

# NORTH CAROLINA

## Agricultural Water Use

# 2014



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## 2014 Agricultural Water Use Survey

The sixth statewide survey was conducted to document water use for the agricultural sector during 2014. As directed in legislation enacted in 2008 (SL2008-0143), the North Carolina Department of Agriculture and Consumer Services, Agricultural Statistics Division, is required to collect annual information from farmers who withdraw 10,000 gallons or more in any one day. Individual responses remain confidential and are only used in combination with other reports to produce totals.

Farmers who use over 1,000,000 gallons in any one day are required to report their water usage directly to the Department of Environment and Natural Resources (DENR). DENR's report can be found on [http://www.ncwater.org/Permits\\_and\\_Registration/Water\\_Withdrawal\\_and\\_Transfer\\_Registration/report](http://www.ncwater.org/Permits_and_Registration/Water_Withdrawal_and_Transfer_Registration/report).

When looking at agricultural water use from a total volume withdrawn perspective, table 1 on page 4 is most representative of total water use. Because farms that withdraw the largest amounts of water do not make those withdrawals every day, the average daily use across all 365 days of the year is most representative of relative volumes used. On average, farm operations that use irrigation will withdraw water about 18 days each month. Field crop operations use water even less often, primarily to supplement rainfall. While there are other agricultural users of water, including livestock and poultry producers, aquaculture farms, and others, the largest volume of water use is from irrigators. The average North Carolina farm that uses water does so infrequently and in relatively small amounts. Table 2 on page 7 displays "demand" use, which is calculated by dividing the total water withdrawn for the month by the days applied.

The results of this survey reflect water withdrawals from ground and surface sources. Many comparisons across sectors will incorporate an estimate of consumptive use of withdrawals. The definition of a consumptive use varies depending on the source. Most experts in agricultural sciences consider consumptive use to be the amount of water that is either taken up by plants, or evaporated. According to an Economic Research Service (USDA) report, irrigation consumptive use on farms is about 61 percent of total withdrawals nationally. This can vary greatly between regions depending on the type of system used and efficiency of the irrigation equipment.

Of the farms surveyed in the state, 1017 withdrew over 10,000 gallons of water in any one day. The majority of the state experienced normal soil moisture conditions until July when much of the piedmont experienced abnormally dry conditions. The situation improved significantly in August but deteriorated again to abnormally dry conditions in October which impacted even

more Piedmont counties. The abnormally dry conditions spread in November to cover the eastern counties. December brought most counties' soil moisture back to normal. July was the largest water use month in 2014, averaging 106.2 million gallons daily, with a maximum daily withdrawal of 226.1 million gallons. The annual average daily water use for 2014 was 47.0 million gallons. The daily withdrawal capacity for the 1017 operations totaled 854.5 million gallons in 2014.

A questionnaire was mailed to operations which had potential for large water usage. Operations that did not respond were contacted by telephone follow-up. In addition, livestock and poultry contractors in the state were contacted by email, phone, or mail.

The unique number of operations, the annual average daily ground and surface usage, as well as the capacity is published by county and by hydrologic unit codes (HUC). The capacity is the potential amount of ground and/or surface water that could be withdrawn in a 24-hour period. The published capacity represents the sum of capacities for all reporting operations in that county or HUC. In nearly all cases, this capacity was never met. Data was not disclosed if there were less than three operations in any category or if one report comprised 60 percent or more of the total.

One survey instrument was used to gather data for the whole state as well as for the Central Coastal Plain Capacity Use Area (CCPCUA). Results for the CCPCUA are summarized and published in a separate table.

**Table 1: Total & Average Daily Water Withdrawn <sup>1</sup>**  
**2014 North Carolina Water Use by Month**

Month	Operations	Monthly Total Ground	Monthly Total Surface	Average Across All Days-Ground	Average Across All Days-Surface
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
January	737	387,277,147	230,333,583	12,492,811	7,430,116
February	749	358,541,837	212,181,504	12,805,066	7,577,911
March	782	433,341,486	319,153,730	13,978,758	10,295,282
April	830	742,423,788	510,316,050	24,747,460	17,010,535
May	879	843,965,145	879,952,717	27,224,682	28,385,572
June	942	1,224,764,771	1,223,004,108	40,825,492	40,766,804
July	951	1,477,725,661	1,813,133,342	47,668,570	58,488,172
August	897	1,171,944,698	1,306,016,775	37,804,668	42,129,573
September	833	790,595,711	759,077,553	26,353,190	25,302,585
October	788	596,905,990	472,883,862	19,255,032	15,254,318
November	753	467,100,923	262,325,185	15,570,031	8,744,173
December	734	441,847,248	238,159,534	14,253,137	7,682,566
<b>Annual Average</b>				<b>24,483,382</b>	<b>22,538,460</b>

**Operations :**

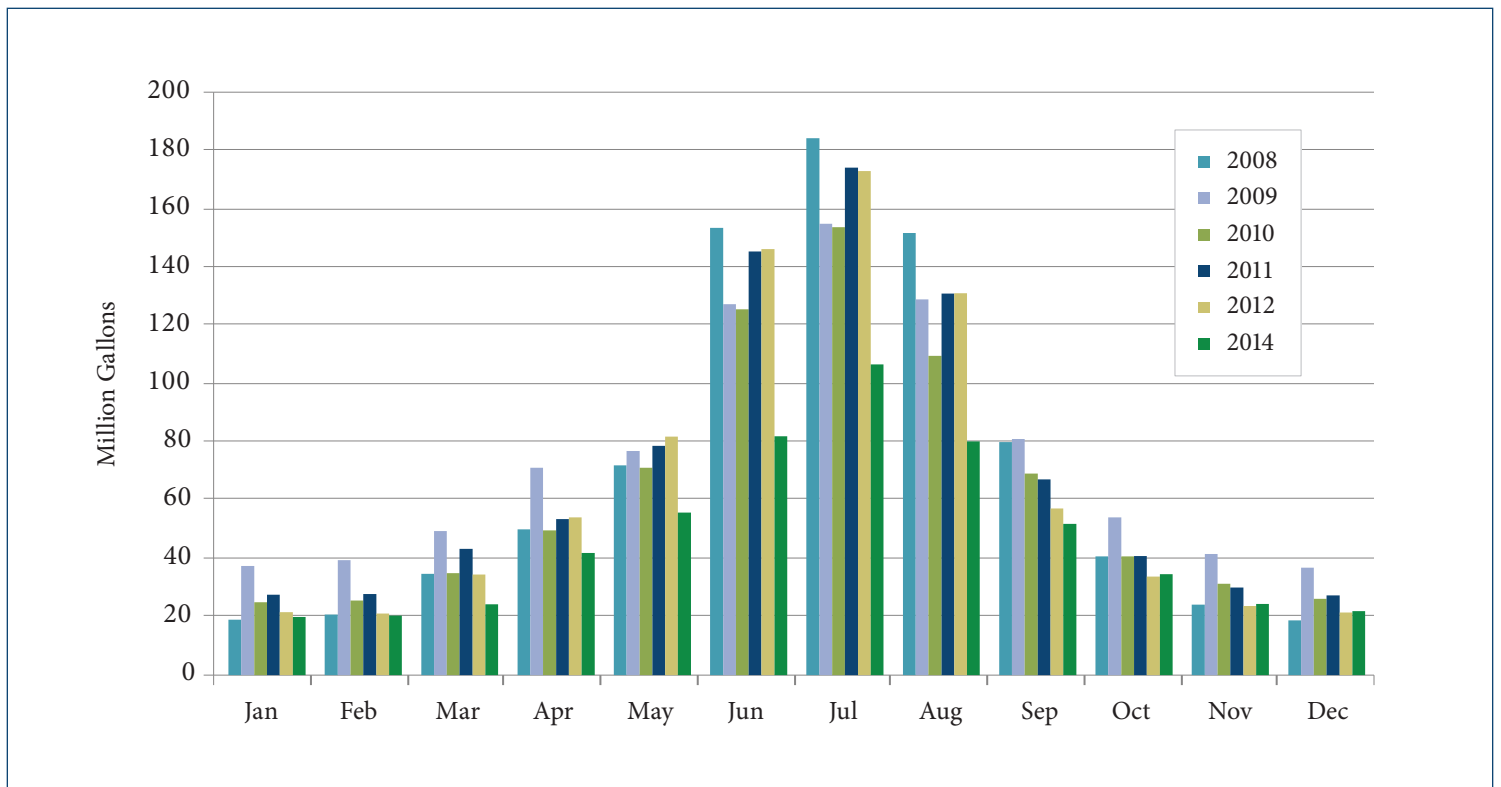
**1017 Total Operations**

**Daily Withdrawal Capacity (incl. ground & surface):**

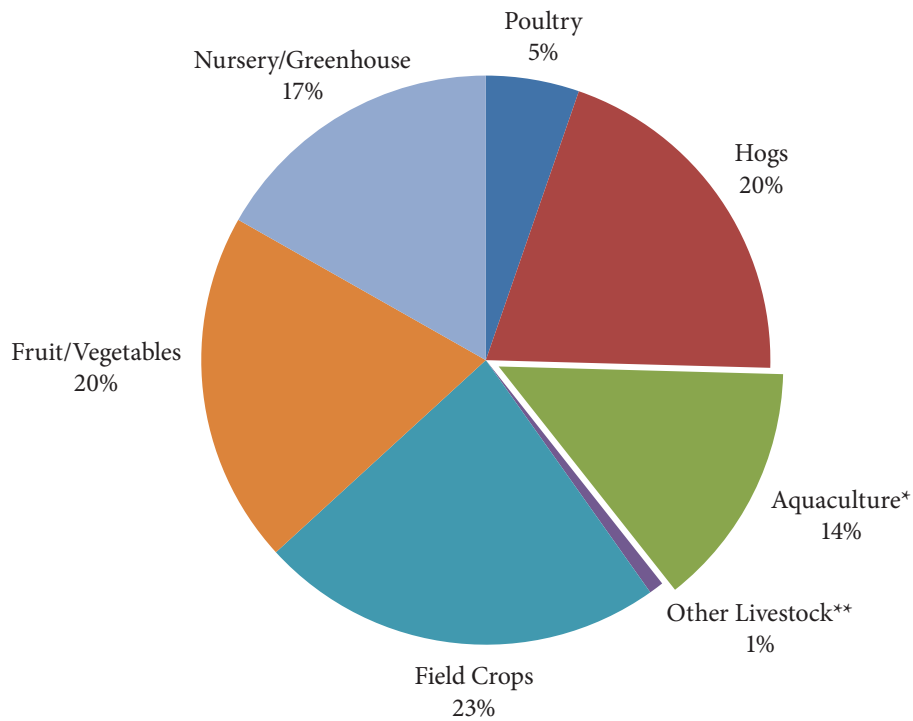
**854,513,659 Gallons**

<sup>1</sup> Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn across all days of the month. Farms that reported their withdrawals directly to DENR by May 21, 2015 have been excluded. The monthly number of operations will not add to the total. Some operations reported both surface and ground water withdrawals, which are counted twice in the monthly number of operations. However, the total number of operations represents operations that withdrew water at any time during the year, regardless if withdrawn from multiple sources.

**Average Across All Days**  
**Ground & Surface Water Withdrawals**  
**2008–2014**



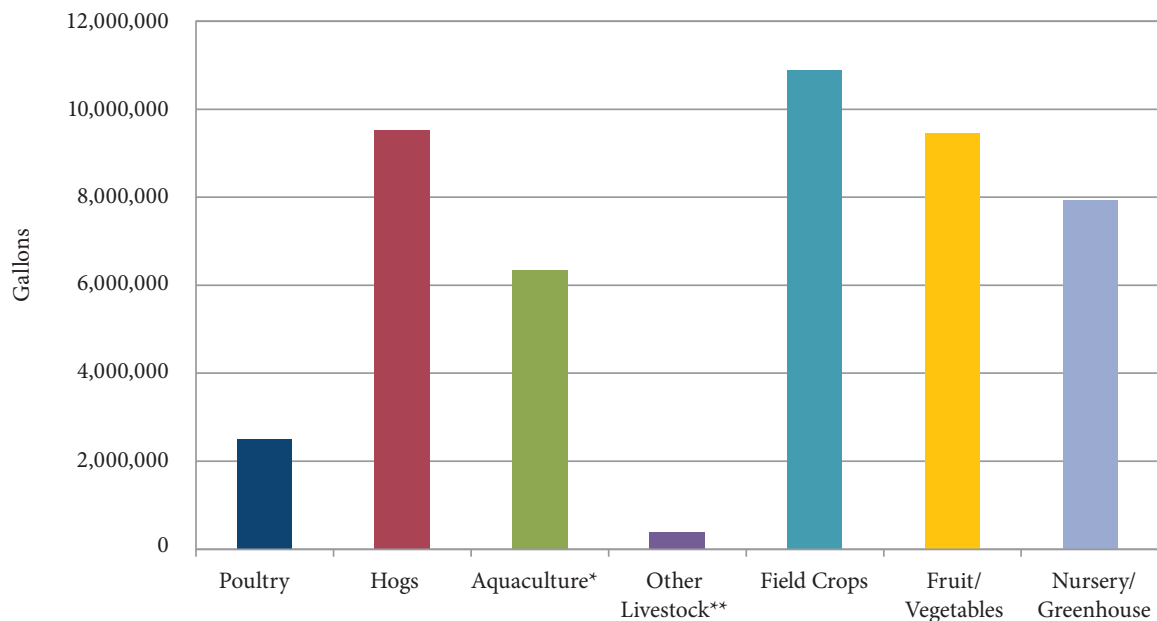
## 2014 Annual Water Withdrawals by Percent



\* 99% of aquaculture water withdrawals occur in western counties from rivers and streams and are typically flow through/non-consumptive.

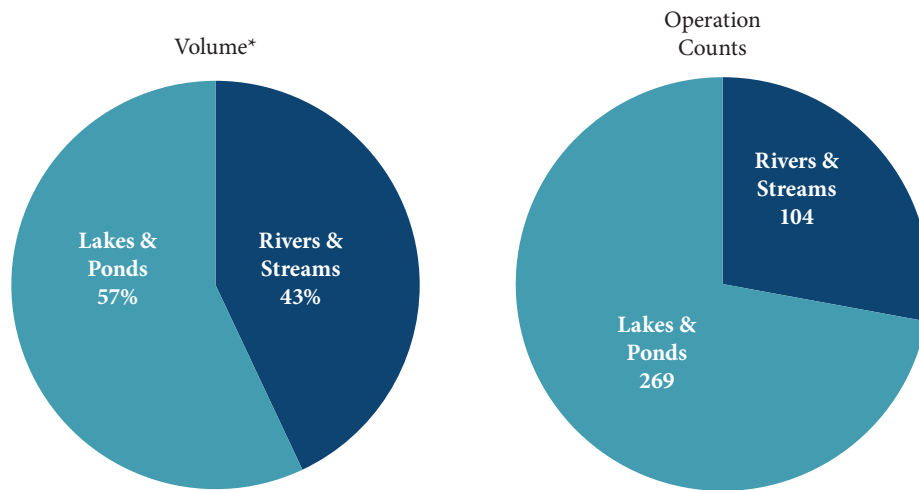
\*\* Other Livestock includes cattle, horses, goats, sheep, etc.

## 2014 Average Daily Water Withdrawals



\* 99% of aquaculture water withdrawals occur in western counties from rivers and streams and are typically flow through/non-consumptive. \*\*Other Livestock includes cattle, horses, goats, sheep, etc.

## 2014 Annual Surface Water Withdrawals



*\*56% of River & Stream Withdrawals are made by aquaculture operations from the western portion of the state and are typically flow through/non-consumptive.*



**Table 2: Demand Use for Days Applied <sup>1</sup>**  
**2014 North Carolina Water Use by Month**

Month	Average Days Applied Ground	Average Days Applied Surface	Total Average Daily-Ground	Total Average Daily-Surface	Total Max Daily-Ground	Total Max Daily-Surface
	<i>Days</i>	<i>Days</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
January	29	19	16,320,298	9,515,491	18,356,326	10,039,169
February	25	16	18,312,253	9,864,866	23,146,256	10,456,561
March	27	15	25,733,202	38,632,338	31,934,492	40,207,254
April	27	17	35,185,786	29,459,540	50,717,486	34,771,885
May	27	18	52,176,158	48,928,519	69,280,879	61,968,994
June	27	17	75,600,565	90,094,650	91,910,768	109,292,718
July	28	17	86,388,854	107,249,952	96,881,799	129,189,699
August	28	18	66,022,405	81,687,609	77,952,796	99,862,349
September	27	20	38,580,084	44,085,721	50,977,371	54,185,283
October	28	18	26,492,113	23,413,412	38,646,102	26,435,742
November	27	18	20,930,266	13,565,543	31,501,129	15,722,273
December	28	18	21,326,509	10,944,457	25,581,884	12,073,692
<b>Annual Average</b>			<b>40,255,708</b>	<b>42,286,842</b>		

<sup>1</sup> Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn during the days of application. Farms that reported their withdrawals directly to DENR by May 21, 2015 have been excluded.





## 2014 North Carolina Water Use County Summary

County	Unique Operations <sup>1</sup>	Annual Average Daily <sup>2</sup> Ground	Annual Average Daily <sup>2</sup> Surface	Daily Withdrawal Capacity <sup>3</sup>
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
Alamance	10	*	213,026	15,834,560
Anson	12	136,826	*	2,222,831
Beaufort	8	553,559	*	9,432,680
Bladen	69	1,169,677	370,448	79,797,961
Brunswick	5	45,782	*	1,390,200
Catawba	7	*	1,061,262	10,852,800
Chatham	6	46,639	*	987,000
Cleveland	6	87,216	*	1,058,072
Duplin	122	3,537,516	*	61,475,193
Granville	12	*	597,550	20,062,840
Greene	15	222,976	*	2,318,532
Halifax	8	79,623	*	6,045,056
Harnett	17	*	406,212	24,838,653
Johnston	23	164,276	916,035	20,221,102
Lee	8	13,542	114,098	7,038,400
Lincoln	10	56,474	981,161	9,724,000
Montgomery	9	46,174	*	2,231,840
Moore	20	83,313	268,871	28,517,740
Nash	20	*	312,812	23,929,400
New Hanover	5	426,192	*	2,541,800
Northampton	13	238,150	*	6,686,547
Onslow	7	77,568	*	1,500,200
Orange	5	*	5,643	684,000
Pender	23	707,012	626,207	21,397,565
Pitt	15	316,256	*	17,456,600
Randolph	16	51,050	*	8,963,880
Richmond	18	174,357	*	5,811,557
Robeson	48	4,697,524	*	70,771,100
Rockingham	16	*	273,940	18,053,080
Sampson	105	2,782,811	393,110	53,821,942
Surry	12	66,705	*	7,388,200
Union	27	392,501	*	7,942,600
Wayne	31	461,418	*	8,805,240
Wilkes	16	117,098	*	2,565,800
Wilson	8	8,754	162,324	6,760,000
Other Counties <sup>4</sup>	265	7,653,918	15,719,603	285,384,688
<b>State</b>	<b>1017</b>	<b>24,483,382</b>	<b>22,538,460</b>	<b>854,513,659</b>

\* disclosure - one operation is greater than 60% of total or less than 3 operations. <sup>1</sup> represents the unique number of operations which withdrew surface and or ground water <sup>2</sup> represents the average across all 365 days of the year <sup>3</sup> includes ground and surface <sup>4</sup> includes nondisclosed data from the table above and all data for Alexander, Alleghany, Ashe, Avery, Bertie, Buncombe, Burke, Cabarrus, Caldwell, Camden, Carteret, Caswell, Cherokee, Chowan, Clay, Columbus, Craven, Cumberland, Currituck, Dare, Davidson, Davie, Durham, Edgecombe, Forsyth, Franklin, Gaston, Gates, Graham, Guilford, Haywood, Henderson, Hertford, Hoke, Hyde, Iredell, Jackson, Jones, Lenoir, McDowell, Macon, Madison, Martin, Mecklenburg, Mitchell, Pamlico, Pasquotank, Perquimans, Person, Polk, Rowan, Rutherford, Scotland, Stanly, Stokes, Swain, Transylvania, Tyrrell, Vance, Wake, Warren, Washington, Watauga, Yadkin, and Yancey.



## 2014 North Carolina Water Use - Hydrologic Unit Code Summary

Hydrologic Unit Code	Unique Operations <sup>1</sup>	Annual Average Daily <sup>2</sup> Ground	Annual Average Daily <sup>2</sup> Surface	Daily Withdrawal Capacity <sup>3</sup>
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
03010104	12	*	88,828	9,434,600
03010107	21	310,861	*	9,037,950
03010203	22	*	604,578	29,075,351
03020101	37	*	920,917	39,710,400
03020104	5	729,898	*	8,149,000
03020201	54	414,426	1,188,684	42,686,780
03020202	27	394,147	*	12,727,001
03020203	36	423,644	447,087	24,313,720
03020204	11	134,336	*	4,468,869
03030002	32	102,252	916,239	36,943,240
03030003	36	195,799	402,955	30,755,440
03030004	33	*	753,943	34,682,381
03030005	20	390,160	*	9,769,777
03030006	145	2,769,620	843,999	145,474,920
03030007	160	4,988,248	2,502,376	75,170,619
03040101	38	204,078	1,552,717	23,113,520
03040104	15	132,354	*	3,335,991
03040105	38	1,858,818	437,372	18,472,400
03040201	5	38,230	*	513,677
03040203	60	3,181,278	*	58,238,460
03040204	42	2,710,117	*	75,968,680
03040208	4	44,516	*	1,176,600
03050101	16	*	89,773	22,550,000
03050102	12	89,811	1,919,581	15,904,000
03050105	10	87,216	142,736	2,325,872
Other HUCs <sup>4</sup>	126	5,215,100	9,610,518	120,514,411
<b>STATE</b>	<b>1017</b>	<b>24,483,382</b>	<b>22,538,460</b>	<b>854,513,659</b>

\* disclosure - one operation is greater than 60% of total or less than 3 operations.

<sup>1</sup> represents the unique # of operations which withdrew surface and or ground water <sup>2</sup> represents the average across all days of the year <sup>3</sup> includes ground and surface <sup>4</sup> includes nondisclosed data from the table above and all data for 03010102, 03010103,

03010106, 03010204, 03010205, 03020102, 03020103, 03020105, 03020301, 03020302, 03040102, 03040103, 03040206, 03050103, 05050001, 06010103, 06010105, 06010106, 06010108, 06010202, 06010203, 06020002

## 2014 Central Coastal Plain Total Water Use by Month <sup>1</sup>

Month	# Operations	Average Across All Days-Ground	Average Across All Days-Surface	Total Max Daily-Ground	Total Max Daily-Surface
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
January	207	3,420,189	496,540	3,583,649	589,195
February	210	3,085,642	455,061	3,775,413	700,726
March	215	3,798,870	1,510,793	8,836,940	10,873,223
April	225	6,880,372	3,991,233	10,332,727	7,236,477
May	231	7,843,038	5,808,942	13,824,245	11,614,542
June	236	8,190,931	7,631,084	14,137,785	24,653,843
July	230	8,341,132	6,422,638	12,980,764	16,271,620
August	224	7,827,844	6,339,246	11,614,109	15,211,804
September	216	6,998,794	4,751,491	10,026,566	10,899,856
October	213	4,358,592	1,605,175	8,311,874	3,526,630
November	207	3,499,200	1,458,481	5,125,119	1,951,158
December	204	3,054,961	857,544	3,392,344	1,321,537
<b>Annual Average</b>		<b>5,628,893</b>	<b>3,458,720</b>		

### Operations:

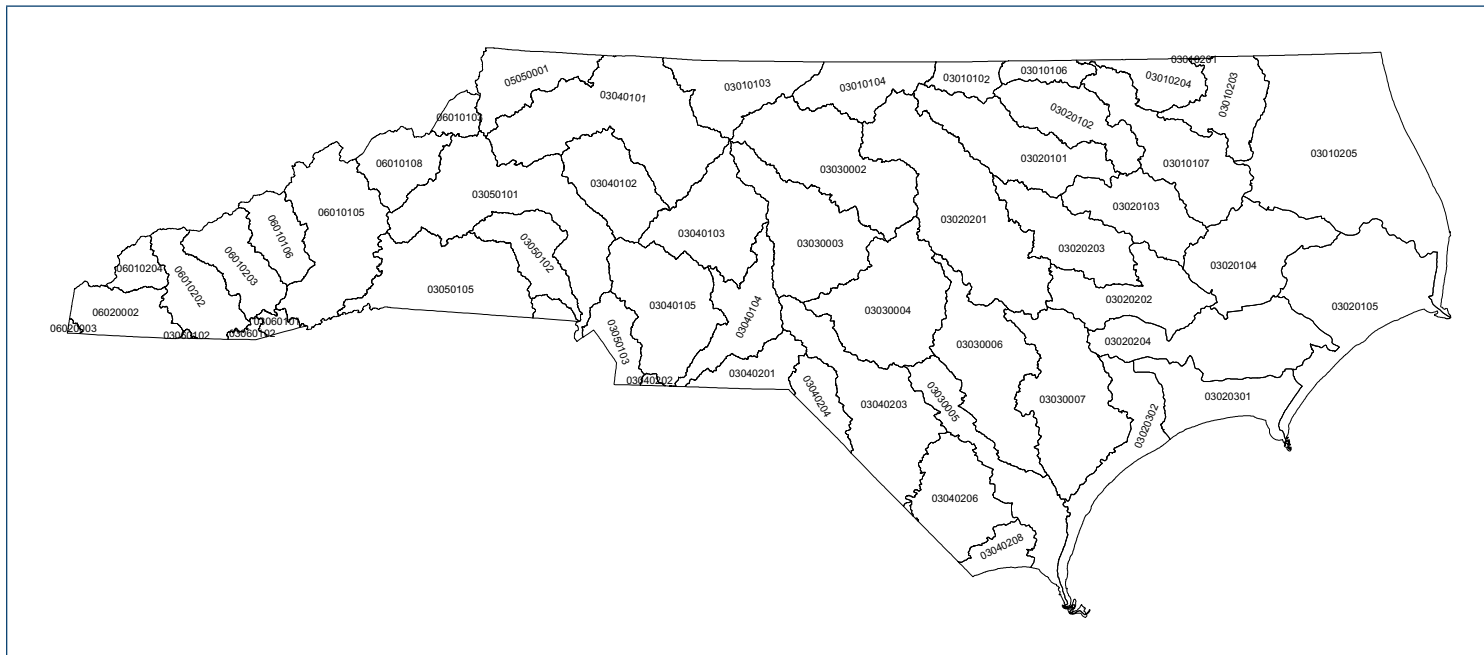
**243 Total Operations**

### Daily Withdrawal Capacity (incl. ground & surface):

**167,987,423 Gallons**

<sup>1</sup> Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn across all days of the month. Does not include farms that have reported their withdrawals directly to DENR by May 21, 2015. The number of operations represents operations that withdrew water at any time during the year. "Central Coastal Plain Counties include Beaufort, Carteret, Craven, Duplin, Edgecombe, Greene, Jones, Lenoir, Martin, Onslow, Pamlico, Pitt, Washington, Wayne, and Wilson"

## Hydrologic Unit Codes (HUC)



## Statistical Defensibility

The North Carolina Department of Agriculture and Consumer Services' Agricultural Statistics Division conducted a census of all known farm operations in North Carolina which had farming types that could potentially use more than 10,000 gallons of water in one day. More than 2,800 such operations were contacted and included farms with a history of withdrawing more than 10,000 gallons on any one day. Also included were operations with large numbers of poultry, hogs, cattle, aquaculture, fruits, vegetables, nursery/ greenhouse crops, tobacco, or other field crops which are often irrigated. An 88% response rate was attained via mail, phone, or electronically via the web or email. Historical data for all respondents was reviewed to insure comparability with previous surveys. Operations were offered work sheets which assisted them, if necessary, in reporting their withdrawals.

The Census of Agriculture List, the most comprehensive source of farms, was used as the basis for this survey. Although no under-coverage estimator has been applied, the list of NC farmers is expanded on a daily basis as new operations are discovered through routine list building activities. Since agricultural operations that withdraw at least 10,000 gallons of water per day tend to be larger, more intensive farms, under-coverage for this survey is minimal based on historic surveys with similar operations.

Taking the above steps, including conducting a census of all known farm operations that use 10,000 gallons of water on any one day, results in zero sampling error around the estimates and minimal non-sampling and coverage error. Prior to the 2008 NC Agricultural Water Use Survey, there was no official statistically defensible data set to represent agricultural water use in North Carolina.





**Table 1: Total & Average Daily Water Withdrawn <sup>1</sup>**  
**2014 North Carolina Water Use by Month**

Month	# Operations	Monthly Total-Ground	Monthly Total-Surface	Average Across All Days-Ground	Average Across All Days-Surface
	<i>Count</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
January	737	387,277,147	230,333,583	12,492,811	7,430,116
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<b>Annual Average</b>				<b>24,483,382</b>	<b>22,538,460</b>

**Operations :**

**1017** *Total Operations*

**Daily Withdrawal Capacity (incl. ground & surface):**

**854,513,659** *Gallons*

<sup>1</sup> Users of 10,000 gallons or more per day. Averages reported in this table reflect the average water withdrawn across all days of the month. Farms that reported their withdrawals directly to DENR by May 21, 2015 have been excluded. The monthly number of operations will not add to the total. Some operations reported both surface and ground water withdrawals, which are counted twice in the monthly number of operations. However, the total number of operations represents operations that withdrew water at any time during the year, regardless if withdrawn from multiple sources.

**Table 2: Demand Use for Days Applied <sup>1</sup>**  
**2014 North Carolina Water Use by Month**

Month	Average Days Applied Ground	Average Days Applied Surface	Total Avg. Daily-Ground	Total Avg. Daily-Surface	Total Max Daily-Ground	Total Max Daily-Surface
	<i>Days</i>	<i>Days</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
January	29	19	16,320,298	9,515,491	18,356,326	10,039,169
February	25	16	18,312,253	9,864,866	23,146,256	10,456,561
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