Initial Groundwater Management Plan for the Lowcountry Capacity Use Area

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Executive Summary

South Carolina's Groundwater Use and Reporting Act (Chapter 5, Section 49-5-60) gives the South Carolina Department of Health and Environmental Control (DHEC) the legal authority and mandate to establish and implement a local groundwater management program in designated Capacity Use Areas. Effective groundwater management ensures that the groundwater resources of the State are put to beneficial use to the fullest extent which they are capable, conserves and protects the resource, prevents waste, and establishes conditions which are conducive to the development and long-term viability of the water resources. As aquifers and the relative social and economic requirements of the State vary by area and region, groundwater management should be locally and/or regionally assessed, balancing all needs and interests. In this regard, DHEC coordinates with local stakeholders to achieve the stated goals of the plan leading to sustainable development of the groundwater resources. Sustainable development is the key guiding principle, where South Carolina's groundwater resources are managed so that development meets the needs of the present without compromising the ability of future generations to meet their needs.

Introduction

On July 24, 1981, the South Carolina Water Resources Commission established and declared the whole of Jasper County, Beaufort County, and Colleton County as the ***Lowcountry Capacity Use Area*** (Lowcountry Area), Figure 1. Hampton County was added on June 10, 2008. The Lowcountry Area was the second of the four currently declared Capacity Use Areas in South Carolina. Within the Lowcountry Area, no person shall withdraw, obtain, or otherwise utilize groundwater at or in excess of three (3) million gallons per month for any purpose unless said person shall first obtain a Groundwater Withdrawal Permit from DHEC. A groundwater withdrawer is defined as any person withdrawing groundwater at or in excess of three (3) million gallons during any one month from a *single well* or *multiple wells* within a one-mile radius of any existing or proposed well.

A part of this designation is the development of the Lowcountry Area Groundwater Management Plan. The plan will guide the initial groundwater management strategy and provide direction for future groundwater management goals by evaluating, as data become available, the hydrologic, environmental, social, and economic impacts of groundwater withdrawals at various rates on the long-term sustainable levels for the aquifers of the Lowcountry Area. Sustainable development meets the needs of the present without compromising the ability of future generations to meet their needs and requirements. Therefore, the three general goals of the Lowcountry Area Groundwater Management Plan are:

1. Ensure sustainable development of the groundwater resource by management of groundwater withdrawals;
2. The protection of groundwater quality from salt-water intrusion; and,
3. Monitoring of groundwater quality and quantity to evaluate conditions.

To accomplish the above goals, the Lowcountry Area Groundwater Management Plan will address the following aspects of water use in the Lowcountry region:

- Groundwater sources currently utilized;
- Current water demand by type and amount used;
- Current aquifer storage and recovery and water reuse;
- Population and growth projections;
- Water demand projections;
- Projected opportunities for aquifer storage and recovery, as well as water reuse;
- Projected groundwater and surface water options; and,
- Water conservation measures.

Planning is a multi-stage process that includes provisions for updating/amending as conditions change over time. In this first plan, only general goals can be established. As more data are developed about the groundwater resources of the Lowcountry Area, more specific goals and withdrawal limits will be incorporated.

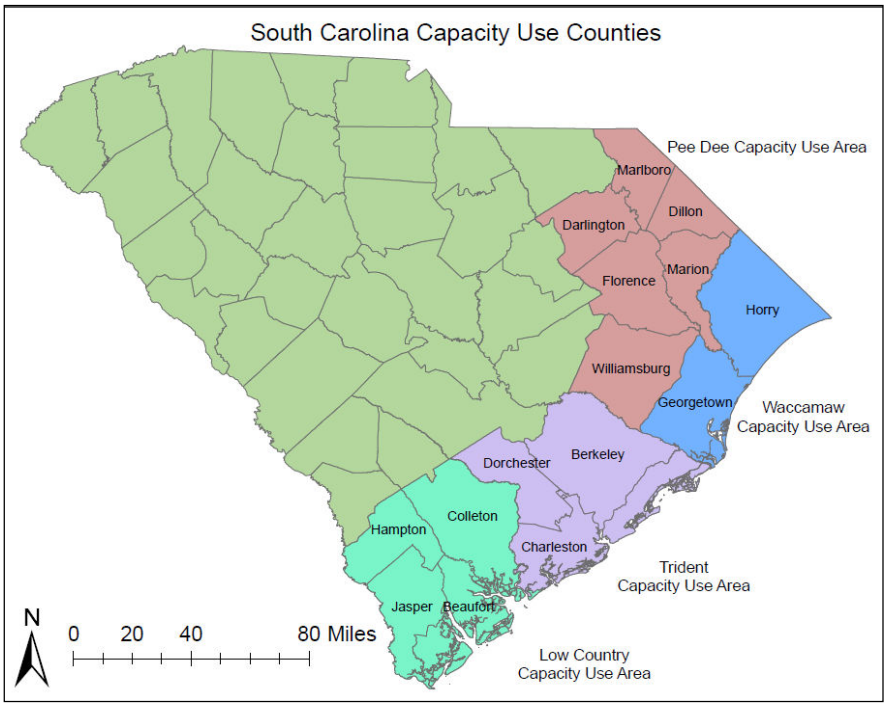

Figure 1. Capacity Use Areas.

Definitions

"Adverse Effects" – Undesirable consequences of withdrawing groundwater that may include: changes in water quality, significant reduction in water level of the aquifer, saltwater intrusion, land subsidence, and decreases in stream flow.

"Beneficial Use" - The use of that amount of water that is reasonable and appropriate under reasonably efficient practices to accomplish without waste the purpose for which the appropriation is lawfully made.

"**Best Management Plan**" means a document that supports the design, installation, maintenance, and management of water conveyance systems and/or water withdrawal systems (water supply, commercial, industrial, agricultural, etc.), which promotes water conservation, and protects water quality.

"**Person**" means an individual, firm, partnership, association, public or private institution, municipality or political subdivision, local, state, or federal government agency, department, or instrumentality, public water system, or a private or public corporation organized under the laws of this State or any other state or county.

"Sustainable Yield" - ground-water sustainability as development and use of ground water in a manner that can be maintained for an indefinite time without causing unacceptable environmental, economic, or social consequences.

"Water User" - A person using groundwater for any purpose.

Geo-Political Structure

Currently, the four county Lowcountry Area contains twenty-four cities and towns and just under a quarter million people. This includes a few central cities surrounded by smaller cities, island communities, and rural towns. All four Counties use Council-Administrator forms of government. The majority of the municipalities in the region utilize a Mayor-Council form of government.

The SCDHEC has permit authority for all groundwater withdrawals in the Lowcountry Area. Permits will be issued after appropriate review in accordance with Chapter 5, The Groundwater Use and Reporting Act, Groundwater Use and Reporting Regulation, R.61-113, and the goals and management strategy developed in the Lowcountry Area Groundwater Management Plan.

Regional Description

Comprised of Beaufort, Colleton, Jasper and Hampton Counties, the Lowcountry Area covers 3,364.8 square miles, of which approximately 470 square miles are surface water. The Lowcountry area stretches approximately sixty miles through south western South Carolina, bordered by the Savannah River on the south, the Edisto River on the north, and the Atlantic Ocean on the east. The region extends some 67 miles inland towards the counties of Allendale and Bamberg to the northwest, and includes over 49 miles

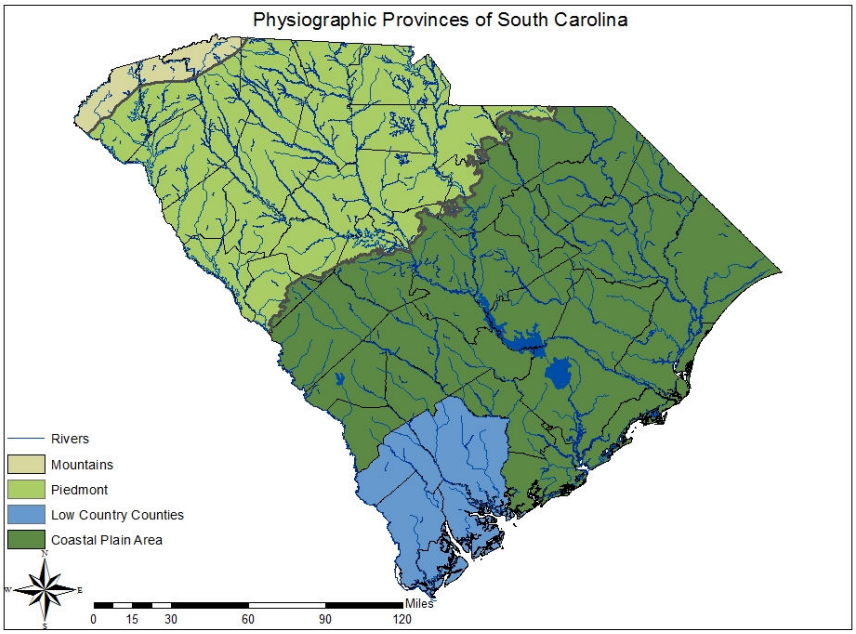

Figure 2. Physiographic provinces of South Carolina.

of Atlantic coastline. All four counties are located in the Coastal Plain physiographic region, Figure 2. There are several major water bodies in the area in addition to the Atlantic Ocean including numerous rivers such as the Edisto, Salkehatchie and Savannah Rivers and a network of streams, wetlands, and marshes, Figure 3. The topography of the region is very level with only slight undulations in the landscape. Elevations range from mean sea level to slightly over one hundred feet.

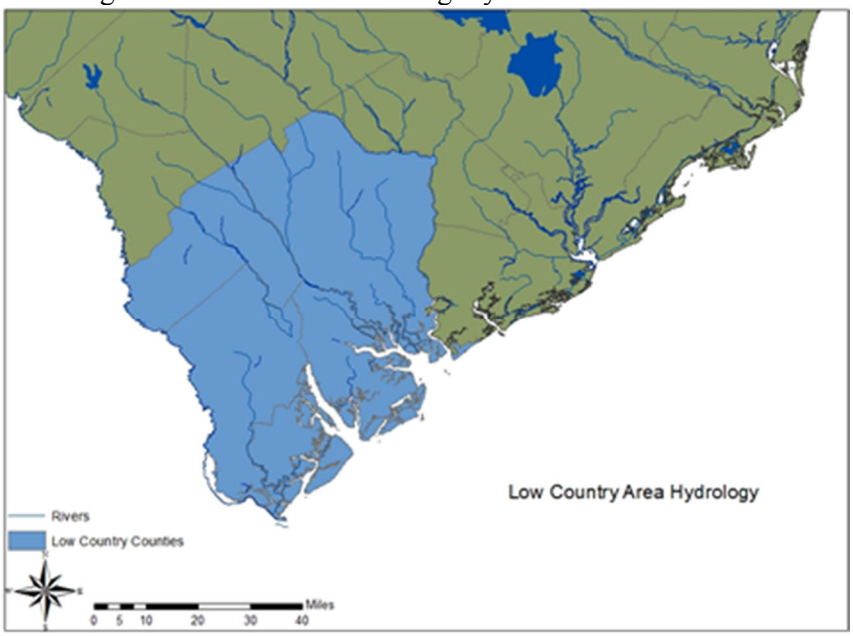

Figure 3. Hydrology of the Lowcountry.

The Lowcountry Area enjoys a relatively mild and moderate climate characteristic of its southeast US coastal location. Compared to overall State averages, winter temperatures are generally warmer and summers tend to be cooler and less humid. The average annual temperature is 65.8°F, with an average daily maximum of 74.5°F and a minimum of 57°F. Approximately forty percent of the forty-nine inches of average annual precipitation occurs during the summer months (Figure 4, and 5). Thunderstorms are most frequent during the summer and create relatively short durations of concentrated runoff.

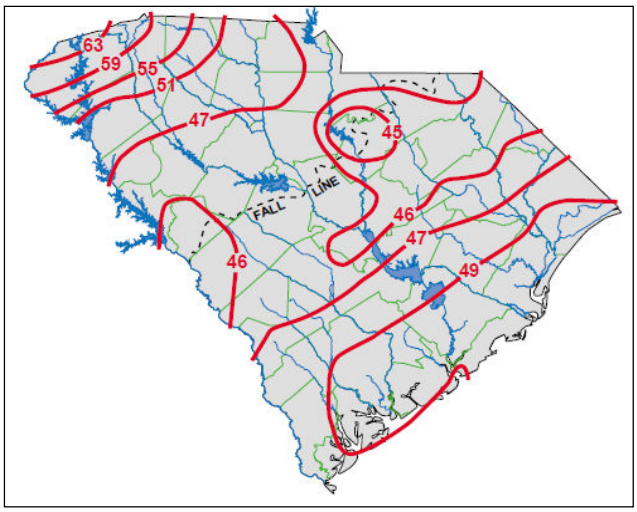

Figure 4. Average annual precipitation, in inches for the period 1948-1990. Source: South Carolina Department of Natural Resources (SCDNR)-Hydrology/Geology Map 2, R.N. Cherry, A.W. Badr, and Andrew Wachob, 2001.

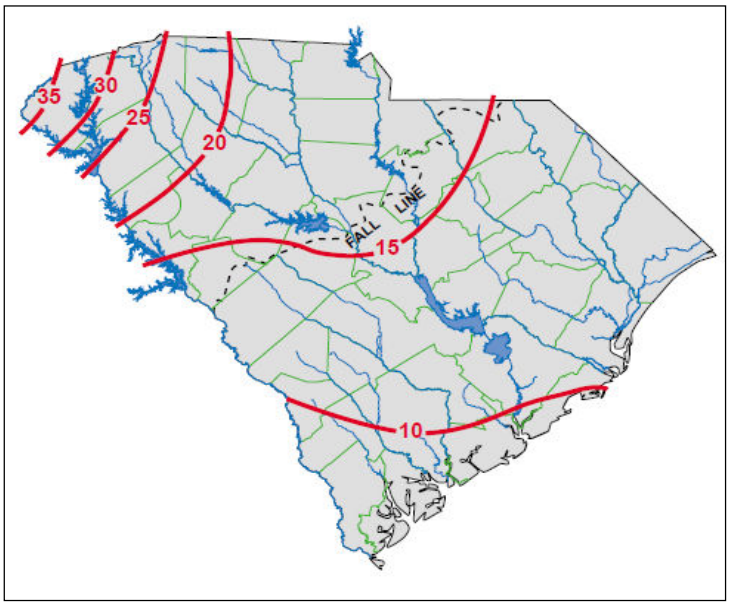

Figure 5. Average annual water yield (precipitation less evapotranspiration), in inches, 1948-1990. Source: SCDNR-Hydrology/Geology Map 2, R.N. Cherry, A.W. Badr, and Andrew Wachob, 2001.

Groundwater Supplies

The oldest (and deepest) aquifers or water-bearing units underlying the Lowcountry Area are of Late Cretaceous age and comprise sediments that have been subdivided into four (4) aquifer systems (oldest to youngest): the Gramling, Charleston/McQueen Branch, Crouch Branch, and Gordon, Figure 6. These units are generally continental shelf to inner marine shelf and deltaic deposits and range from fine to medium grained sand, silts and clays. Water bearing zones typically are beds of sands of varying thickness and extent separated by silty, clayey beds or lenses.

- The Gramling Aquifer is not well defined and no known outcrop has been identified in South Carolina. It is thought to mainly consist of sand and gravel beds separated by thick layers of silt and clay.
- The Charleston/McQueen Branch Aquifer occurs throughout the Coastal Plain, from the Fall Line to the coast. The McQueen Branch crops out (catchment area) adjacent to the Fall Line from Chesterfield County to Edgefield County. In the Lowcountry Area the aquifer is generally composed of thin- to thick-bedded sands and clays deposited in marginal marine and/or lower delta plain environments. In the Lowcountry area, the McQueen Branch-Charleston aquifer is approximately 400 feet thick.
- The Crouch Branch Aquifer occurs throughout the Lower Coastal Plain and crops out in the eastern portion of the Coastal Plain from Lexington County to Dillon County. The aquifer is generally composed of thin- to thick-bedded sands and clays deposited in marginal marine and/or lower delta plain environments. In the Lowcountry area, the Crouch Branch is approximately 400-800 feet thick.

Units overlying the Late Cretaceous formations include the Tertiary age Gordon, Floridan, and Surficial Formations, Figure 6. These units range from marginal marine to outer shelf deposits and their lithologies consist predominantly of sand, silt, and clay, with the upper part being mainly pure to impure limestone.

- The Gordon Aquifer extends from its catchment area in the middle of the Lower Coastal Plains to the southwest. In the Lowcountry area, the Gordon is approximately 300 feet thick.
- The Floridan Aquifer occurs throughout the southern portion of the coastal plain. In the Lowcountry Area, the Floridan aquifer ranges from approximately 310-500 feet thick.
- The Tertiary units are overlain by a sequence of sand, silt, clay, and shells of Pleistocene age that are generally not more than fifty feet thick.
  Source: (Bruce G. Campbell, 2010 Hydrogeologic Framework of the Atlantic Coastal Plain, North and South Carolina: U.S. Geological Survey Professional Paper 1773, pp. 71-76)

Groundwater recharge occurs with infiltration of precipitation in catchment (recharge) areas. Figure 7 depicts the general recharge or catchment areas for the aquifers of the Lowcountry Area. Although limited recharge of the Tertiary Sand/Limestone Aquifer occurs in the Lowcountry area, the majority of recharge of aquifers in the area occurs mainly north of the region proper.

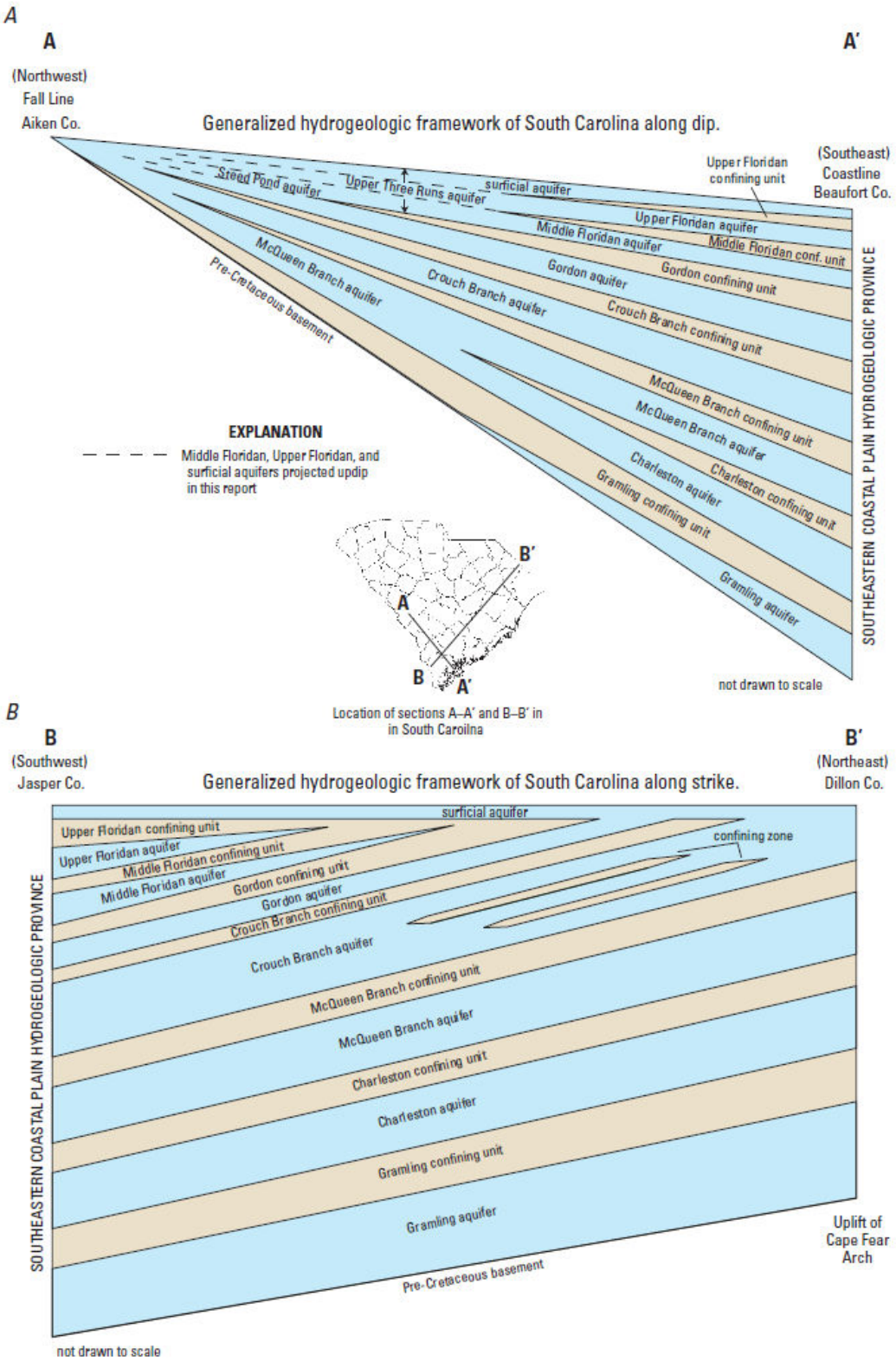

Figure 6. Generalized hydrogeologic framework, J. Gellici and J. Lautier, 2010 Hydrogeologic Framework of the Atlantic Coastal Plain, North and South Carolina: U.S. Geological Survey Professional Paper 1773, 113p.

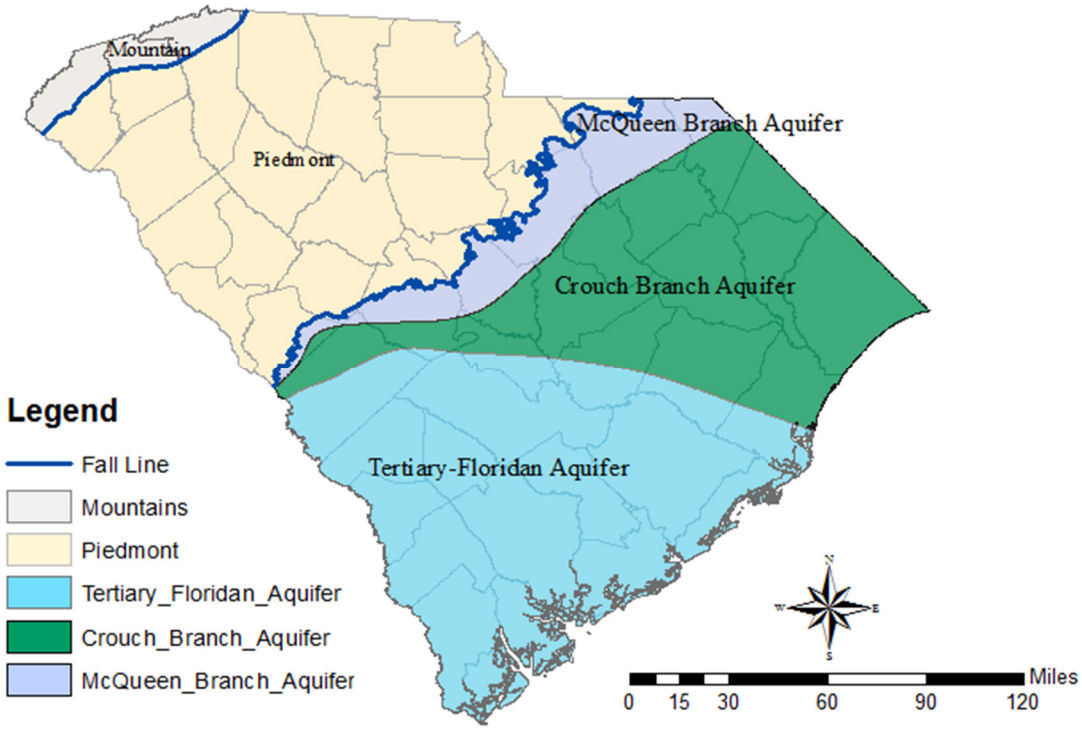

Figure 7. Generalized aquifer recharge areas.

Groundwater Level Trends

Groundwater levels in the Floridan Aquifer System have declined over the period from pre-development (1879) to the present in the Lowcountry Area. Much of this decline is attributed to public water supply and irrigation usage. In 2004, the potentiometric surfaces of the Atlantic Coastal Plain aquifers were mapped in detail. The most prominent feature within the Tertiary aquifer system is the large water-level decline associated with pumping at Savannah, GA, and Hilton Head, SC. Much of the updip area of the Tertiary aquifers, however, is unaffected by pumping and is, therefore, close to pre-development conditions. *(Bruce G. Campbell, 2010 Professional Paper 1773, pp.9)* Since 2004, there has been a large decline in groundwater use, this decline in use has positively affected the aquifer systems underlying the Lowcountry Area. These improvements in groundwater levels can be seen through the potentiometric maps published by the South Carolina Department of Natural Resources. Water-levels in the Floridan Aquifer System have rebounded up to 20 feet in certain areas, primarily in the most affected region, Beaufort County. As the population is anticipated to continue growing in the area, expected to reach 304,300 in 2030, the practices that have been adopted to limit the use and over-pumping of groundwater will be especially important. With consistent practice, the water-levels in the area should continue to rise.

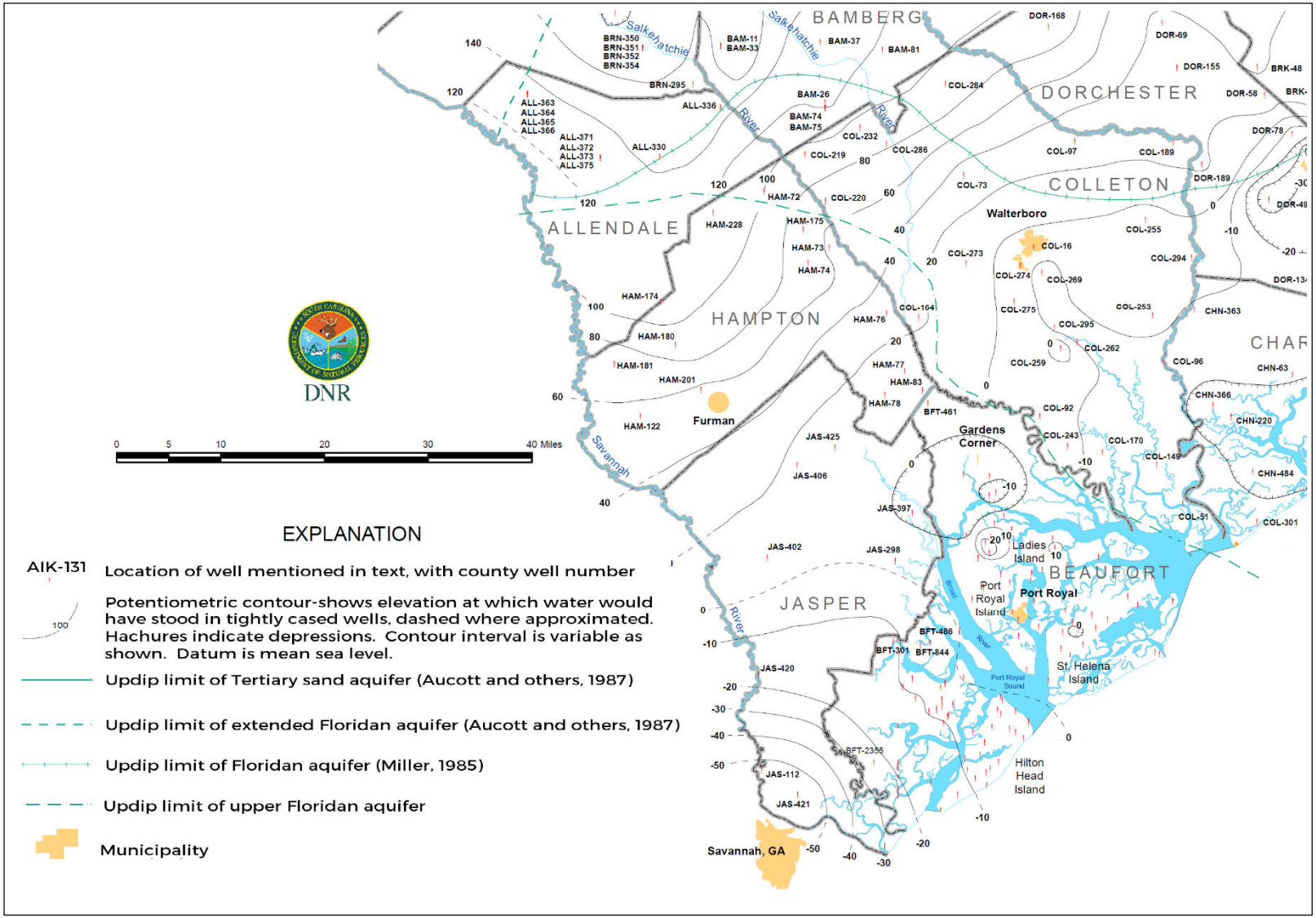

Figure 8. Water level map for the Floridan and Tertiary Sands Aquifer, 2004. Source: Hockensmith, 2009, SCDNR Water Resources Report 48.

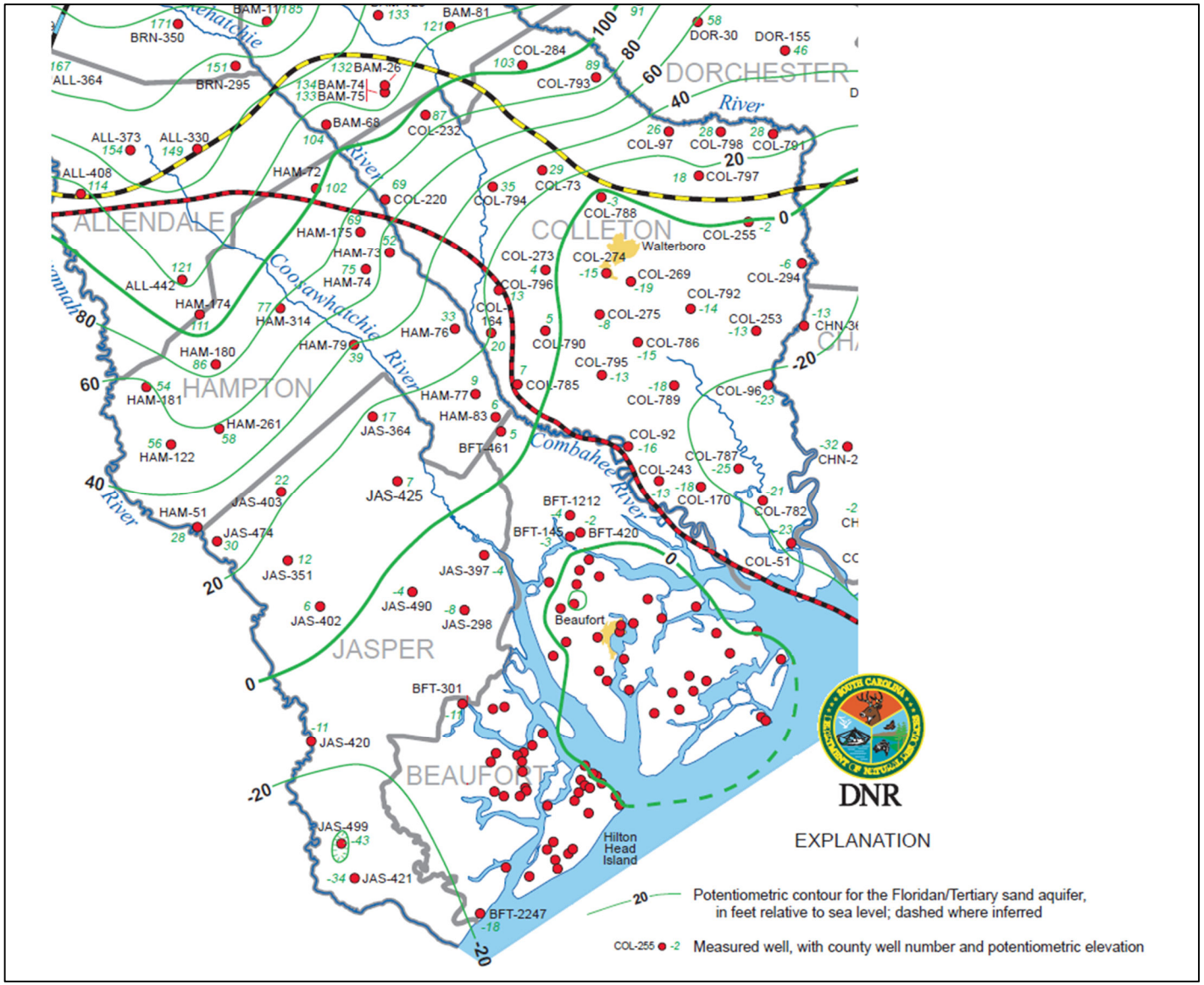

Figure 9. Water level map of the Floridan and Tertiary Sands Aquifer, 2013. Source: Wachob, 2014, SCDNR Water Resources Report 56.

Current Groundwater Demand

For purposes of water use reporting, DHEC defines the following groundwater withdrawal categories:

- Aquaculture (**AQ**)**–** Water used for raising, farming and/or harvesting of organisms that live in water, such as fish, shrimp and other shellfish and vegetal matter (seaweed),
- Golf course irrigation (**GC**)- Water applied to maintain golf course turf, including tee boxes, fairways, putting greens, associated practice areas and periphery aesthetic landscaping,
- Industrial process (**IN**)- Water used for commercial and industrial purposes, including fabrication, processing, washing, in-plant conveyance and cooling,
- Agricultural and aesthetic irrigation (IR)- Water that is used for agricultural and landscaping purposes including turf farming and livestock management.
- Mining process (**MI**)- Water used in mine operations, including mining, processing, washing and cooling,
- Water supply (**WS**)- Water withdrawn by public and private water suppliers and conveyed to users or groups of users. Water suppliers provide water for a variety of uses including domestic, commercial, industrial and public water use.

Currently in the Lowcountry Area there are 129 **permitted** groundwater withdrawers distributed as follows: 26 WS, 32 GC, 2 IN, 65 IR, 2AQ, and 2 OT. These 129 facilities have 446 wells of which 445 are currently active, Figure 10.

Table 1. Permitted Groundwater Withdrawers by County.

	BEAUFORT	**COLLETON**	**HAMPTON**	**JASPER**		
Category	**No. Facilities**	**No. Facilities**	**No. Facilities**	**No. Facilities**	**Total**	**% Withdrawers**
Aquaculture	1	-	1	-	**2**	1.55%
Golf Courses	26	2	1	3	**32**	24.81%
Industry	1	-	1	-	**2**	1.55%
Irrigation	15	8	31	11	**65**	50.39%
Other	1	1	-	-	**2**	1.55%
Public Water Supply	12	2	7	5	**26**	20.16%
Total	**56**	**13**	**41**	**19**	**129**	
% Withdrawers	43.41%	10.08%	31.78%	14.73%		

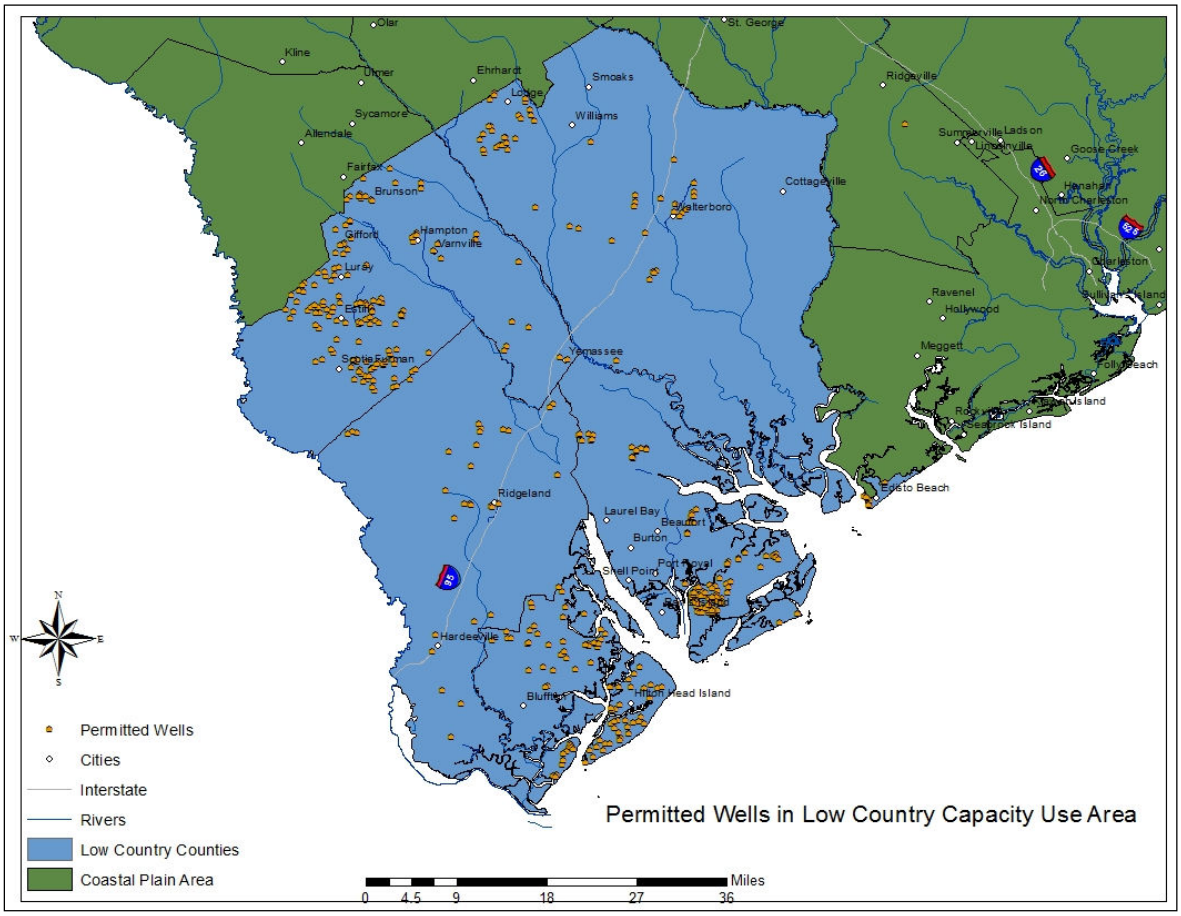

Figure 10. Locations of permitted groundwater withdrawals.

During the period 2010 through 2015, total reported groundwater withdrawals for the Lowcountry Area averaged 12,784.4 million gallons per year or approximately 35.03 million gallons per day (MGD). Withdrawals for water supply averaged 6,042.5 million gallons per year or approximately 16.55 MGD, agricultural irrigation use averaged 5,121.2 million gallons per year or approximately 14.03 MGD, and remaining withdrawal categories averaged 405.16 million gallons per year or approximately 1.11 MGD. For reporting year 2015, withdrawers in Beaufort county reported total withdrawals of 5,907,870,000 gallons (approximately 5.91 billion gallons), Colleton county 3,002,870,000 gallons (approximately 3 billion gallons), and Hampton county 2,705,320,000 gallons (approximately 2.7 billion gallons), and Jasper county 595,580,000 gallons (approximately 595 million gallons). Reported usage by category for 2015 is listed in Table 2 and shown in Figure 11.

Table 2. Reported Groundwater Use by Category of Use, 2015

2015 Reported Groundwater Use						
Category	**Beaufort**	**Colleton**	**Hampton**	**Jasper**	**Totals MGY**	**Totals MGD**
Aquaculture	34.05	-	108.20	-	**142.25**	0.39
Golf Courses	729.00	34.70	16.56	23.21	**803.48**	2.20
Industry	32.01	-	51.20	-	**83.21**	0.23
Irrigation	565.66	2,215.60	2,129.94	278.19	**5,189.39**	14.22
Other	26.44	20.55	-	-	**46.99**	0.13
Public Water Supply	4,520.71	732.02	399.42	294.18	**5,946.33**	16.29
Totals MGY	**5,907.87**	**3,002.87**	**2,705.32**	**595.58**	**12,211.64**	33.46
Totals MGD	16.19	8.23	7.41	1.63	33.46	

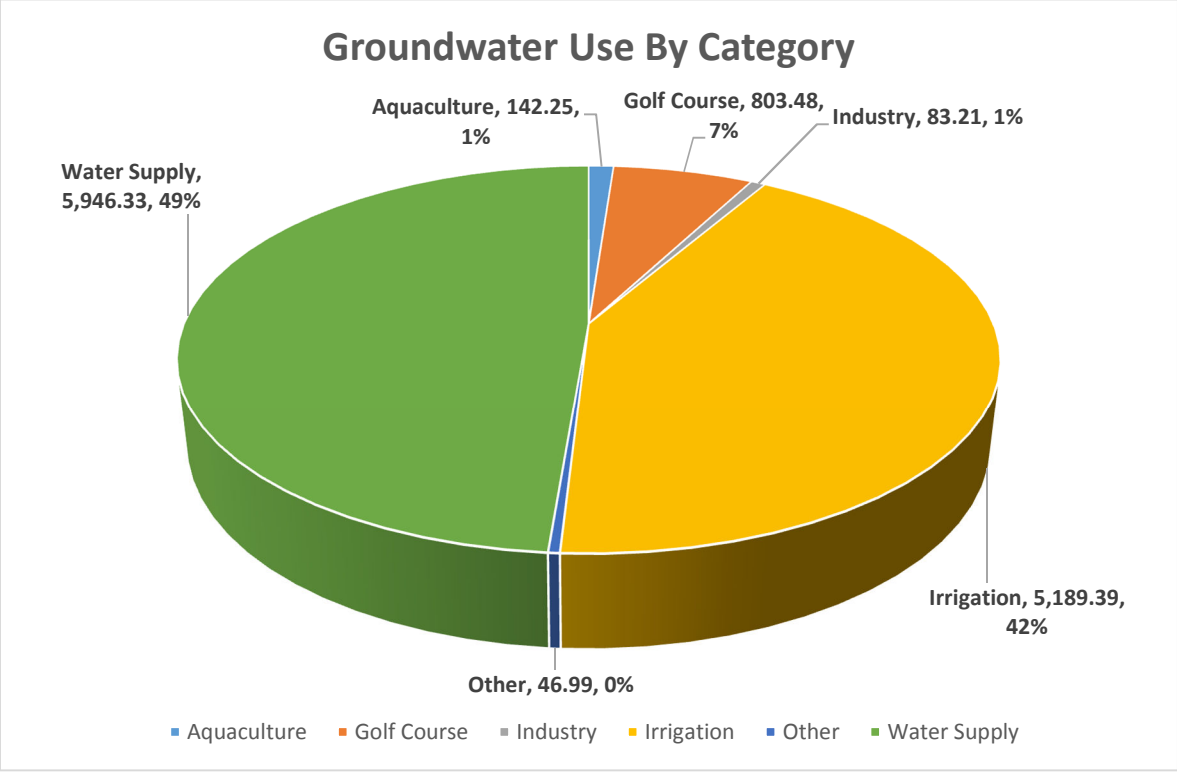

Figure 11. Reported groundwater use by category, 2015.

For the Lowcountry Area in 2015 reported groundwater withdrawals from the Surficial aquifer were 30,700,000 gallons (0.084 MGD), the Floridan aquifer were 8,485,700,000 gallons (23.249 MGD), the Gordon aquifer 1,052,700,000 gallons (2.884 MGD), the Crouch Branch aquifer 1,842,800,000 gallons (5.049 MGD), the McQueen Branch aquifer 275,230,000 gallons (0.754 MGD), and the Gramling aquifer 524,510,000 gallons (1.437 MGD). Groundwater withdrawals by aquifer/county are presented in Table 3 and Figure 12. In 2015, Beaufort County used 49.38% of the region's water usage while Colleton County used 24.59%, Hampton County used 22.15%, and Jasper County used 4.88%.

Table 3. Reported Groundwater Use (Million Gallons) By Aquifer and County, 2015.

2015 Reported Totals Use (Million Gallons)							
	Beaufort	**Colleton**	**Hampton**	**Jasper**	**Aquifer Total**	**Million Gallons/Day**	**% Reported Total**
Surficial	30.70	-	-	-	**30.70**	0.084	0.25%
Floridan	5,284.32	350.55	2,255.26	595.583	**8,485.70**	23.249	69.49%
Gordon	68.35	599.99	384.37	-	**1,052.70**	2.884	8.62%
Crouch Branch	-	1,777.10	65.70	-	**1,842.80**	5.049	15.09%
McQueen Branch	-	275.23	-	-	**275.23**	0.754	2.25%
Gramling	524.51	-	-	-	**524.51**	1.437	4.30%
Total	**5,907.87**	**3,002.87**	**2,705.322**	**595.583**	**12,211.64**	33.457	100.00%
% County Use	48.38%	24.59%	22.15%	4.88%			

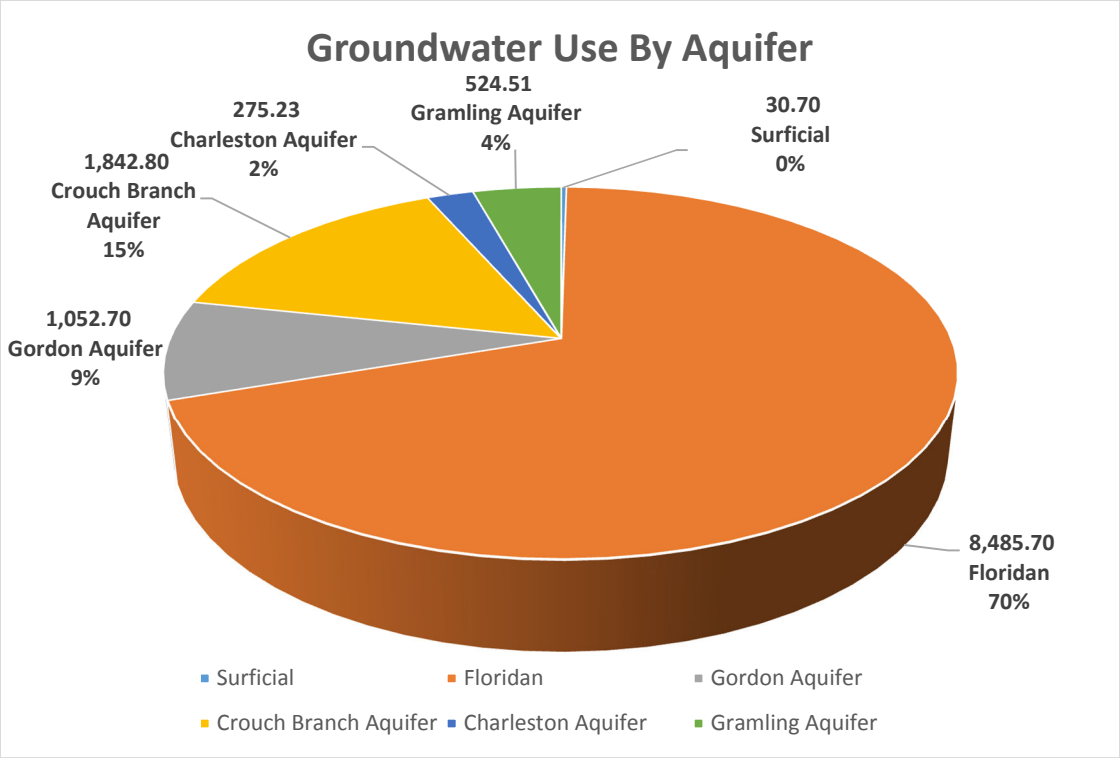

Figure 12. Reported groundwater use by aquifer, 2015.

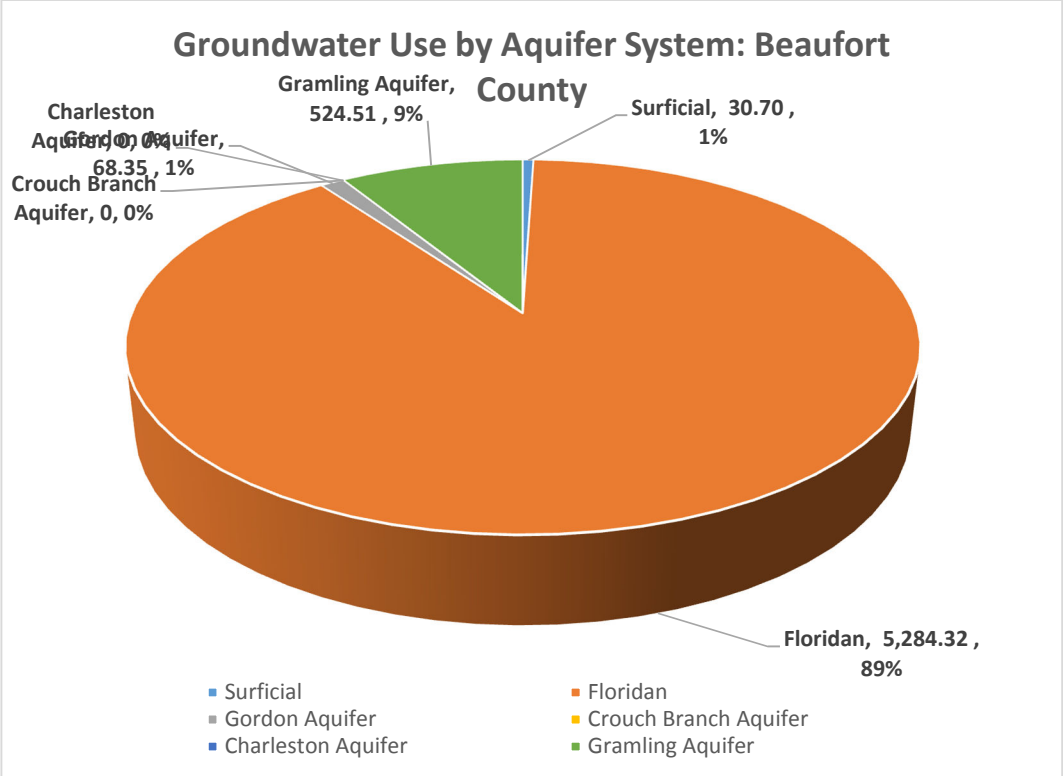

Figure 13. Reported groundwater use by aquifer for Beaufort County, 2015.

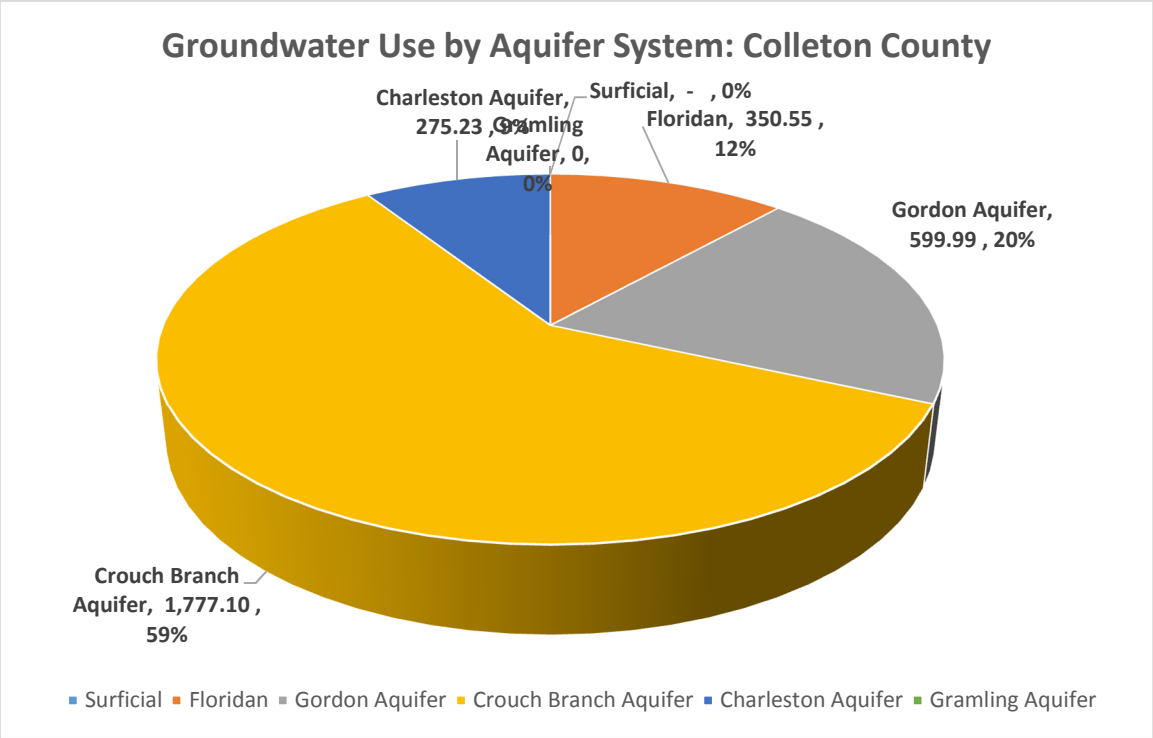

Figure 14. Reported groundwater use by aquifer for Colleton County, 2015.

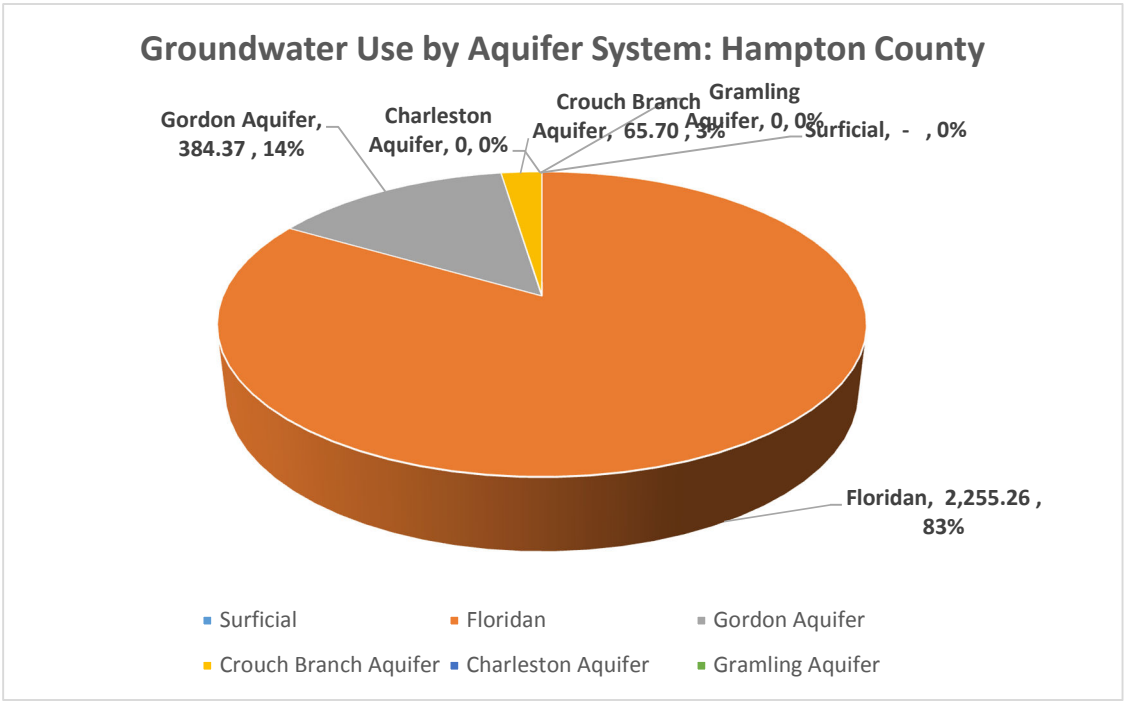

Figure 15. Reported groundwater use by aquifer for Hampton County, 2015.

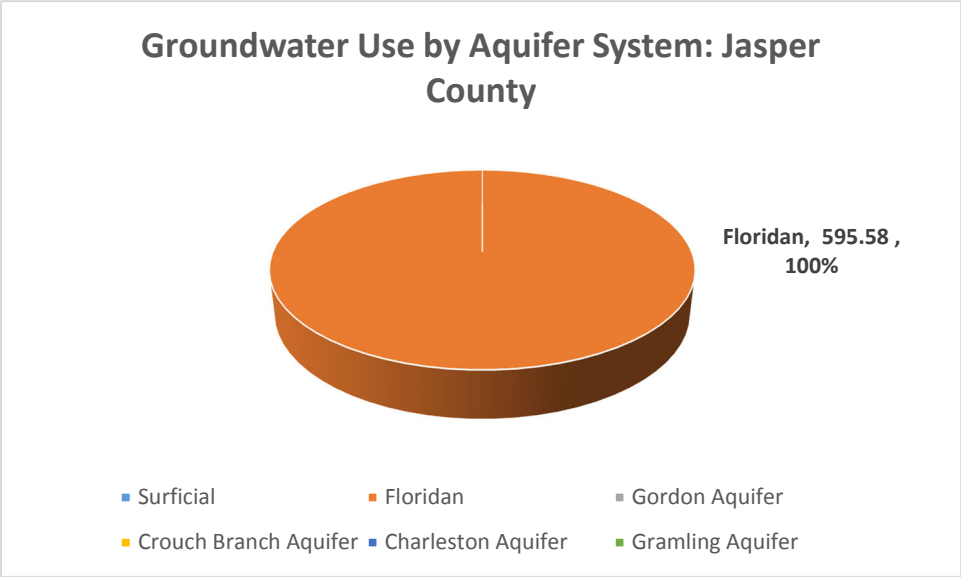

Figure 16. Reported groundwater use by aquifer for Jasper County, 2015.

Groundwater Demand Trends

To provide an historical perspective on reported groundwater use in the Lowcountry Capacity Use Area, Figures 17 and 18 show reported use by category of use. Since 1996, the reported permitted use of groundwater for public water supply has remained relatively steady. The reported use for industry has declined since 2002. Between 1996 and 2010, the reported use for golf courses showed an increasing trend. After 2010, golf course reported use of groundwater declined. Reported irrigation use has shown an increase after 2004. Comparing 2004 reported groundwater use data:

- Public water supply reported use was 5,896 million gallons in 2004 and 5,946 million gallons in 2015.
- Industrial use has declined from 537 million gallons in 2004 to 83 million gallons in 2015.
- Reported groundwater use for Golf Courses declined from 1656 million gallons in 2004 to 803 million gallons in 2015.
- Reported use for irrigation has increased however, from 2,797 million gallons in 2004 to 5,189 million gallons in 2015.

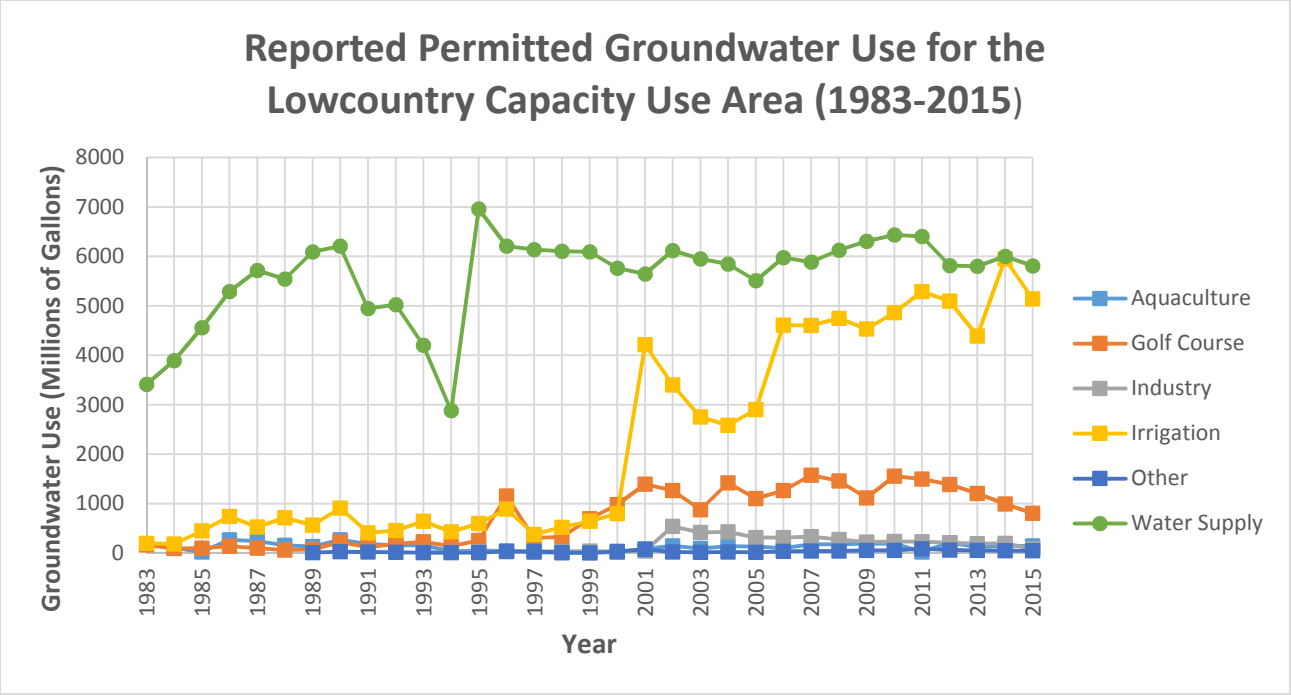

Figure 17. Reported permitted groundwater use for the Lowcountry Capacity Use Area, 1983-2015.

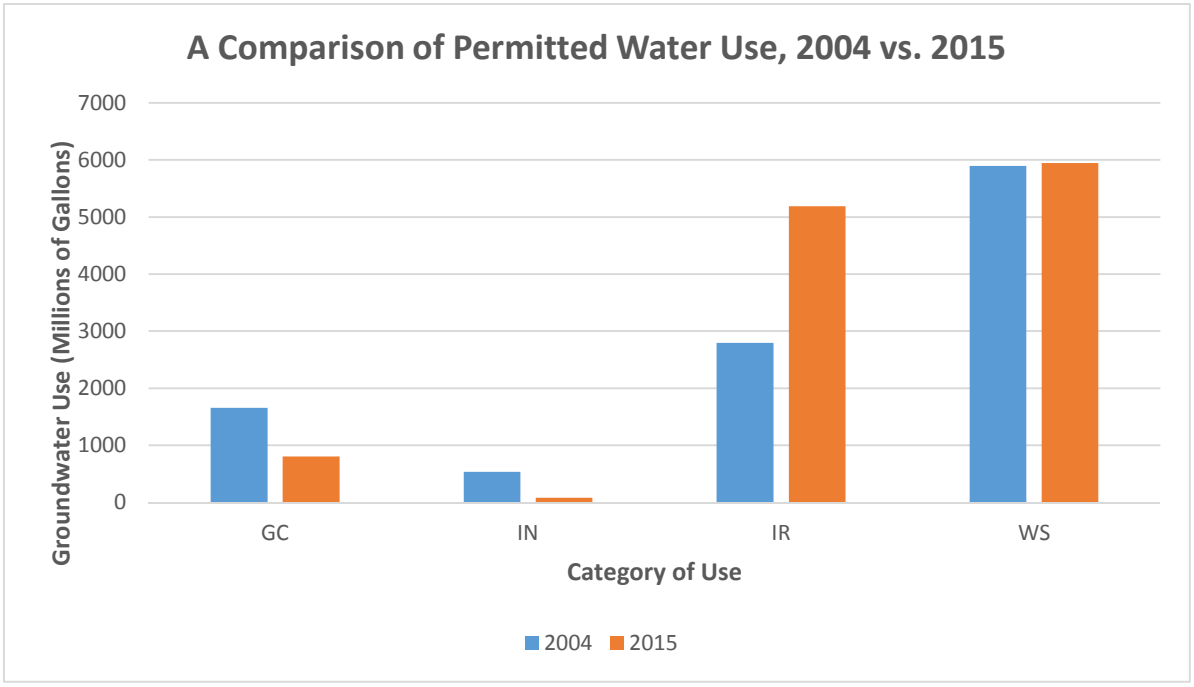

Figure 18. A comparison of reported groundwater use for 2004 to 2015.

Population, Growth, and Water Use Projections

As with coastal communities around the nation, the population in the Lowcountry Area has increased dramatically, rising over 54 percent the last 10 years. At the time of the 2010 Census, over 240,000 people were living in the region. Since the 2000 Census, Beaufort County experienced the largest percent increase in population, followed by Jasper and Colleton Counties, as shown in Table 4.

Table 5 depicts population projections for the three counties and the region as a whole from 2000 to 2030 presented in the *South Carolina Statistical Abstract, 2010,* as prepared by the Office of Revenue and Fiscal Affairs, South Carolina Department of Administration. The region is expected to grow by more than 103,035 people between 2000 and 2030, an increase of 51.2 percent. Beaufort County is projected to experience the largest percent increase, followed by Jasper and Colleton Counties.

Table 4. County Population Change 2000-2010.

Area	2000	2010	Number Change	Percent Change
Beaufort County	120,937	162,233	41,296	34.1%
Colleton County	38,264	38,892	628	1.6%
Hampton County	21,386	21,090	296	-1.4%
Jasper County	20,678	24,777	4,099	19.8%

Source: US Census Bureau & SC State Data Center

Table 5. County Projected Population Change, 2000-2030.

County	2000	2010	2015	2020	2025	2030	Number Change	Percent Change
Beaufort	120,937	162,233	175,900	189,500	202,400	215,300	94,363	78 %
Colleton	38,264	38,892	39,000	39,200	39,300	39,500	1,236	3.2%
Hampton	21,386	21,090	21,000	20,900	20,800	20,700	-686	-3.2%
Jasper	20,678	24,777	26,000	27,300	28,000	28,800	8,122	39.3%
Lowcountry Total	**201,265**	**246,992**	**261,900**	**276,900**	**290,500**	**304,300**	**103,035**	**51.2%**

*Source: **http://abstract.sc.gov/chapter14/pop5.html**, SC Statistical Abstract, Table 5, Status of Population Projections Based on the 2010 Census Data, South Carolina Revenue and Fiscal Affairs Office*).

Permitted withdrawal limits in the Lowcountry Area are 32,525.94 million gallons per year. Total reported usage for 2015 in the Lowcountry Area was 12,211.643 million gallons (Table 6 through 8).

Table 6. Permit limits versus reported use (million gallons) for Beaufort County.

Beaufort								
Permit	**Permitted Amount**	**Reported 2015 Use**	**Permit**	**Permitted Amount**	**Reported 2015 Use**	**Permit**	**Permitted Amount**	**Reported 2015 Use**
07AQ002	36	34.047	**07GC039**	50	40.657	**07IR060**	84	20.382
07GC005	36	4.332	**07GC040**	128	27.645	**07IR064**	45.783	8.12
07GC009	75	40.344	**07GC041**	14	13.933	**07IR066**	26.93	22.222
07GC012	25.261	0.387	**07GC045**	60	14.005	**07IR067**	89.76	33.606
07GC013	27.35	24.881	**07GC046**	100	56.1	**07IR068**	105	18.1
07GC017	88.5	81.1	**07GC047**	85	36.956	**07OT021**	54	26.44
07GC018	60	20.88	**07GC048**	60	3.732	**07WS005**	300	13.134
07GC019	48	9.9	**07GC049**	55	6.96	**07WS014**	583.8	555.8331
07GC022	175	74.9709	**07IN005**	48	32.008	**07WS016**	3,520.256	1,424.122
07GC024	43.49	13.617	**07IR003**	60.3	30.102	**07WS017**	895.942	281.8197
07GC026	96	32.41	**07IR007**	300	170.4	**07WS018**	1,961.27	1,299.47
07GC028	149.5	0	**07IR008**	25	3.838	**07WS028**	49.116	2.614
07GC030	110	24.9	**07IR016**	65	28.62	**07WS032**	75	43.558
07GC031	97.5	5.12	**07IR018**	99.063	44.362	**07WS051**	49.116	13.148
07GC032	62.9	20.31	**07IR054**	159.8	68.349	**07WS052**	3,520.256	105.85
07GC034	75	4.16	**07IR056**	84	26.926	**07WS053**	3,520.256	634.158
07GC036	75	55.5	**07IR057**	116.6	53.852	**07WS054**	3,520.256	143.218
07GC037	75	34.8	**07IR058**	98	18.54	**07WS055**	20	3.783
07GC038	170	81.405	**07IR059**	45	18.241			
Totals							**21,599.01**	**5,907.87**

Table 7. Permit limits versus reported use (million gallons) for Colleton and Hampton Counties.

Colleton				Jasper					
Permit	Permitted Amount	Reported 2015 Use		Permit	Permitted Amount	Reported 2015 Use	Permit	Permitted Amount	Reported 2015 Use
15GC001	80	6.4		**27GC002**	50	10.971	**27IR011**	22	5.969
15GC003	72	28.3		**27GC003**	36	0	**27IR013**	42	10.2
15IR007	35	8.4		**27GC051**	223	12.24	**27IR014**	70	23.853
15IR012	2,294.4	2,205		**27IR001**	85.528	51.05	**27IR046**	190	46.01
15IR016	42	0.189		**27IR004**	200	65.257	**27IR047**	44	9.31
15IR017	15	2.01		**27IR007**	30	2.538	**27WS001**	10	16.656
15OT002	84	20.548		**27IR008**	45	11.649	**27WS002**	679	243.188
15WS001	778.3	579.13		**27IR009**	44.1	6.024	**27WS004**	250.7	17.014
15WS002	256	152.89		**27IR010**	63.5	46.333	**27WS005**	83.87	14.739
Totals	**3656.70**	**3002.87**					**27WS006**	4	2.582
							Totals	**2,172.70**	**595.583**

Hampton								
Permit	**Permit Amount**	**Reported 2015 Use**	**Permit**	**Permit Amount**	**Reported 2015 Use**	**Permit**	**Permit Amount**	**Reported 2015 Use**
25AQ033	190	108.2	**25IR034**	36	16.1	**25IR067**	20.2	50.3
25GC012	57.72	16.56	**25IR051**	20	13.5	**25WS001**	132	122.58
25IN001	393.4	51.2	**25IR052**	36	7	**25WS002**	111	83.825
25IR005	429	124.84	**25IR053**	120	91.351	**25WS003**	225	100.323
25IR015	395.93	371.7	**25IR055**	55	37.651	**25WS004**	73	54.227
25IR018	36	14.5	**25IR056**	98	95.568	**25WS005**	36	18.327
25IR025	125	68.5	**25IR058**	36	30.166	**25WS006**	24	12.36
25IR027	260	137.4	**25IR059**	178.2	45.35	**25WS007**	36	7.779
25IR028	47.28	121	**25IR060**	36	4.5	**Total**	**5,097.53**	**2,705.32**
25IR029	78	24.68	**25IR061**	32	9.5			
25IR030	108	47.694	**25IR062**	36	26.3			
25IR031	48	33.837	**25IR064**	140	129			
25IR032	36	13.044	**25IR065**	1228.8	566.44			
25IR033	72	29.5	**25IR066**	112	20.52			

Table 8. Permit limits versus reported use (million gallons) for Hampton County.

Potential future groundwater demands are estimated for water supply, based on population projections, and all other categories (total) based on an estimated nominal growth of 2.5% per year.

Water Supply:

For 2015 in the Lowcountry Area, total groundwater withdrawal for water supply is approximately 5,946,330,000 gallons. Combined with reported surface water supply (9,668,859,000 gallons), the per capita use of water in the Lowcountry Area is approximately 163 gallons per day. Utilizing this value (163 gpd), projected population, and assuming groundwater will represent approximately 38% of the total water supply demand, groundwater demand is projected through 2030 (Table 9).

Table 9. Projected groundwater demand-water supply (million gallons) in Lowcountry Area.

2015	2020	2025	2030
5,946.33 MGY	6,453.75 MGY	7,004.47 MGY	7,602.18 MGY
16.29 MGD	17.68 MGD	19.19 MGD	20.83 MGD

Other:

Groundwater demand for all other categories through 2030 is calculated based on an estimated nominal and steady growth of 1.71% per year (Table 8).

Table 10. Projected groundwater demand-other (million gallons) in Lowcountry Area.

2015	2020	2025	2030
6265.31 MGY	6,799.95 MGY	7,380.21 MGY	8,009.99 MGY
17.17 MGD	18.63 MGD	20.22 MGD	21.95 MGD

Total Projected Water Demand:

Total potential groundwater demand for the Lowcountry Area is estimated from the calculations for Water Supply (Table 9) and All Other Uses category (Table 10) (see Table 11).

Table 11.Total projected groundwater demand-Lowcountry Area (million gallons).

Category	2015	2020	2025	2030
Water Supply	5,946.33	6,453.75	7,004.47	7,602.18
All Other Uses	6265.31	6,799.95	7,380.21	8,009.99
Total MGY	12,211.64	13,253.70	14,384.68	15,612.17
Total MGD	33.46	36.31	39.41	42.77

Groundwater Management Strategy

The ultimate goal of the Groundwater Management Plan is to outline a process to conserve and protect the groundwater resource while establishing conditions that are conducive to the continued development and long-term viability of the aquifers of the Lowcountry Area. In short, the goal is to develop and implement a sustainable development strategy. Sustainable development is defined as development that meets the needs of the present without compromising the ability of future generations to meet their needs. Ultimately, good scientific data must be available that allow the sustainable yields from each aquifer system in the Lowcountry Area to be determined, and permits for withdrawals issued accordingly. However, these data do not fully exist at this date. This plan, therefore, must focus on obtaining this critical data and the issuance of permits for reasonable water withdrawals in the interim. The key strategies to achieve these goals are outlined below.

Strategy #1: Identify areas where a leveling and/or reduction in pumping is appropriate.

Prior to each permit renewal cycle, SCDHEC will consider the best available information on the geologic and hydrogeologic characteristics of the aquifer(s) and groundwater withdrawals of the area to protect against or abate unreasonable, or potentially unreasonable, adverse effects on the aquifer(s) and water users of the Lowcountry Area. Measures that the SCDHEC may require applicants, permit holders and groundwater withdrawers to take may include, but not be limited to, the following:

- Reduction of groundwater withdrawal in areas of concentrated pumping;
- Withdrawals from other available freshwater aquifers than those currently used;
- Selective curtailment or reduction of groundwater withdrawals where it is found to be in the public interest or general welfare or to protect the water resource;
- Conjunctive use of aquifers, or waters of less desirable quality, where water quality of a specific character is not essential;
- Construction and use of observation or monitor wells;
- Abandonment of wells that have penetrated zones of undesirable water quality where such wells are found to cause contamination of freshwater aquifers. Undesirable water quality is defined as not meeting the standards for Class GB Waters as listed in *Water Classifications & Standards*, R.61-68.H.9;
- Prohibiting the hydraulic connection of aquifers that could result in deterioration of water quality in a freshwater aquifer(s);
- Abandonment of wells, which will be filled with cement grout, plugged, and sealed;
- Implement reasonable and practical methods to conserve and protect the water resources and to avoid or minimize adverse effects of the quantity and quality of water available to persons whose water supply has been materially reduced or impaired as a result of groundwater withdrawals;
- Such other necessary and appropriate control or abatement techniques as are technically feasible.

Strategy #2: Review of permit applications based on demonstrated reasonable use.

Proposed withdrawals will be evaluated considering reasonableness of use and need, aquifer(s) being utilized, potential adverse effects on adjacent groundwater withdrawers, previous reported water use, anticipated demand for the proposed activities, availability of alternate water sources and reported water use at facilities with similar activities. Applications for groundwater withdrawal will incorporate a "Water Use Plan" or a "Best Management Strategy" detailing actual or proposed water use activities and all conservation techniques for site specific water management including, but not limited, to:

- Provide appropriate documentation that the proposed water use is a beneficial use of the resource and necessary to meet the reasonable needs of the applicant;
- Describe in detail the applications for which the water is being withdrawn and approximate quantities utilized in each application;
- Identify the aquifer(s) currently utilized and the hydrogeologic (groundwater quality, specific capacity/yield, etc.) factors for utilization. Identify if a less utilized aquifer is suitable to the facility's need;
- Identify additional or alternate sources of water, including surface water, effluent, or recycled water, among others, suitable to meet the needs of the applicant and supplement, minimize, or eliminate groundwater sources;
- Identify reasonable and appropriate conservation methods or practices that maximize current water use and reduce current water demand;
- Identify any existing or anticipated adverse effects on other groundwater withdrawers, including public use, and strategies to eliminate or minimize these effects.

As part of the permitting process, stakeholder involvement, comment and recommendations will be incorporated during the public notice of the permit application

Strategy #3: Establish a comprehensive groundwater monitoring program.

With increased population and a growing industrial base, water demand (from both surface and groundwater) is increasing at an expanding rate. Although water level declines are a normal response to groundwater withdrawals, not stabilizing these declines may cause serious impairment to the aquifers and groundwater quality of the region. SCDHEC will pursue partnerships with local entities, groundwater users and other agencies (both Federal and State) to facilitate the most effective use of resources in designing and maintaining a monitoring network for the Lowcountry Area. Both the USGS (Southeast Region) and the SCDNR maintain several groundwater level monitoring locations in the Lowcountry area. The table below lists the wells currently being used to monitor groundwater levels in the Lowcountry Capacity Use Area. Their locations are shown in Figure 19.

County	Well Id	Aquifer	Agency
Beaufort	BFT1810	Floridan	USGS
Beaufort	BFT0101	Floridan	SCDNR
Beaufort	BFT0429	Floridan	SCDNR
Beaufort	BFT1846	Floridan	SCDNR
Colleton	COL0030	Black Creek	SCDNR
Colleton	COL0097	Floridan	SCDNR
Hampton	HAM0050	Tertiary Sand	SCDNR
Hampton	HAM0083	Floridan	SCDNR
Jasper	JAS0426	McQueen	SCDNR

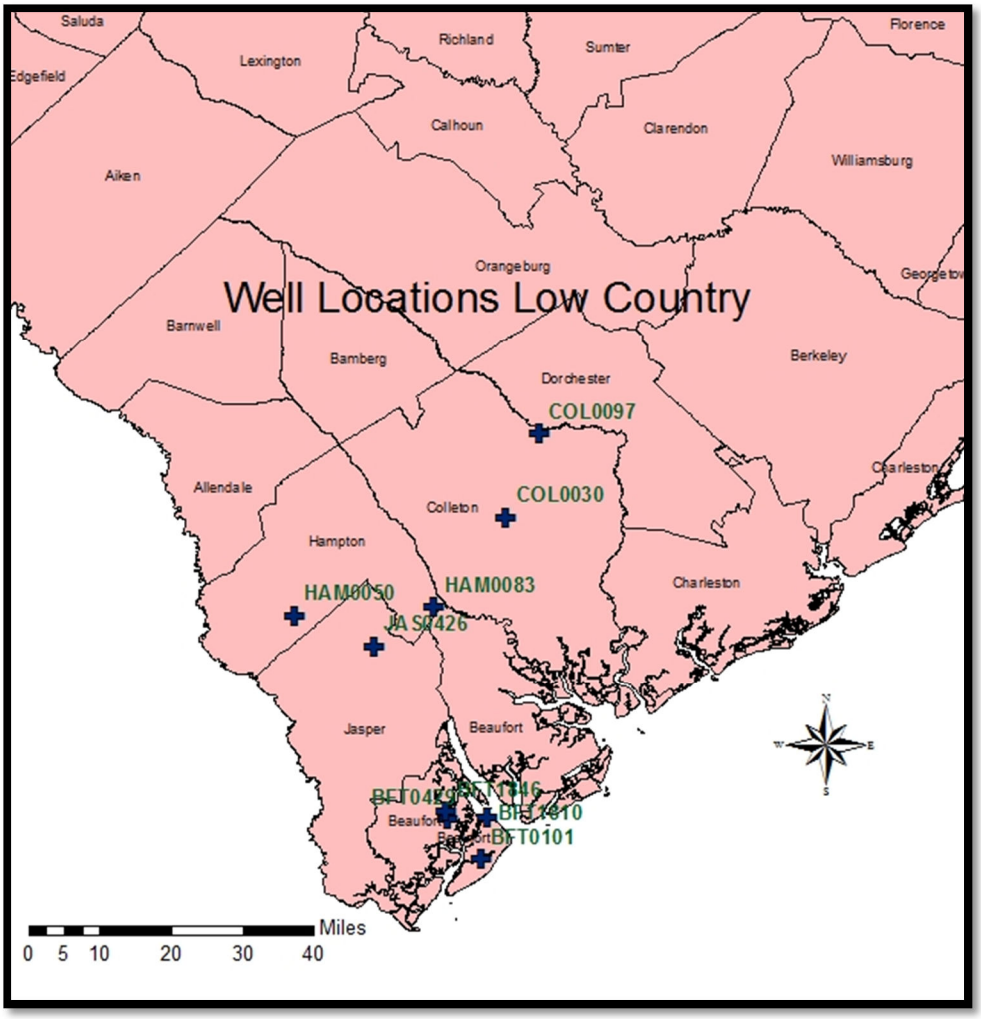

Figure 19. Locations of existing groundwater level monitoring wells.

The existing groundwater monitoring network is necessary to:

- Provide accurate data on the amount and rate of groundwater level declines;
- Establish the correlation between groundwater pumping and water level changes, both on a local and regional scale;
- Guide management efforts to minimize potential impairment of the aquifers and track progress in reversing water level declines;
- Provide groundwater withdrawers with timely and accurate information to effectively manage withdrawal activities.

Strategy #4: Establish a conservation educational plan for the general public and existing groundwater withdrawers.

Water conservation has increasingly become a cornerstone to the development of water management strategies. An effective, viable water conservation program should incorporate the following:

- Provide public education and outreach programs;
- Determine and enhance water use efficiency;
- Determine water losses and establish corrective actions;
- Prepare for water shortages and provide appropriate responses.

Strategy #5: Regulation and Planning.

The Groundwater Use and Reporting Act provides for regulation of water withdrawals in South Carolina. Groundwater regulation is necessary to protect and provide for the long-term sustainability of the resource. As data are developed on the groundwater resources of the designated Capacity Use Areas, the regulations should will be reviewed to ensure that sufficient and adequate protection of the resource is provided.

SCDNR is responsible for developing and updating the State Water Plan. A groundwater model of the coastal aquifers is currently being developed by the USGS and SCDNR. As the results of the modeling effort and the updates to the State Water Plan become available, they will help inform potential regulatory and policy changes and will be incorporated into this Groundwater Management Plan.

Groundwater Management Plan Reports

Every 5 years, or length of the permitting cycle, total annual groundwater withdrawals will be compiled and compared to available aquifer potentiometric maps. The report will include the following information:

- Listing of all permitted withdrawers, permitted withdrawal limits, and average groundwater withdrawal;
- Evaluation of withdrawal by category and by aquifer;
- Identification of areas of aquifer stress and all withdrawers utilizing the stressed aquifer(s).

Based on the information developed for the plan report, modifications of groundwater withdrawals in stressed areas will be reviewed and subsequently the Groundwater Management Plan may be amended. The report will also evaluate, as information is developed, changes in water quality of the aquifers, available storage capacity of the aquifers, project future rates of withdrawal and estimate future groundwater declines from the projected withdrawal rates. Through time, a safe sustainable yield for each aquifer will be developed and subsequent withdrawal limits will be based on this available yield. The Department will host a stakeholder meeting to discuss the draft report. Comments on the draft plan will be taken into consideration as the Department finalizes the report and updates the groundwater management plan based on the report recommendations. The final report and updated groundwater management plan will be shared with the Stakeholders and the permit renewals will be issued consistent with the report and the plan.

Upper Floridan Aquifer and Salt Water Intrusion

By 1990, groundwater withdrawals from the Upper Floridan aquifer at Savannah and Hilton Head Island had reached about 88 and 14.5 Million gallons per day (MGD), respectively. Groundwater withdrawals remained at peak levels throughout much of the 1990's and chloride concentration was increasing in public supply wells near the northern part of Hilton Head Island. Efforts to mitigate water-level declines in the Upper Floridan aquifer required the use of alternative sources by permitted users to include surface water, deeper aquifers, and reclaimed water for irrigation use. Permits for long-term golf-course irrigation require reclaimed water or from wells that withdraw water from a deeper part of the aquifer. The States of Georgia and South Carolina continue to work closely through their respective agencies, GaEPD and SCDHEC, to manage by reducing groundwater withdrawals in the Upper Floridan aquifer by conservation and alternative sources. The City of Savannah in cooperation with GaEPD has decreased permitted withdrawals from the Upper Floridan aquifer to 1950 levels through conservation and increased use of surface water, and SCDHEC has held Hilton Head Island's permitted withdrawals from the aquifer at 9.5 MGD since 1998.

Salt-water migration in the Upper Floridan aquifer continues to be monitored. Specific strategies are currently being used, both in Georgia and South Carolina, to address increasing chloride concentrations in the aquifer. Further actions may be necessary and will be evaluated in the Groundwater Management Plan Report to be drafted prior to permit renewals.

Aquifer Recovery and Storage

ASR is the re-injection of potable water back into an aquifer for later recovery and use. This process replenishes ground water stored in aquifers for beneficial purposes. Presently, SCDHEC regulation states that only 80% of water injected can be recovered for potable use leaving millions of gallons for replenishing declining water levels. "Potable" refers to water of high quality posing no health risk when consumed.

Some recognized environmental benefits of ASR:

- A significant amount of water can be stored underground reducing the need to construct large and expensive surface reservoirs.
- ASR systems are considered to be more environmentally and aesthetically friendlier than surface reservoirs and offer better protection from tampering and contamination.
- ASR adds millions of gallons that may stabilize or reverse declining water levels in an aquifer that has experienced long-term declines in water levels due to heavy pumping.

This process has proven to be a viable option for storing water for emergencies and reducing capital cost for meeting peak summer tourism demands. ASR is an important management tool for maintaining declining aquifer water levels and certain items should be considered to continue its success.

- Permitted ASR sites are limited to recover no more than 80% of total injected water.
- ASR sites should have top priority and the process should not be jeopardized by groundwater withdrawal.
- Applications and renewal for use should be evaluated for water use purpose and location to an ASR site.

- Reducing or limiting existing groundwater usage in close proximity of an ASR site to reduce the risk of pulling injected water away from an ASR site.