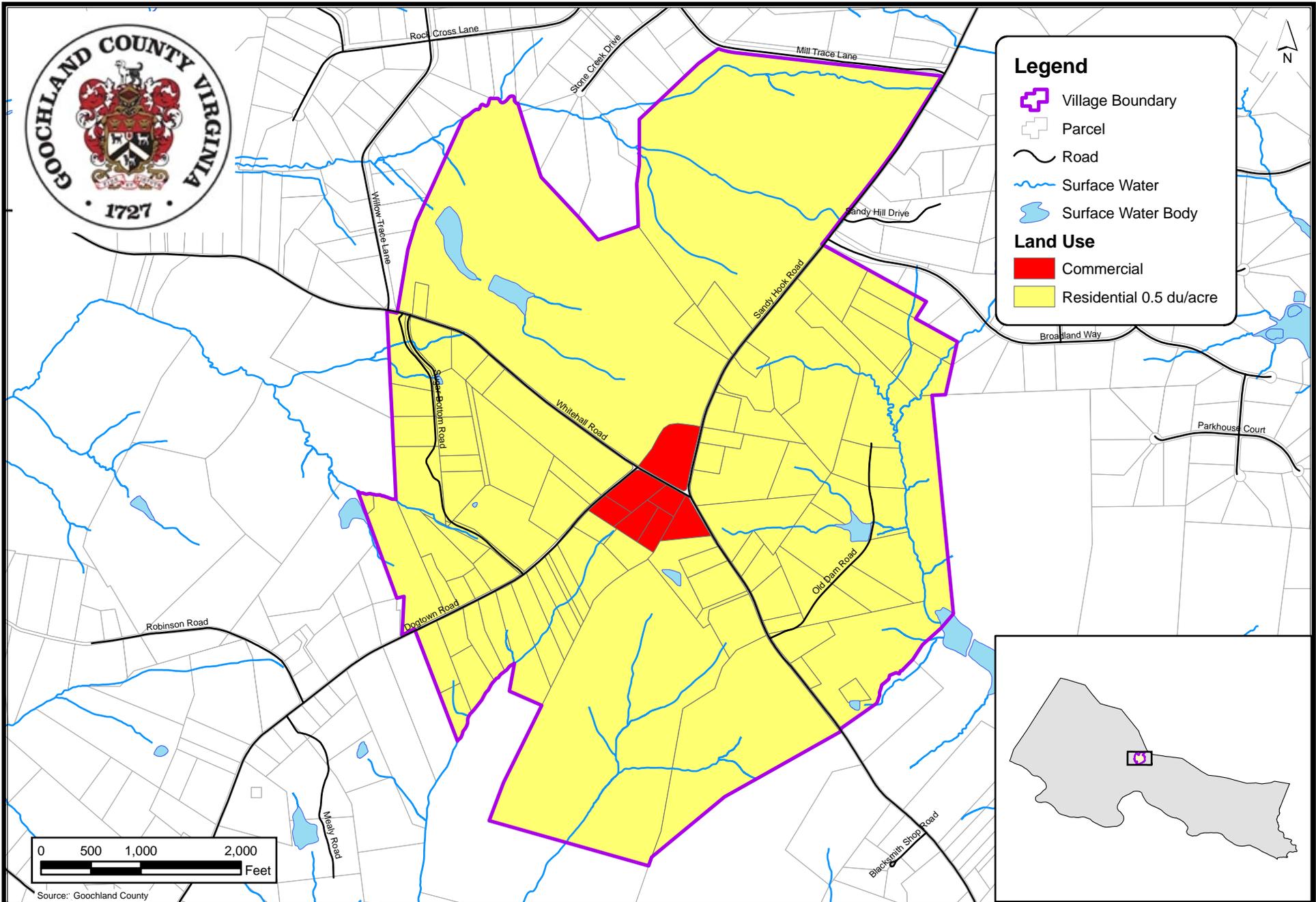


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**Oilville Village  
Future Land Use**  
Goochland County, Virginia

FIGURE  
29

DAA# R07246-01



**Legend**

- Village Boundary
- Parcel
- Road
- Surface Water
- Surface Water Body

**Land Use**

- Commercial
- Residential 0.5 du/acre

0 500 1,000 2,000 Feet

Source: Goochland County

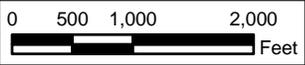
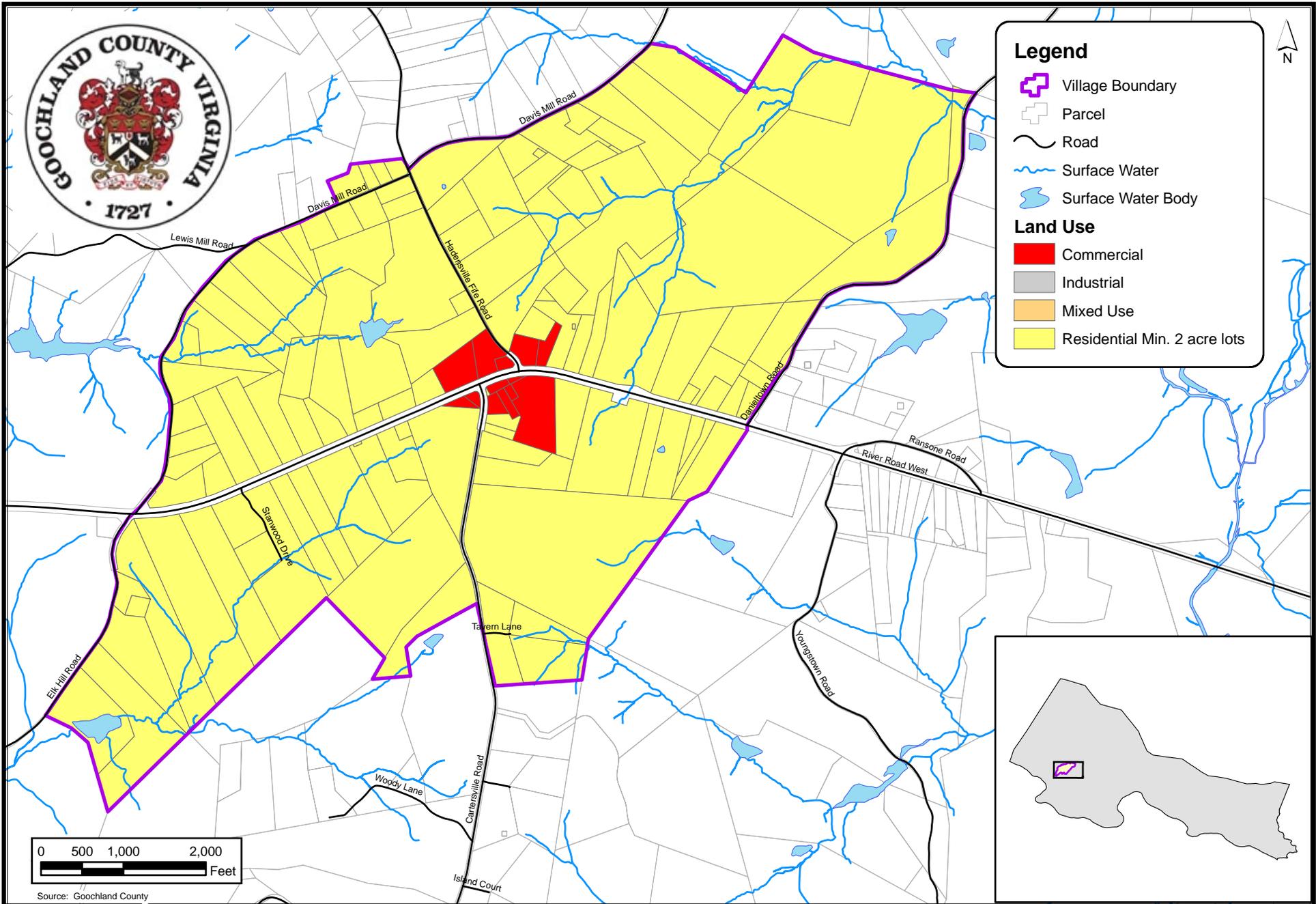
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**Sandy Hook Village**  
**Future Land Use**  
Goochland County, Virginia

**FIGURE**  
**30**

DAA# R07246-01



Source: Goochland County



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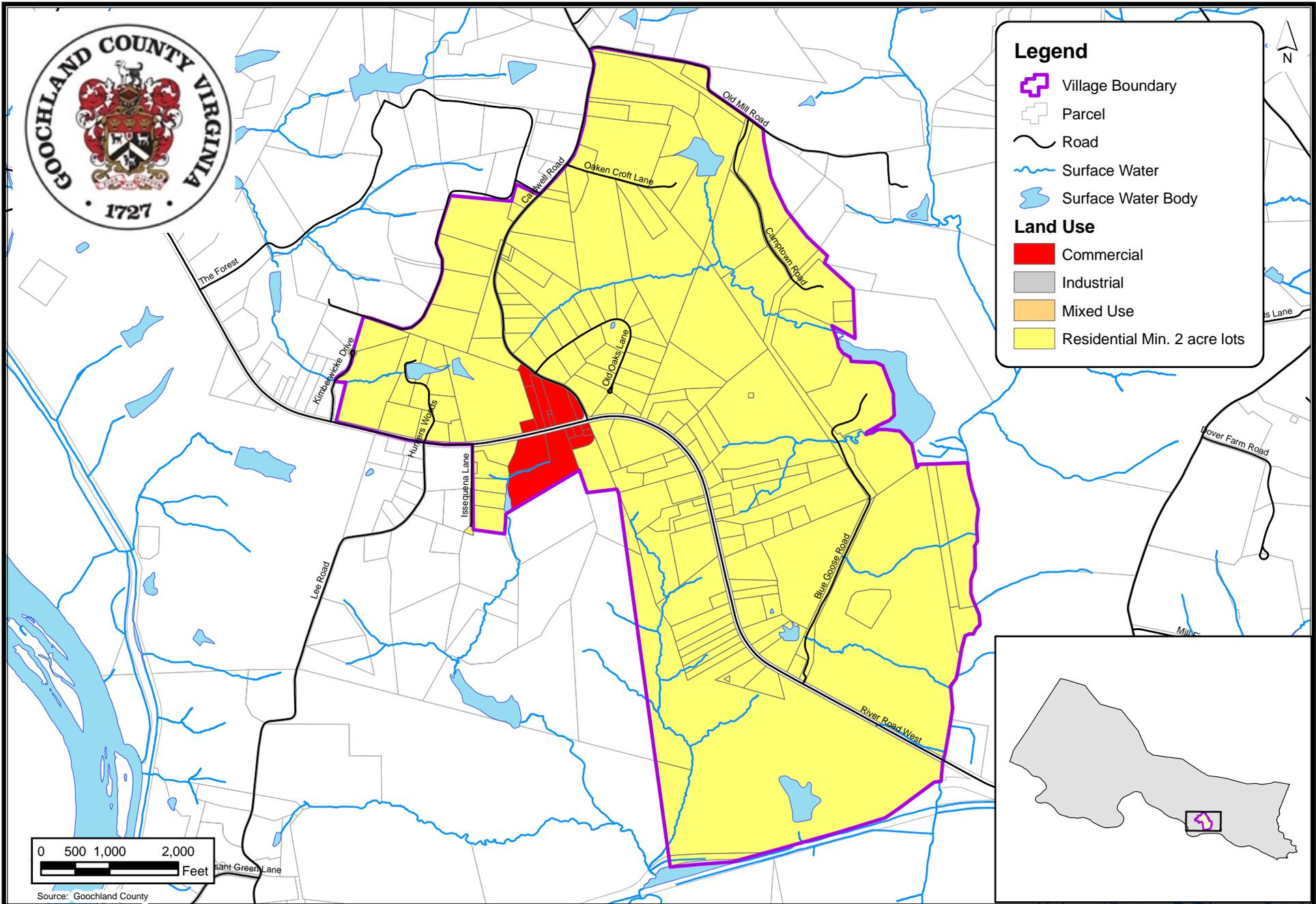
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## George's Tavern - Fife Village Future Land Use

Goochland County, Virginia

FIGURE  
31

DAA# R07246-01



**Legend**

- Village Boundary
- Parcel
- Road
- Surface Water
- Surface Water Body

**Land Use**

- Commercial
- Industrial
- Mixed Use
- Residential Min. 2 acre lots

0 500 1,000 2,000  
Feet

Source: Goochland County



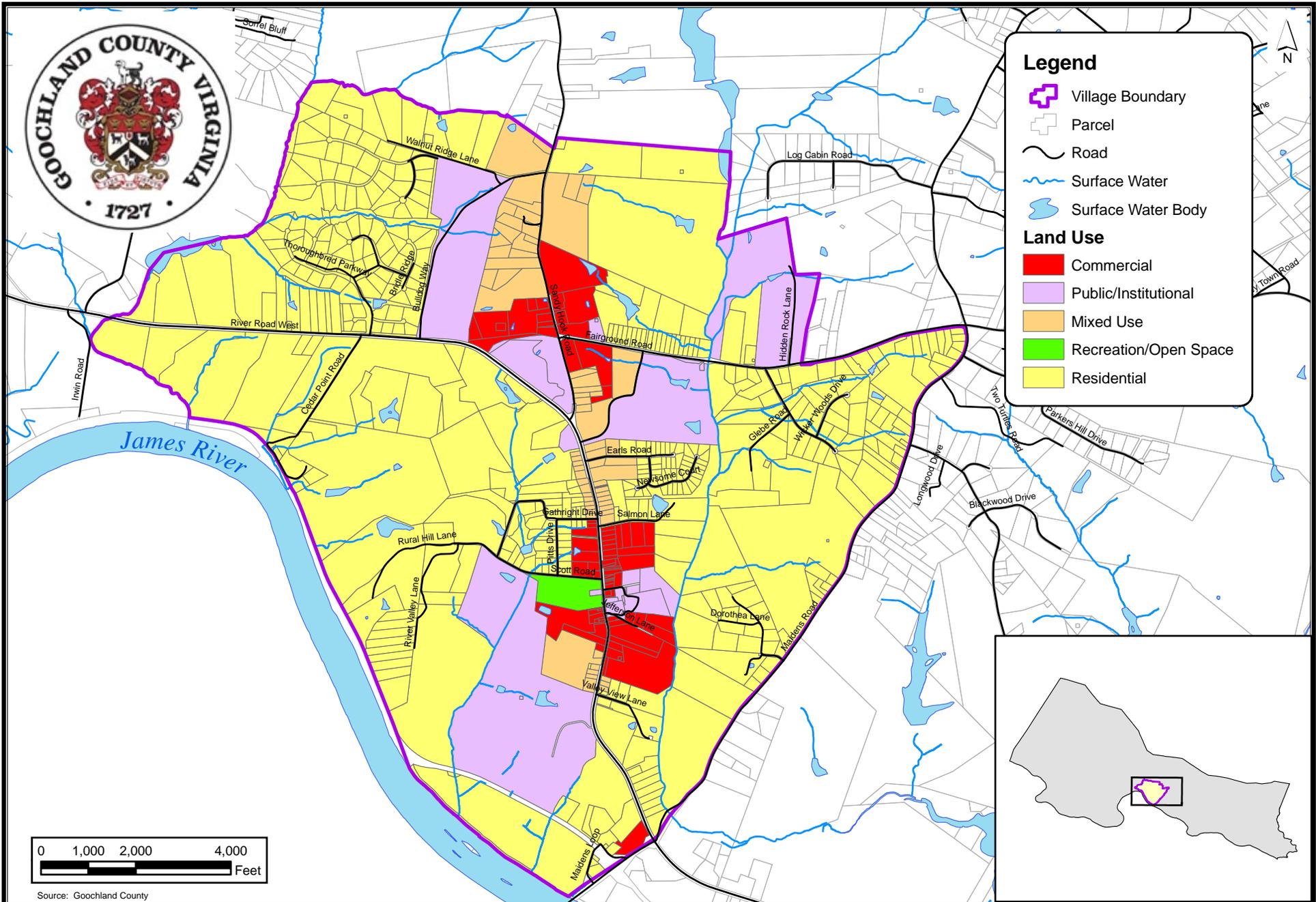
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**Crozier Village  
Future Land Use**  
Goochland County, Virginia

**FIGURE  
32**

DAA# R07246-01



Source: Goochland County



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**Courthouse Village  
 Future Land Use**  
 Goochland County, Virginia

FIGURE  
 33

DAA# R07246-01

#### 5.4.10 Land Use Demand by Census Tracts

In Goochland County, the majority of the county is covered by forestal and agricultural land. The total land designated for agricultural, forestal, and rural land in the future is estimated to be 153,947 acres, which comprises approximately 82.9% of the total land in Goochland County. This estimate is made assuming that the preservation of the county's rural characteristic is achieved and that the majority of future development occurs within the village and growth center boundaries.

According to the Comprehensive Plan, the agricultural, forestal, and rural land has an average of approximately 0.05 dwellings per acre. Assuming 1,500 gallons per dwelling per day, the total gallons per acre per day is approximately 75 gallons. However, water used by the agricultural sector must be added to this rural water usage estimate. Hence, in Goochland County, it is estimated that each acre of agricultural, forestal, and rural land uses approximately 85 gpd. When applying this number to the total available agricultural, forestal, and rural land, approximately 13.09 million gallons per day will be used in the future by this land designation.

For each census tract, the projected village demands and anticipated agricultural/forestal/rural residential demands were analyzed in order to estimate census tract demands. The following table reveals the future water demand for each census tract in Goochland County.

**Table 79: Census Tract Land Use Demand Projections**

Land Use	Land Area (acres)	Percent Developable (%)	Unit Flow Rate (gpd/acre)	Build-Out Flow (mgd)
<b>Census Tract 4001</b>				
Eastern Goochland	18,062	100	873	15.76
Agricultural/Forestral/Rural Residential	10,757	100	85	0.91
<b>Sub-Total Flow</b>				<b>16.68</b>
<b>Census Tract 4002</b>				
Oilville Village	2,075	100	744	1.54
Crozier Village	1,285	100	193	0.25
Agricultural/Forestral/Rural Residential	31,366	100	85	2.67
<b>Sub-Total Flow</b>				<b>4.46</b>
<b>Census Tract 4003</b>				
James River Correctional Center (Goochland)	100	100	3,000	0.30
James River Correctional Center (Powhatan)	200	100	3,000	0.60
Residential	2,844	100	160	0.46
<b>Sub-Total Flow</b>				<b>1.36</b>
<b>Census Tract 4004</b>				
Courthouse Village	3,705	100	427	1.58
Sandy Hook Village	775	100	191	0.15
Agricultural/Forestral/Rural Residential	46,854	100	85	3.98
<b>Sub-Total Flow</b>				<b>5.71</b>
<b>Census Tract 4005</b>				
George's Tavern-Fife Village	1,130	100	196	0.22
Hadensville Village	1,560	100	934	1.46
Agricultural/Forestral/Rural Residential	64,970	100	85	5.52
<b>Sub-Total Flow</b>				<b>7.20</b>
<b>Total Build-Out Flow</b>				<b>35.40</b>

5.4.11 Population and Land Use Projection Comparison

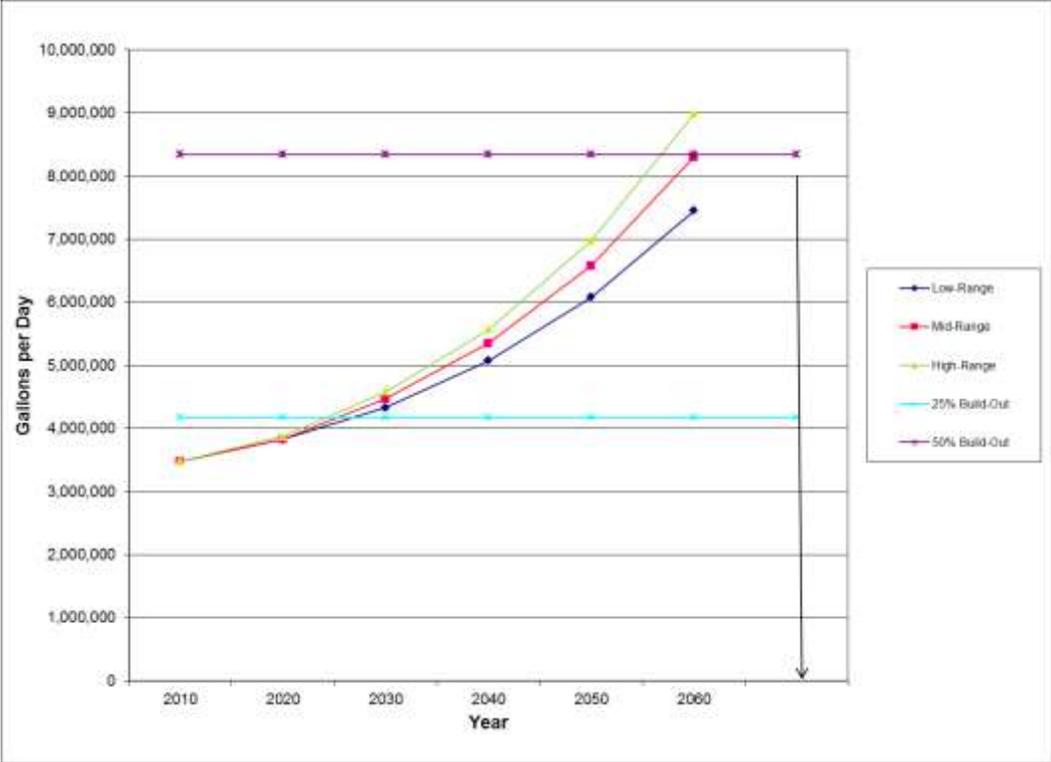
Using the demand estimates for each census tract, the build-out demands can be compared to the population estimates to obtain an estimate of when build-out flows may occur. The following sections compare the population demand estimates to the land use demand estimates.

5.4.12 Census Tract 4001

According to the land use demand estimate, Census Tract 4001 is anticipated to have a demand of approximately 16.68 mgd at build-out. The mid-range population estimate predicts a demand of only 8.29 mgd by 2060. This demonstrates that the Eastern Goochland Area will not reach full build-out by

2060 according to the projected population growth rates. If these assumptions hold true, Census Tract 4001 is not anticipated to experience the 50% build-out demand until 2060.

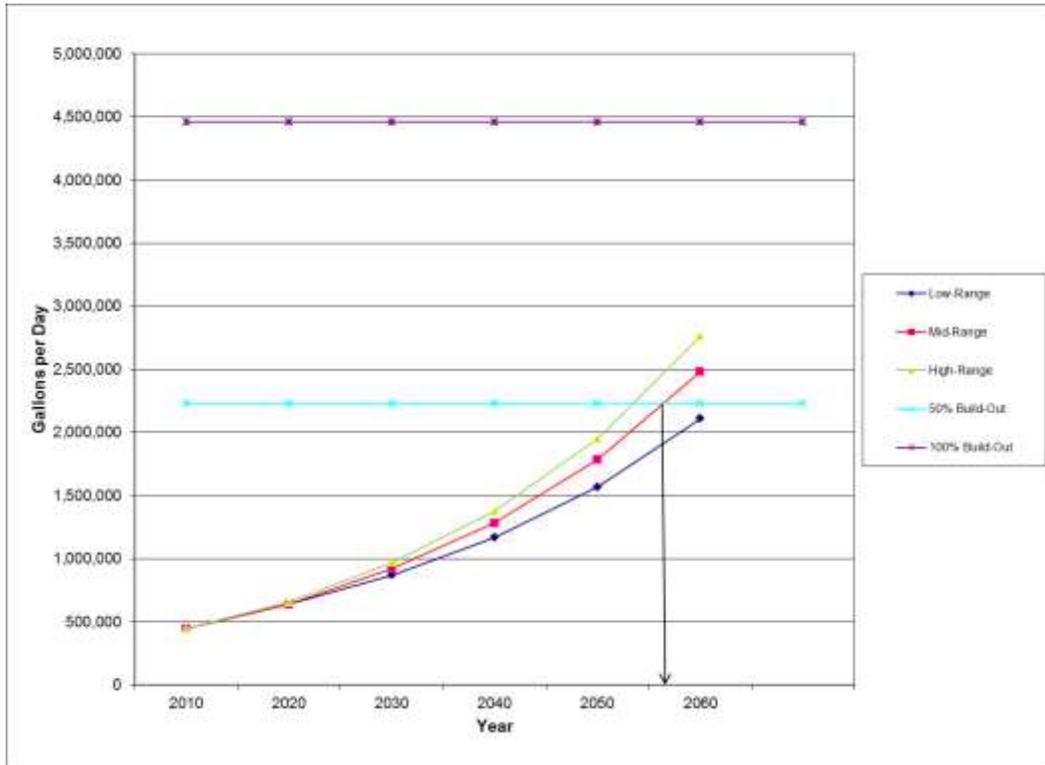
**Figure 34: Census Tract 4001 Population and Land Use Demand Comparison**



5.4.13 Census Tract 4002

According to the land use demand estimate, Census Tract 4002 is anticipated to have a demand of approximately 4.46 mgd at build-out. The mid-range population estimate predicts a demand of approximately 2.48 mgd by 2060. The following figure demonstrates that the 50% build-out flow is projected to occur after 2055. With these anticipated growth patterns and water demands, Census Tract 4002 is not anticipated to experience the build-out demand until beyond the planning horizon.

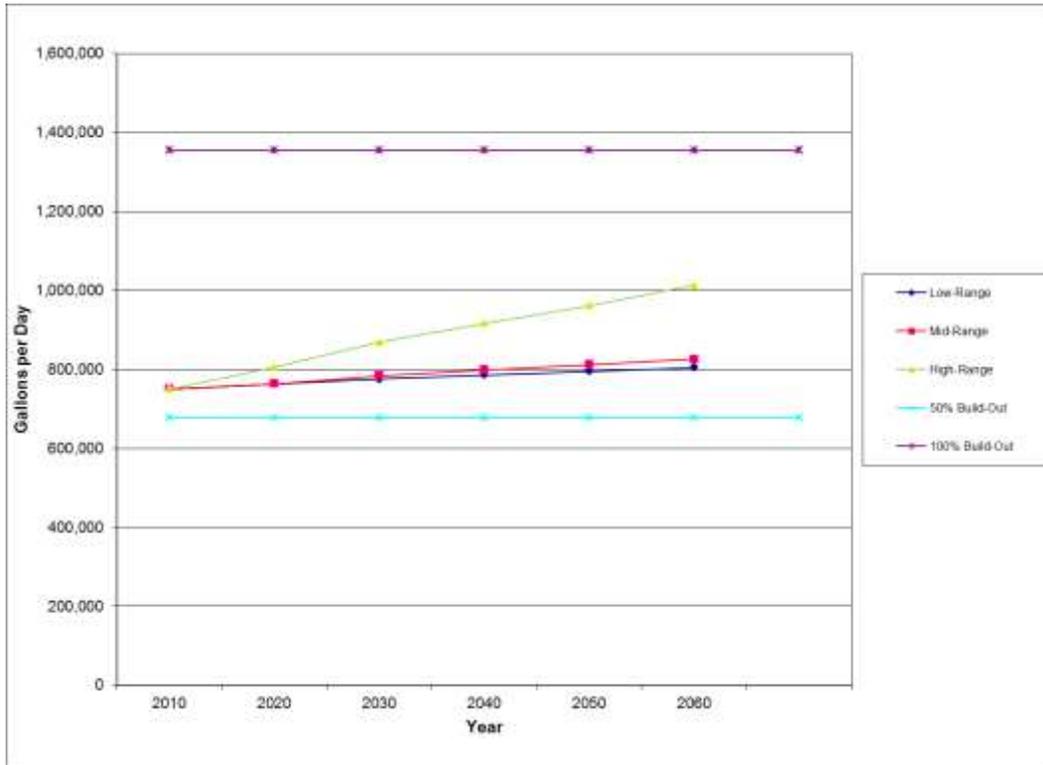
**Figure 35: Census Tract 4002 Population and Land Use Demand Comparison**



#### 5.4.14 Census Tract 4003

According to the land use demand estimate, Census Tract 4003 is anticipated to have a demand of approximately 1.36 mgd at build-out. The mid-range population estimate predicts a demand of approximately .83 mgd by 2060. When comparing these two estimates it becomes evident that Census tract 4003 will not experience the build-out demand within the planning horizon. The following figure depicts the future demands for Census Tract 4003.

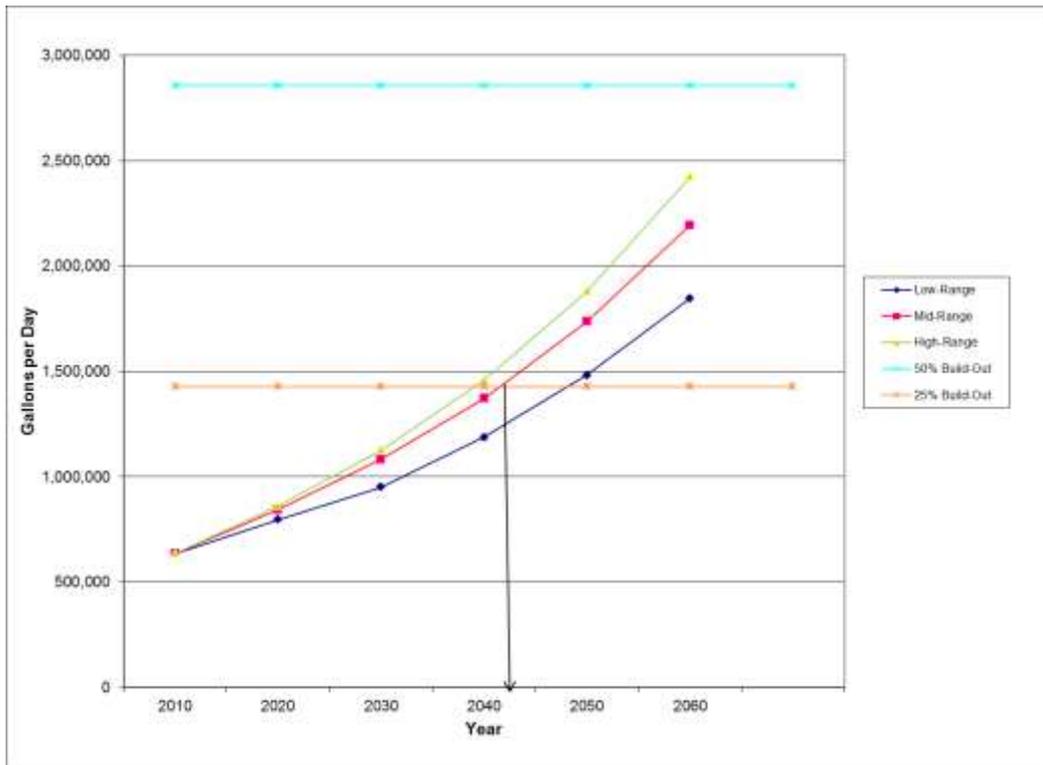
**Figure 36: Census Tract 4003 Population and Land Use Demand Comparison**



#### 5.4.15 Census Tract 4004

According to the land use demand estimate, Census Tract 4004 is anticipated to have a demand of approximately 5.71 mgd at build-out. The mid-range population estimate predicts a demand of approximately 2.19 mgd by 2060. When comparing these two estimates, it is predicted that the 4004 Census Tract will not see build-out out flows until well beyond 2060. The following figure demonstrates that the 25% build-out flow will occur near 2045.

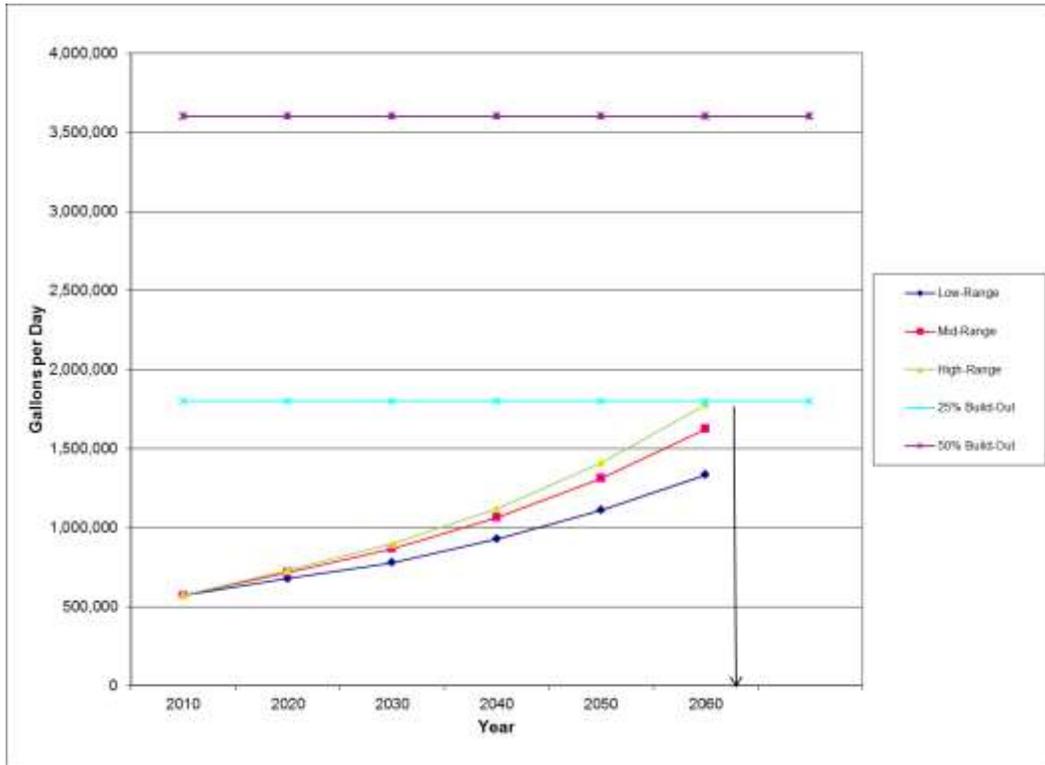
**Figure 37: Census Tract 4004 Population and Land Use Demand Comparison**



#### 5.4.16 Census Tract 4005

According to the land use demand estimate, Census Tract 4005 is anticipated to have a demand of approximately 7.20 mgd at build-out. The mid-range population estimate predicts a demand of approximately 1.62 mgd by 2060. When comparing these two estimates, it is predicted that the 4004 Census Tract will not see build-out out flows until beyond 2060. The following figure demonstrates that the 25% build-out flow may occur by 2060.

**Figure 38: Census Tract 4005 Population and Land Use Demand Comparison**



### 5.5 Comparison of Population-Based and Land-Use Based Projections

The following tables provides a comparison of the 2010 demands, the projected 2060 demands based on the mid-range population-based projections and the demand projections at full build-out.

**Table 80: Average Daily Water Demand Projections (Mid-range Population and Land Use)<sup>165</sup>**

Census Tract	Type of Water Use	Demand Projections (gpd)		
		2010	2060	Build-Out
4001	Community System (Eastern Goochland)	705,000	3,654,501	15,760,000
	Other Community Systems (Manakin Farms)	70,190	358,333	
	Quarries and Golf Courses	2,329,307	2,329,307	
	Self-Supplied Residential	<u>373,200</u>	<u>1,106,210</u>	<u>910,000</u>
	<b>Sub-Total</b>	<b>3,477,697</b>	<b>7,448,351</b>	<b>16,680,000</b>
4002	Community System (Crozier and Oilville) <sup>166</sup>	7,981	1,059,385	1,790,000
	Golf Course	16,667	16,667	
	Self-Supplied Residential	<u>419,200</u>	<u>1,404,301</u>	<u>2,670,000</u>
	<b>Sub-Total</b>	<b>443,848</b>	<b>2,480,354</b>	<b>4,460,000</b>
4003	Institutional (Goochland County)	190,739	190,739	300,000
	Institutional (Powhatan County)	559,260	559,260	600,000
	Self-Supplied Residential	-	<u>82,621</u>	<u>460,000</u>
	<b>Sub-Total</b>	<b>749,999</b>	<b>832,620</b>	<b>1,360,000</b>
4004	Community System (Courthouse)	144,000	877,736	1,580,000
	Other Community Systems	12,772	20,846	150,000
	Self-Supplied Residential	<u>478,000</u>	<u>1,295,758</u>	<u>3,980,000</u>
	<b>Sub-Total</b>	<b>634,772</b>	<b>2,013,449</b>	<b>5,710,000</b>
4005	Community Systems (Elk Hill)	5,480	13,267	<u>7,200,000</u>
	Golf Course	150,000	150,000	
	Self-Supplied Residential	<u>413,800</u>	<u>1,460,822</u>	
	<b>Sub-Total</b>	<b>569,280</b>	<b>1,624,089</b>	<b>7,200,000</b>
<b>Total</b>		<b>5,875,596</b>	<b>14,398,863</b>	<b>35,410,000</b>

<sup>165</sup> Agricultural uses are not included .

<sup>166</sup> Assumes a potential community water system in Oilville Village by 2020.