

### **3.0 EXISTING WATER USE INFORMATION**

Community systems in Goochland County use in total approximately 1.69 mgd, or 618.8 million gallons per year, from a variety of sources. These community systems serve approximately 4,135 people in Goochland County as well as 3,707 people in correctional centers in Powhatan County. Individual/private well systems use approximately 1.68 mgd and serve approximately 16,842 people in Goochland County. Non-transient-non-community systems withdraw approximately 18,700 gpd from wells.<sup>74</sup>

Another large water user in Goochland County is the agricultural sector. The agricultural sector in Goochland County uses an estimated 80.16 million gallons of water per year for livestock and irrigation of crops. However, this usage is heavily dependent on rainfall and climatic conditions. The self-supplied non-agricultural users such as quarries and golf courses in Goochland County use an estimated 1.44 and 1.06 mgd, respectively. The following table depicts the population served and water usage for all of the major water users in each census tract of Goochland County. A figure depicting the census tracts in Goochland County may be seen in Figure 21.

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<sup>74</sup> See Table 35.

Table 35: Goochland County Water Usage Summary

Census Tract	2010 Census	Water Systems Within Census Tract	Type of Water Use	Population Served (Estimated Based on 2006 Actual, Plus % Change in Census Tract from 2006 - 2010)	Average Daily Use (gpd)	Disaggregated Percentages	Disaggregated Uses (gpd)	Percentage of Total Water Usage in Census Tract (%)	Total Water Usage (mgd)	Gross Gallon per Capita per Day	Adjusted Gross Gallons per Capita**
4001	6,228	Eastern Goochland	Community	1,811	705,000	Residential: 85% Commercial: 5% Losses: 10%	Residential: 599,250 Commercial: 35,250 Unbilled: 70,500	20%	3.478	558	184
		Manakin Farms	Community	685	70,190	Residential: 95% Commercial: 5%	Residential: 66,680 Commercial: 3,510	2.0%			
		Luck Stone	Self-Supplied-Non-Agricultural	-	Unknown	Industrial: 100%	Industrial: Unknown	Unknown			
		Martin Marietta	Self-Supplied-Non-Agricultural	-	127,068	Industrial: 100%	Industrial: 127,068	3.7%			
		Vulcan Construction	Self-Supplied-Non-Agricultural	-	1,311,781	Industrial: 100%	Industrial: 1,311,781	37.7%			
		Sycamore Creek Golf Club	Self-Supplied-Non-Agricultural	-	200,000	Commercial: 100%	Commercial: 200,000	5.8%			
		Hermitage Country Club	Self-Supplied-Non-Agricultural	-	277,958	Commercial: 100%	Commercial: 277,958	8.0%			
		Kinloch Country Club	Self-Supplied-Non-Agricultural	-	312,500	Commercial: 100%	Commercial: 312,500	9.0%			
		Richmond Country Club	Self-Supplied-Non-Agricultural	-	100,000	Commercial: 100%	Commercial: 100,000	2.9%			
		Self-Supplied Residents	Self-Supplied Residential	3,732	373,200	Residential: 100%	Residential: 318,700	10.7%			
4002	4,264	Crozier	Community	72	7,981	Residential: 95% Commercial: 5%	Residential: 7,582 Commercial: 399	1.8%	0.444	104	100
		Kanawha Club	Self-Supplied-Non-Agricultural	-	16,667	Commercial: 100%	Commercial: 16,667	3.8%			
		Self-Supplied Residents	Self-Supplied Residential	4,192	419,200	Residential: 100%	Residential: 420,300	94.4%			
4003***	706	James River Correctional Center (Powhatan)	Community	3,707	559,260	Institutional: 100%	Institutional: 559,260	75%	0.750	253	253
		James River Correctional Center (Goochland)	Community	706	190,739	Institutional: 100%	Institutional: 190,739	25%			
4004	5,516	Courthouse	Community	434	144,000	Residential: 62% Commercial: 28% Losses: 10%	Residential: 89,280 Commercial: 40,320 Unbilled: 14,400	14%	0.635	115	115
		Jenkins Trailer Park	Community	111	2,923	Residential: 100%	Residential: 2,923	0.6%			
		Meadows Nursing Center	Community	191	9,849	Residential: 100%	Residential: 9,849	1.9%			
		Self-Supplied Residents	Self-Supplied Residential	4,780	478,000	Residential: 100%	Residential: 435,100	83.7%			
4005	4,263	Elk Hill Farm	Community	125	5,480	Residential: 100%	Residential: 5,480	1.0%	0.569	134	98
		Royal Virginia Golf Club	Self-Supplied-Non-Agricultural	-	150,000	Commercial: 100%	Commercial: 150,000	28.6%			
		Self-Supplied Residents	Self-Supplied Residential	4,138	413,800	Residential: 100%	Residential: 369,000	70%			
Countywide	-	Agriculture	Agricultural	-	219,616	Crops: 63% Livestock: 37%	Crops: 138,466 Livestock: 81,151	92.2%	0.238	-	-
		Non-Transient-Non-Community	Self-Supplied Public Facilities and Businesses	-	18,701	Public: 28% Residential: 14% Commercial: 58%	Public: 5,310 Residential: 2,584 Commercial: 10,807	7.8%			
				<b>20,977</b>	<b>24,684</b>	<b>6,113,913</b>					

\* The Estimated 2006 Census Tract Populations are estimated based on the 2005 U.S. Census Bureau Census Tract Populations for Goochland County and recent growth patterns.

\*\* Adjusted Gross Gallons per Capita does not include water usage from self-supplied-non-agricultural users such as golf courses and quarries.

\*\*\* The estimated water usage for the James River Correctional Center includes those that reside in Powhatan County. When applying the gross gallons per capita per day to the population of inmates that reside only in Goochland County, approximately 257,565 gpd are used.

Shaded cells reflect data that was updated in July 2011 to reflect current demands in the Goochland Courthouse service area, the closing of the James River Correctional Center in Goochland, and demands in Eastern Goochland.

When analyzing the total water usage in the county, it can be estimated that approximately 248 gross gallons per day are used per capita. However, this gross gallons per capita per day is estimated by applying the total estimated water consumed for agricultural, commercial, industrial, institutional, and residential uses in the county and dividing that water usage over every individual in the county<sup>75</sup>. This gross usage estimate is high when comparing it to the Virginia gross usage average of 170 gross gallons per capita per day.<sup>76</sup>

When analyzing Census Tract 4001, approximately 558 gross gallons per capita per day are used. However, a majority of the golf courses and quarries in the county are located within this census tract and the water usage from these self-supplied-non-agricultural users drives the gross gallons per capita per day up. When only analyzing the community and self-supplied residential water systems from Census Tract 4001, approximately 184 gross gallons per capita per day are used. However, when analyzing the Eastern Goochland Water System alone, approximately 389 gross gallons per capita per day are used. This high usage rate in the Eastern Goochland Water System is influenced by concentrations of residential and commercial developments. The Eastern Goochland Water System is also influenced by system flushing due to the low number of users in the northern Tuckahoe Creek Service District. The water in this area of the system must be flushed periodically in order to maintain acceptable chlorine levels.

In Census Tract 4003, the James River Correctional Center Treatment Plant serves correctional facilities in both Goochland and Powhatan County and the Goochland Courthouse District<sup>77</sup>, which is mostly located in Census Tract 4004. The correctional facilities' water usage, is approximately 253 gross gallons per capita per day.

The gross gallons per capita per day for Census Tracts 4002 and 4005 is also influenced by the presence of golf courses. The gross gallons per day for Census Tracts 4002 and 4004 are 104 and 134, respectively. However, when analyzing only community and self-supplied residential systems, the demands in Census Tracts 4002 and 4005 are 100 and 98 gallons per capita per day, respectively. Census Tract 4004, which is largely served by the Courthouse water system, has a

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<sup>75</sup> Includes the prison facilities located in Powhatan.

<sup>76</sup> Water Supply Plan Workshop in Charlottesville, VA on November 14, 2007.

<sup>77</sup> Population Served = Courthouse (434) + Powhatan County Correctional Centers (3,707) + Goochland County Correctional Centers (706).

gross gallons per capita per day of approximately 115. When analyzing only the Goochland Courthouse District's water usage, approximately 331 gross gallons per capita per day are used.

As required by the Regulation, current information on the existing water use in Goochland County is detailed in the following sections.

### **3.1 Community Water Systems<sup>78</sup>**

Limited water use information is reported to the Virginia Department of Health. As a result, information concerning peak day water use by month, maximum daily withdrawal, or disaggregated water usage is not available for the majority of the community systems.

#### **3.1.1 James River Correctional Center**

The James River Correctional Center Treatment Plant serves five correctional facilities and sells water to the Goochland Courthouse District serving approximately 5,761 people; 1,662 of which reside in Goochland County correctional facilities, 3,707 of which reside in Powhatan County correctional facilities, and 392 of which are served by the Goochland Courthouse District. The following table depicts the average daily production rates for the James River Correctional Center Treatment Plant in 2006 and 2007.

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<sup>78</sup> 9 VAC 25-180-80 B.

**Table 36: James River Correctional Center Treatment Plant Average Daily Production, 2006-2007<sup>79</sup>**

Month	Average Daily Production (mgd)	
	2006	2007
January	0.769	0.827
February	0.783	0.916
March	0.812	0.858
April	0.847	0.857
May	0.821	0.947
June	0.864	1.053
July	0.882	0.984
August	0.857	0.951
September	0.888	0.909
October	0.901	0.600
November	0.862	0.820
December	0.807	0.860
<b>Daily Average</b>	<b>0.841</b>	<b>0.882</b>
<b>Monthly Average</b>	<b>25.583</b>	<b>26.822</b>
<b>Annual</b>	<b>306.995</b>	<b>321.869</b>

As can be seen above, the average daily production for the James River Correctional Center Treatment Plant in 2007 was approximately 0.882 mgd. Through linear extrapolation, the average monthly and annual production for the James River Correctional Center Treatment Plant in 2007 was approximately 26.82 million gallons of water per month and approximately 321.87 million gallons of water per year. However, this usage is distributed among users in Powhatan County and Goochland County. The following table reveals the distribution of water usage from the James River Correctional Center Treatment Plant.

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<sup>79</sup> Virginia Department of Health water usage records.

**Table 37: James River Correctional Center Water Distribution<sup>80</sup>**

User	Population Served	Water Usage (gpd)	Gross Gallons per Capita per Day
James River Correctional Center (Powhatan)	3,707	559,260	151
James River Correctional Center (Goochland) (2011 Data)	1,000 <sup>81</sup>	190,739 <sup>82</sup>	191
Goochland Courthouse District (2010)	392	144,118	368
<b>Total</b>	<b>5,099</b>	<b>894,117</b>	<b>175</b>

As shown above, the correctional facilities in Powhatan County and Goochland County use approximately 0.750 mgd.. The Goochland Courthouse system purchases approximately 144,118 gpd from the James River Correctional Treatment Plant.<sup>83</sup> When distributing the treatment plant's total production over the total population that it serves (5,099 people), the production corresponds to a gross gallons per capita per day of approximately 175. The following table depicts the maximum daily production for each month in 2006 and 2007.

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<sup>80</sup> Table 37 reflects the closing of the Goochland JRCC in April 2011. The closing reduced the number of prisoners by approximately 673 and the water demands decreased by 60,000 gpd. In addition, in 2010, the demands in the Courthouse District increased to 144,188 gpd. The data in Table 37 includes data from 2007, 2010 and 2011; due to significant changes in the population and demands between 2007 and 2011, it is meaningful to include data from all timeframes.

<sup>81</sup> Estimated population served after April 2011. This number reflects the decrease of 673 prisoners; balance of "population served" includes the people at the training academy, work center, dairy and agribusiness operations.

<sup>82</sup> Water demands decreased by 60,000 gallons per day with the closing of the JRCC. Estimated 2011 demands based on 2007 demands, less 60,000 gpd.

<sup>83</sup> The Water Usage for the Goochland Courthouse District is detailed in Section 3.1.2.

**Table 38: Maximum Daily Production for the James River Correctional Center Treatment Plant**

Month	Max. Flow (MGD)	
	2006	2007
January	0.901	0.985
February	0.910	1.108
March	1.065	1.053
April	0.937	1.115
May	0.995	1.147
June	1.077	1.397
July	1.095	1.407
August	1.063	1.245
September	1.052	1.351
October	1.200	0.936
November	1.052	1.074
December	0.947	1.067

As shown above, the maximum daily flow occurred in the month of October during 2006 and during the month of July during 2007. In general, the maximum daily production occurs during the summer months of June, July, and August.

### 3.1.2 Goochland Courthouse

The Goochland Courthouse system purchases water from the James River Correctional Center Water Treatment Plant and is limited to 300,000 gpd due to the contractual agreement with the Department of Corrections. The population served by this waterworks is approximately 392 people; there are 76 business connections and 156 residential connections.<sup>84</sup> Usage rates from 2006 and 2007 are depicted in the following table.

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<sup>84</sup> 2006 County Wide Statistics.

**Table 39: Goochland Courthouse Usage, 2006-2007<sup>85</sup>**

Month	Monthly Usage (MG)	
	2006	2007
January	1.772	1.536
February	1.718	1.828
March	2.187	2.140
April	2.485	1.878
May	2.226	2.643
June	2.747	2.618
July	2.370	2.163
August	2.715	2.594
September	2.316	2.419
October	2.207	2.277
November	1.862	1.798
December	2.398	2.278
Daily Average	0.074	0.072
Monthly Average	2.250	2.181
<b>Annual</b>	<b>27.003</b>	<b>26.172</b>

As can be seen in the table above, the average daily demand in the Goochland Courthouse system in 2007 was approximately 0.072 mgd. Through linear extrapolation, the total monthly and annual usage was approximately 2.181 and 26.172 million gallons, respectively.

The maximum daily usage for the Goochland Courthouse system was estimated by applying a peaking factor of 1.8 to the average daily usage. The following table depicts the estimated maximum daily usage for 2006 and 2007.

**Table 40: Goochland Courthouse Maximum Daily Demands, 2006-2007**

Year	Maximum Daily Production (MGD)
2006	0.133
2007	0.129

The disaggregated usage for the Courthouse system is divided into three categories: residential, commercial, and losses. These categories consume 62%, 28%, and 10% of the total water used, respectively. The estimated disaggregated uses for 2006 and 2007 are shown below.

<sup>85</sup> Goochland County Billing Records.

**Table 41: Goochland Courthouse Disaggregated Water Usage, 2006-2007**

Year	Residential 62% (MG/year)	Commercial 28% (MG/year)	Losses 10% (MG/year)
2006	16.742	7.561	2.700
2007	16.227	7.328	2.617

### 3.1.3 Eastern Goochland Water System<sup>86</sup>

The Eastern Goochland Water System purchases water from Henrico County through four metered points: River Road, Patterson Avenue, Centerville, and Ridgefield Parkway. The population served by this waterworks is approximately 1,546 people. There are currently 65 business connections and 616 residential connections. The following tables depict the amount of water purchased from Henrico County in 2006 and 2007.

**Table 42: Eastern Goochland Purchased Water, 2006**

Month	River Road (MG/month)	Patterson (MG/month)	Centerville (MG/month)	Ridgefield Parkway (MG/month)	Total Water Purchased (MG/month)
January	1.39	1.52	1.10	0.52	4.53
February	1.21	1.95	0.72	0.00	3.88
March	1.35	2.46	1.77	0.21	5.79
April	1.20	2.27	1.39	0.41	5.27
May	1.46	3.55	2.28	2.21	9.50
June	1.20	7.96	2.05	1.73	12.94
July	1.24	3.22	2.04	1.29	7.79
August	1.46	3.19	4.40	1.75	10.80
September	1.32	3.29	1.27	1.05	6.93
October	1.23	3.21	1.83	0.79	7.06
November	1.28	3.17	1.89	0.68	7.02
December	1.23	3.40	1.46	0.34	6.43
<b>Daily Average</b>	<b>0.04</b>	<b>0.11</b>	<b>0.06</b>	<b>0.03</b>	<b>0.24</b>
<b>Monthly Average</b>	<b>1.30</b>	<b>3.27</b>	<b>1.85</b>	<b>0.91</b>	<b>7.33</b>
<b>Total</b>	<b>15.57</b>	<b>39.19</b>	<b>22.20</b>	<b>10.97</b>	<b>87.93</b>

<sup>86</sup> Goochland County Billing Records.

**Table 43: Eastern Goochland Purchased Water, 2007**

<b>Month</b>	<b>River Road (MG/month)</b>	<b>Patterson (MG/month)</b>	<b>Centerville (MG/month)</b>	<b>Ridgefield Parkway (MG/month)</b>	<b>Total Water Purchased (MG/month)</b>
January	1.40	8.07	1.27	1.17	11.91
February	1.19	12.12	2.13	2.30	17.74
March	1.27	5.17	2.31	1.17	9.92
April	1.17	6.90	2.32	1.81	12.19
May	1.46	10.74	4.11	2.92	19.22
June	1.19	10.91	4.34	3.83	20.27
July	1.45	13.33	3.11	5.55	23.43
August	1.23	9.83	4.61	3.68	19.35
September	1.26	10.95	4.60	5.06	21.86
October	1.41	10.18	4.51	3.92	20.01
November	1.29	5.62	2.30	1.26	10.48
December	1.34	4.12	1.48	0.98	7.91
<b>Daily Average</b>	<b>0.04</b>	<b>0.30</b>	<b>0.10</b>	<b>0.09</b>	<b>0.53</b>
<b>Monthly Average</b>	<b>1.30</b>	<b>8.99</b>	<b>3.09</b>	<b>2.80</b>	<b>16.19</b>
<b>Annual</b>	<b>15.64</b>	<b>107.93</b>	<b>37.08</b>	<b>33.64</b>	<b>194.29</b>

As can be seen in the tables above, the amount of water purchased from Henrico in 2007 was approximately 2.21 times higher than the amount of water purchased in 2006. This higher usage is largely due to the expansion of the Eastern Goochland Water System. In 2006, several community systems, including James River Estates and Pagebrook, abandoned their community well systems and connected to the Eastern Goochland Water System. This growth, combined with business and commercial development increased the water demands in 2007.

The average daily usage for 2007 was approximately 532,300 gpd. This average daily usage corresponds to an average monthly usage of 16.19 million gallons per month and an annual usage of 194.29 million gallons per year. When distributing this usage equally over the 1,546 people that the Eastern Goochland Water System serves, the usage corresponds to approximately 344 gross gallons per capita per day. This usage is influenced by commercial users in the West Creek Business Park. The high gross gallons per capita per day is also influenced by the large amount of water used for system flushing. In the northern area of the Tuckahoe Creek Service District, a small number of users and connections causes treated water to remain in the distribution system for a long period of time. This water must be flushed periodically in order to maintain acceptable chlorine levels.

The disaggregated usage for the Eastern Goochland Water System is divided into three categories: residential, commercial, and losses. Each category consumes 85%, 5%, and 10% of the total water used, respectively. The table below shows the estimated disaggregated use for 2006 and 2007.

**Table 44: Eastern Goochland Disaggregated Water Usage**

Year	Residential 85%	Commercial 5%	Losses 10%
	(MG/year)	(MG/year)	(MG/year)
2006	74.737	4.396	8.793
2007	165.147	9.715	19.429

#### 3.1.4 Groundwater Community Systems<sup>87</sup>

The community systems of Crozier, Elk Hill Farm, Jenkins Mobile Home Park, Manakin Farms, and Meadows Nursing Center serve a combined population of 1,054 people. The following table depicts the estimated water usage for each of these community systems. Due to the lack of water usage records, the maximum daily withdrawal was estimated by applying a common peak flow multiplier of 1.8 to the average daily withdrawal.

In total, these groundwater community systems withdraw approximately 96,423 gpd. Through linear extrapolation, the total monthly and annual usage in 2006 was approximately 2.93 and 35.19 million gallons, respectively. When distributing this usage equally over the 1,054 people that these groundwater community systems serve, the usage corresponds to approximately 92 gross gallons per capita per day. This gross gallons per capita day is lower when compared to other community systems in Goochland County largely because these systems mainly serve residential connections. These groundwater systems do not supply water to large non-residential users.

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<sup>87</sup> Virginia Department of Health Sanitary Survey Reports. See **Appendix F**.

**Table 45: Water Usage for Community Ground Water Systems, 2006**

FACILITY NAME	SOURCE	ACTIVE (A) INACTIVE (I)	NUMBER OF CONNECTIONS	POPULATION SERVED	AVERAGE DAILY WITHDRAWAL	MAXIMUM DAILY WITHDRAWAL	AVERAGE WATER CONSUMED PER MONTH	AVERAGE WATER CONSUMED PER YEAR
					(GPD)	(GPD)	(MGD)	(MGD)
Crozier	Well	A	24	72	7,981	14,366	0.24	2.91
Elk Hill Farm	Well	A	10	125	5,480	9,864	0.17	2.00
Jenkins Mobile Home Park (Well 1)	Well	A	49	100	2,923	5,261	0.09	1.07
Jenkins Mobile Home Park (Well 2)	Well	A						
Manakin Farms (Well 4)	Well	A	195	585	70,190	126,342	2.13	25.62
Manakin Farms (Well 6)	Well	A						
Manakin Farms (Well 7)	Well	A						
Manakin Farms (Well 8)	Well	A						
Manakin Farms (Well 9)	Well	A						
Meadows Nursing Center	Well	A	1	172	9,849	17,728	0.30	3.59
<b>Total</b>				<b>1,054</b>	<b>96,423</b>	<b>173,561</b>	<b>2.93</b>	<b>35.19</b>

Source: Virginia Department of Health Sanitary Survey Reports. See Appendix F.

### 3.2 Self-Supplied Non-Agricultural Users of More than 300,000 Gallons per Month of Surface and Groundwater Within the Service Area of a Community System

Based on a review of records from the Virginia Department of Health and Department of Environmental Quality, there are no known non-agricultural self-supplied groundwater users within the service area of community systems in Goochland County. However, there are several non-agricultural self-supplied surface water users that are within the service area of the community water systems. Of the non-agricultural self-supplied surface water users detailed in Section 2.5 of this Plan, five can be considered to be within the service area of a community water system. These five non-agricultural self-supplied surface water users include: Hermitage Country Club, Richmond Country Club, Kinloch Country Club, Sycamore Creek Golf Club, and Luck Stone. The table below depicts the surface water usage from the five non-agricultural self-supplied water users within a community system.

**Table 46: Non-Agricultural Self-Supplied Water Use Within a Community System**

Non-Agricultural Self-Supplied Users	Community System	Estimated Daily Usage	Monthly Usage	Annual Usage
		(gpd)	(MG/month)	(MG/year)
Hermitage Country Club	Eastern Goochland	277,958	8.34	66.71
Kinloch	Eastern Goochland	312,500	9.38	75.00
Richmond Country Club	Eastern Goochland	100,000	3.00	24.00
Sycamore Creek Golf Course	Eastern Goochland	200,000	6.00	48.00
Luck Stone	Manakin	-	-	-
<b>Total</b>		<b>890,458</b>	<b>26.71</b>	<b>213.71</b>

The total water used by golf courses within community systems is approximately 213.71 million gallons of water a year. The amount of water used by Luck Stone quarries for dust suppression and aggregate washing is unknown<sup>88</sup>. The following section details the surface water usage for each non-agricultural self-supplied user within community water systems.

#### 3.2.1 Hermitage Country Club

According to the Department of Environmental Quality, the total annual usage by the Hermitage Country Club during 2006 was approximately 66.71 million

<sup>88</sup> The Luck Stone quarries are not required to meter or report water usage.

gallons of water. The surface water for the Hermitage Country Club is used for irrigating the greens on all 36 holes of the golf course. The following table depicts the club’s water usage for each month in 2006.

**Table 47: Hermitage Country Club Water Usage for Irrigation, 2006<sup>89</sup>**

<b>Month</b>	<b>Monthly Usage (mgd)</b>
Jan	0.00
Feb	0.00
Mar	1.84
Apr	2.72
May	6.94
Jun	10.18
Jul	12.25
Aug	13.04
Sep	9.91
Oct	7.04
Nov	2.28
Dec	0.51
<b>Total</b>	<b>66.71</b>

According to the data above, the months that experience the largest withdrawals for irrigation from the on-site irrigation pond are March through November. During these months, the average water usage is 7.36 million gallons per month.

### 3.2.2 Kinloch Country Club

The Kinloch Country Club golf course includes 36 holes where both the greens and fairways are irrigated. The Virginia Department of Health and the Department of Environmental Quality do not maintain water usage records for the Kinloch Country Club. An estimate for the Kinloch water usage can be made by comparing the size of the Kinloch Country Club and the different irrigation practices with the other country clubs in the area. It is estimated that the Kinloch Country Club uses nearly 75.0 million gallons of water per year for irrigation.

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<sup>89</sup> Department of Environmental Quality Water Usage Records. See **Appendix C**.

### 3.2.3 Richmond Country Club<sup>90</sup>

The Virginia Department of Health and the Department of Environmental Quality do not maintain water usage records for the Richmond Country Club. The superintendent of the Richmond Country Club estimated that 24 million gallons of water are used per year to irrigate the greens and fairways of the 18-hole course from March to October. During these months, the average monthly usage is approximately 3.0 million gallons.

### 3.2.4 Sycamore Creek Golf Course<sup>91</sup>

The Virginia Department of Health and the Department of Environmental Quality do not maintain water usage records for the Sycamore Creek Golf Course. According to the owners of the Sycamore Creek Golf Club, 48 million gallons of water per year are used to irrigate the club's 18-hole course from mid-March to mid-October. During these months, the average monthly usage is approximately 6.0 million gallons per month.

### 3.2.5 Luck Stone

The quarry does not record or monitor their water usage. However, most water that is used by quarries eventually returns to the bottom of the quarry to be used again for dust suppression and aggregate washing through seepage and reuse.

## **3.3 Self-Supplied Agricultural Users of More than 300,000 Gallons per Month of Surface and Groundwater Within the Service Area of a Community System<sup>92</sup>**

Based on a review of records from the Virginia Department of Health and the Department of Environmental Quality, there are no known self-supplied agricultural users that use more than 300,000 gallons per month from a surface or groundwater source within community systems.

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<sup>90</sup> Phone interview with Richmond Country Club Superintendent.

<sup>91</sup> Phone interview with the Sycamore Creek Golf Course Owners.

<sup>92</sup> 9 VAC 25-780-80 B.7.

### 3.4 Self-Supplied Users of Less than 300,000 Gallons per Month of Groundwater Within the Service Area of a Community System<sup>93</sup>

Based on a review of records from the Virginia Department of Health and the Department of Environmental Quality and communication with county officials, there are no known self-supplied users that use less than 300,000 gallons per month of groundwater within community systems in Goochland County.

### 3.5 Self-Supplied Non-Agricultural Users of More than 300,000 Gallons per Month of Surface and Groundwater Outside the Service Areas of the Community Water Systems<sup>94</sup>

After reviewing the Virginia Department of Health and the Department of Environmental Quality records, the Kanawha Club is the only non-agricultural self-supplied groundwater user outside of the service area of a community water system. Of the non-agricultural self-supplied surface water users mentioned in detail in Section 2.5 of this Plan, only three are outside the service area of a community water system. These three non-agricultural self-supplied surface water users include: Royal Virginia Country Club, Martin Marietta Materials, and Vulcan Construction Materials. The following table depicts the groundwater and surface water usage from the four non-agricultural self-supplied water users outside community systems.

**Table 48: Non-Agricultural Self-Supplied Water Use Outside a Community System**

Non-Agricultural Self-Supplied Users	Estimated Daily Usage	Monthly Usage	Annual Usage
	(gpd)	(MG/month)	(MG/year)
Kanawha Club	16,667	0.51	6.08
Royal Virginia Golf Club	150,000	4.56	54.75
Martin Marietta Materials	127,068	3.86	46.38
Vulcan Construction Materials	1,311,781	39.90	478.80
<b>Total</b>	<b>1,605,516</b>	<b>48.83</b>	<b>586.01</b>

As shown above, the total water use for non-agricultural self-supplied surface and groundwater users outside a community system is approximately 586 million gallons of water per year. The following section details the surface water and groundwater usage for each non-agricultural self-supplied user outside community water systems.

<sup>93</sup> 9 VAC 25-780-80 B.8.

<sup>94</sup> 9 VAC 25-780-80 C.

### 3.5.1 Kanawha Club<sup>95</sup>

According to the manager of the Kanawha Club Golf Course, approximately 4.0 million gallons of water per year are used to irrigate the club's short 9-hole course. The golf course uses four wells to fill an on-site storage pond, which is used for irrigation. The club irrigates the course for only eight months out of the year and is closed for the other four months. During the months of operation, the Kanawha Club uses approximately 0.5 million gallons of water per month.

### 3.5.2 Royal Virginia Golf Club

The annual usage by the Royal Virginia Golf Club, an 18-hole course that irrigates both the greens and their fairways, is not known. However, an estimate for the Royal Virginia Country Club water usage can be made by comparing it to other 18-hole courses in Goochland County. Other 18-hole courses in the surrounding area include the Richmond Country Club and the Sycamore Creek Golf Course. When averaging the Richmond Country Club usage with Sycamore Creek Golf Course usage, an estimate of the water usage for the Royal Virginia Golf Club can be obtained (assuming that irrigation practices do not vary significantly for golf courses in Goochland County). As a result, it is estimated that the Royal Virginia Golf Club uses approximately 55 million gallons of water a year for irrigation of its greens and fairways.

### 3.5.3 Martin Marietta Materials

According to the Department of Environmental Quality, the total annual water usage for the Martin Marietta Materials Quarry in 2006 was approximately 46 million gallons of water. The surface water used at the Martin Marietta Materials Quarry is supplied by an on-site pond and from water that infiltrates into the sump of the quarry. The following table depicts the quarry's water usage for each month in 2006.

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<sup>95</sup> Phone interview with the Kanawha Club manager.

**Table 49: Martin Marietta Materials Water Usage, 2006<sup>96</sup>**

Month	Monthly Usage (mgd)
Jan	5.04
Feb	5.10
Mar	1.92
Apr	1.53
May	2.82
Jun	3.75
Jul	2.46
Aug	1.80
Sep	1.35
Oct	6.66
Nov	5.52
Dec	8.43
<b>Total</b>	<b>46.38</b>

### 3.5.4 Vulcan Construction Materials

According to the Department of Environmental Quality, the total amount of water used by the Vulcan Construction Materials Quarry in 2006 was approximately 478.8 million gallons of water. The surface water used for aggregate washing and dust suppression is supplied by both the pit sump and the Little Tuckahoe Creek. The following table reveals the water withdrawal for each month from each of the surface water sources.

**Table 50: Vulcan Construction Materials Water Usage, 2006<sup>97</sup>**

Pit Sump		Little Tuckahoe Creek	
Month	Monthly Usage (mgd)	Month	Monthly Usage (mgd)
Jan	20.60	Jan	14.80
Feb	18.00	Feb	24.80
Mar	22.60	Mar	16.40
Apr	19.20	Apr	17.10
May	21.70	May	16.50
Jun	16.30	Jun	20.50
Jul	14.20	Jul	14.10
Aug	20.60	Aug	24.40
Sep	16.20	Sep	17.30
Oct	22.00	Oct	22.20
Nov	15.90	Nov	44.30
Dec	12.70	Dec	26.40
<b>Total</b>	<b>220.00</b>	<b>Total</b>	<b>258.80</b>

<sup>96</sup> Department of Environmental Quality Water Usage Records. See Appendix C.

<sup>97</sup> Department of Environmental Quality Water Usage Records. See Appendix C.

As can be seen in the table above, the Vulcan Construction Materials quarry equally distributes the water withdrawal from both sources. The water withdrawn from the pit sump, which mainly consists of surface runoff from rainfall, is pumped into the Little Tuckahoe Creek after the majority of sediment is allowed to settle.

### 3.6 Self-Supplied Agricultural Users of More than 300,000 Gallons per Month of Surface and Groundwater Outside the Service Areas of the Community Water Systems<sup>98</sup>

After reviewing records from the Virginia Department of Health and the Department of Environmental Quality, no data concerning individual agricultural users for livestock or crops was available. Using information from the 2002 Census of Agriculture, an estimate of water used by the agricultural sector in Goochland County is detailed in the following section.

The approximate volume of water used by the agricultural sector in Goochland County for livestock and crops was estimated to be nearly 80 million gallons of water per year. The volume of water used by livestock was estimated to be about 30 million gallons per year and the volume used for crop irrigation was estimated to be slightly over 50 million gallons per year. The estimated volume of water used by the livestock in Goochland County is tabulated below.

**Table 51: Goochland County Livestock Water Use**

Type of Livestock	# in 2002	Water Needed per Animal (gal/day) <sup>99</sup>	Total Annual Water Need (gal)
Beef Cattle and Calves	3,281	12	14,370,780
Milk Cows	611	35	7,805,525
Hogs and Pigs	93	4	118,808
Sheep and Lambs	151	2	110,230
Poultry - Layers	381	0	8,344
Poultry - Broilers	329,000	0	7,205,100
Horses	2,400	12	10,512,000
<b>Total</b>			<b>29,618,786</b>

<sup>98</sup> 9 VAC 25-780-80 D.

<sup>99</sup> Handbook for Extension Agents; NC State University; 1982.

When estimating the volume of water used to irrigate corn for silage, it can be assumed that only 10% of corn acreage is irrigated. Further, corn used for silage is only irrigated for five months out of the year (April-September). It can also be assumed that crops used for grain and soybeans do not require irrigation in Goochland County.<sup>100</sup> The following table depicts estimates of water usage for irrigation of crops in Goochland County.

**Table 52: Goochland County Crop Water Use**

Type of Crop	Acres in 2002	Acres Irrigated	Number of Farms	Approximate Irrigation (in/acre/yr)	Total Annual Irrigation (Gallons)
Corn for Silage	1,489	148.9	9	10 - 15 inches	50,540,383
Corn for Grain	1,883	0	15	0	0
Wheat for Grain	1,667	0	10	0	0
Oats for Grain	10	0	3	0	0
Soybeans	1,512	0	5	0	0
<b>Total</b>					<b>50,540,383</b>

### **3.7 Estimate of Water used by Self-Supplied Users of Less than 300,000 Gallons per Month of Groundwater and an Outside the Service Areas of the Community Water Systems<sup>101</sup>**

#### **3.7.1 Self-Supplied Residences**

As discussed in Section 2.10.1 of this Plan, the total population that uses self-supplied wells in Goochland County is approximately 16,842 people. Assuming that each individual consumes 100 gpd<sup>102</sup>, the total daily use for residential self-supplied systems is approximately 1.68 million gallons per day; or annual demands of approximately 615 million gallons. It is be assumed that no single residential self-supplied groundwater system withdraws more than 300,000 gallons per month.

#### **3.7.2 Self-Supplied Businesses and Public Facilities**

Water use information concerning transient-non-community systems in Goochland County is scarce. Many of these systems are known as “grandfathered systems” and are not required to monitor or report their water usage. Hence, water usage for these systems is unknown.

<sup>100</sup> Goochland County Agricultural Extension Agent.

<sup>101</sup> 9 VAC 25-780-80 E.

<sup>102</sup> Virginia Department of Health Waterworks Regulations, Section 12 VA 5-590-690.

However, most of the non-transient-non-community water systems in Goochland County monitor and report their water consumption. The following table portrays the population served, number of connections, average and maximum daily withdrawals, and the monthly and annual water consumption for each active non-transient-non-community water system in Goochland County. In order to calculate the maximum daily withdrawal, the average daily withdrawal was multiplied by a common peak flow multiplier of 1.8. The average monthly and annual water usage estimates were linearly extrapolated from the average daily withdrawal data.

**Table 53: Non-Transient-Non-Community Water Use, 2006**

FACILITY NAME	ACTIVE (A) INACTIVE (I)	POPULATION SERVED	NUMBER OF CONNECTIONS	AVERAGE DAILY WITHDRAWAL	MAXIMUM DAILY WITHDRAWAL	AVERAGE WATER CONSUMED PER MONTH	AVERAGE WATER CONSUMED PER YEAR
				(GPD)	(GPD)	(MGD)	(MGD)
<b>ACTIVE</b>							
Byrd Elementary School	A	323	1	2,039	3,670	0.06	0.74
Hermitage Country Club	A	100	1	8,654	15,577	0.26	3.16
Randolph Elementary School	A	439	1	3,271	5,888	0.10	1.19
Sabot Hill Farm	A	38	9	2,584	4,651	0.08	0.94
Salem Baptist Church	A	500	2	-	-	-	-
Veterinary Referral & Critical Care (Well #1)	A	62	1	2,153	3,875	0.07	0.79
Veterinary Referral & Critical Care (Well #2)	A						
<b>Total</b>		<b>1,462</b>	<b>15</b>	<b>18,701</b>	<b>33,662</b>	<b>0.57</b>	<b>6.83</b>

Source: Virginia Department of Health Sanitary Survey Reports. See Appendix F.