

NORTH CAROLINA

Agricultural Water Use

2018



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2018 Agricultural Water Use Survey

The eighth statewide survey was conducted to document water use for the agricultural sector during 2018. 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 Environmental Quality (DEQ). DEQ's report can be found on 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When looking at agricultural water use from a total volume withdrawn perspective, table 1 on page 4 is most representative of total water use.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 days of the year is most representative of relative volumes used. On average, farm operations that use irrigation will withdraw water about 17 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 Table 2 on page 7 displays "demand" use, which is calculated by dividing the total water withdrawn for the month by the days applied.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. https://www.ers.usda.gov/webdocs/publications/41964/30286_wateruse.pdf?v=41143

Of the farms surveyed in the state, 1025 withdrew over 10,000 gallons of water in any one day. The majority of the state experienced abnormally dry soil moisture conditions in January, but conditions improved across the state during the first quarter. Soil conditions were considered normal throughout the majority of the state in the following three quarters. July was the largest water use month in 2018, averaging 110.9 million gallons daily, with a maximum daily withdrawal of 258.8 million gallons. The annual average daily water use for 2018 was 60.2 million gallons. The daily withdrawal capacity for the 1025 operations totaled 1.2 billion gallons in 2018.

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 ¹
2018 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	671	296,204,426	953,338,945	9,554,981	30,752,869
February	676	278,864,356	983,363,881	9,959,441	35,120,139
March	730	353,841,137	1,209,660,116	11,414,230	39,021,294
April	793	419,861,281	1,393,105,505	13,995,376	46,436,850
May	832	453,604,857	1,376,070,828	14,632,415	44,389,382
June	929	1,016,079,127	2,017,313,534	33,869,304	67,243,784
July	934	1,146,292,552	2,290,541,801	36,977,179	73,888,445
August	855	684,421,774	1,864,711,208	22,078,122	60,151,974
September	770	454,515,121	1,203,487,906	15,150,504	40,116,264
October	724	430,565,172	973,041,191	13,889,199	31,388,426
November	680	366,299,667	805,379,324	12,209,989	26,845,977
December	660	292,962,711	724,455,844	9,450,410	23,369,543
Annual Average				16,931,763	43,227,079

Operations :

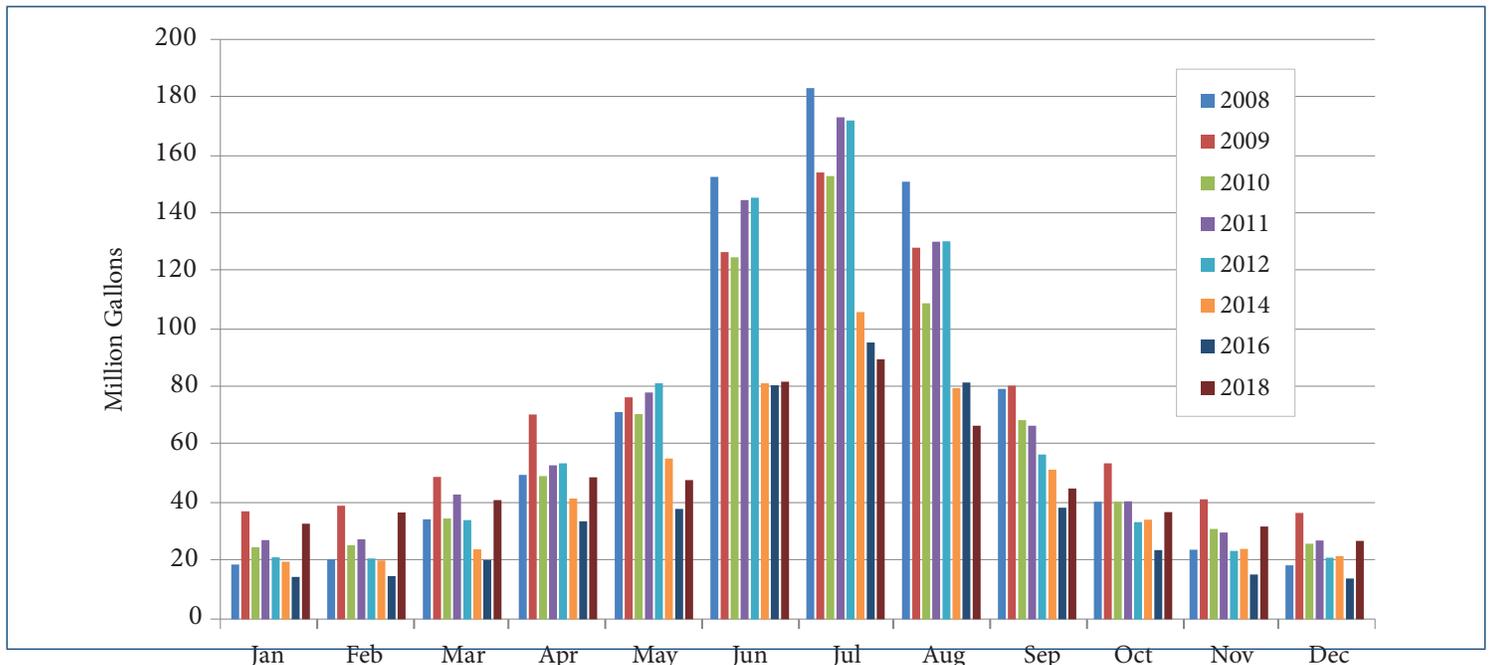
1025 Total Operations

Daily Withdrawal Capacity (incl. ground & surface):

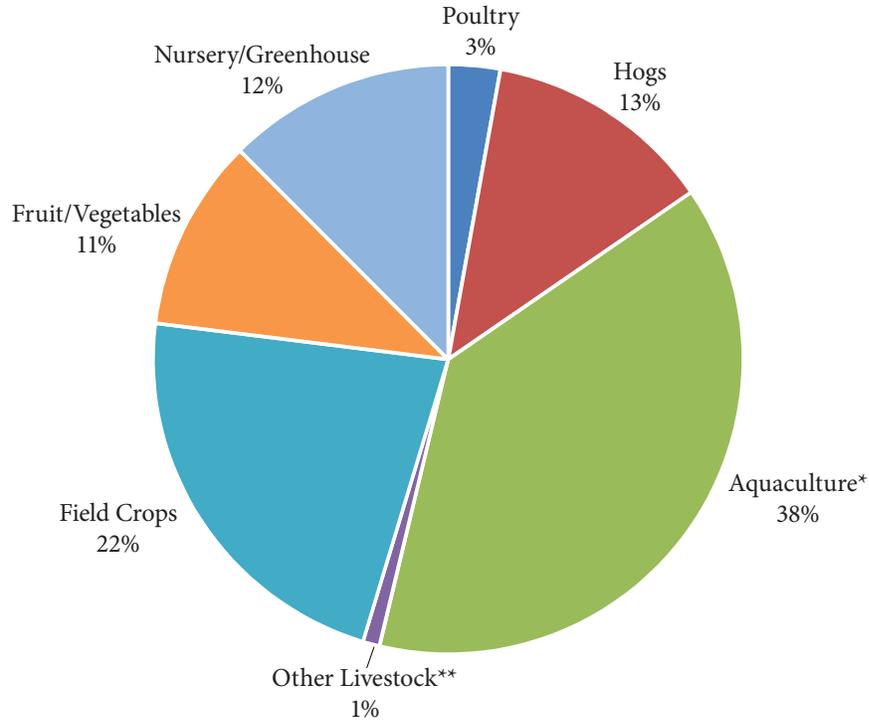
1,200,116,130 Gallons

¹ 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 DEQ by June 10, 2019 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
2008–2018**



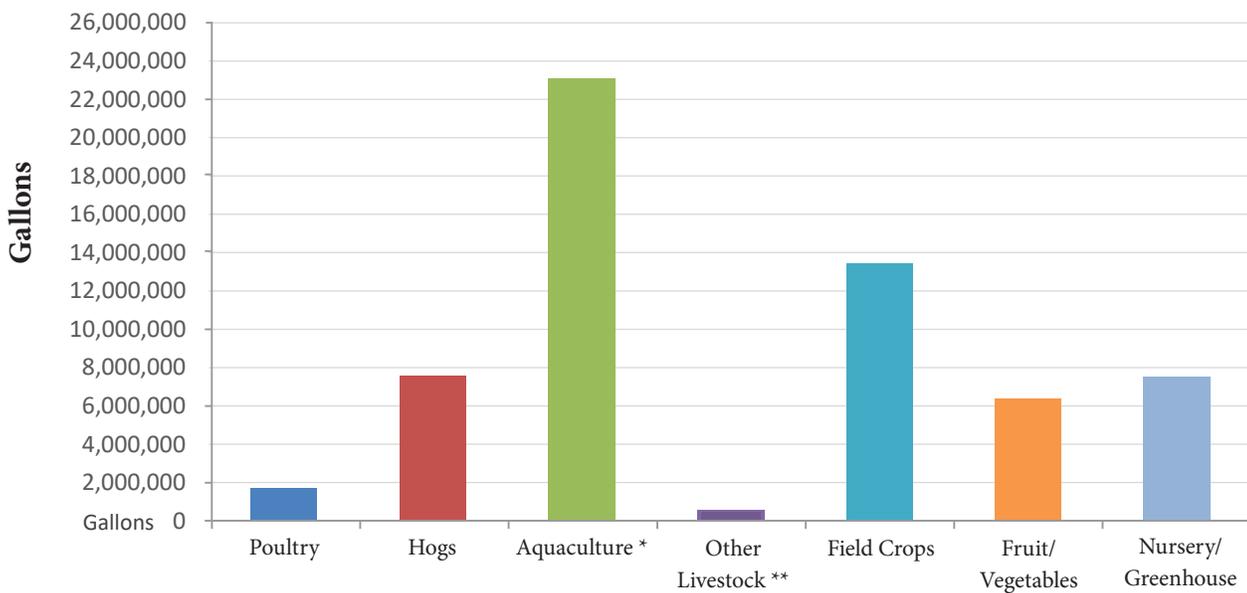
2018 Annual Water Withdrawals by Percent



*92% of aquaculture water withdrawals occurred in western counties from rivers and streams and are typically flow through /non-consumptive.

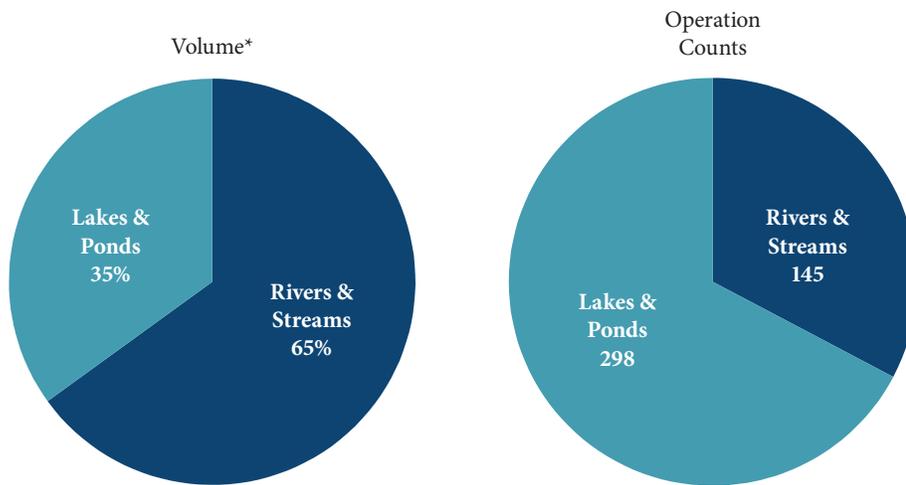
** Other Livestock includes cattle, horses, goats, sheep, etc.

2018 Average Daily Water Withdrawals



*92% of aquaculture water withdrawals occurred in western counties from rivers and streams and are typically flow through non-consumptive ***Other Livestock includes cattle, horses, goats, sheep, etc.

2018 Annual Surface Water Withdrawals



**74% of River & Stream Withdrawals were made by aquaculture operations and are typically flow through/non-consumptive.*



Table 2: Demand Use for Days Applied ¹
2018 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	28	16	10,857,288	34,531,266	11,864,106	34,867,145
February	25	14	11,388,949	40,892,514	12,522,646	41,154,374
March	27	14	16,733,307	83,459,103	20,165,512	84,656,081
April	27	15	27,247,047	112,513,732	33,116,438	115,527,468
May	27	16	30,743,327	79,723,061	35,221,340	87,529,512
June	26	15	72,449,562	129,486,949	80,938,835	144,331,114
July	27	15	69,520,220	144,447,895	83,759,645	175,084,872
August	27	16	42,818,158	134,865,903	53,467,002	169,216,163
September	27	17	27,104,151	99,817,045	30,067,784	106,800,152
October	28	18	19,208,792	43,270,410	21,053,885	47,874,850
November	28	16	18,966,753	35,364,450	22,099,687	36,058,797
December	28	16	10,675,381	28,298,559	11,890,754	29,172,768
Annual Average			29,809,411	80,555,907		

¹ 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 DEQ by June 10, 2019 have been excluded.



2018 North Carolina Water Use County Summary

County	Unique Operations ¹	Annual Average Daily ² Ground	Annual Average Daily ² Surface	Daily Withdrawal Capacity ³
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
Alexander	8	53,969	*	2,459,375
Anson	7	131,678	*	*
Beaufort	4	180,074	*	6,310,584
Bladen	67	1,124,806	*	181,629,684
Chatham	9	39,342	*	1,563,222
Cleveland	10	121,862	*	1,394,178
Columbus	7	115,803	*	*
Davidson	9	*	64,422	10,773,068
Duplin	115	2,658,879	*	61,014,445
Edgecombe	10	60,771	*	26,548,992
Gates	9	*	295,254	*
Guilford	9	*	342,463	9,555,501
Halifax	9	111,170	*	4,655,656
Hertford	12	148,068	*	*
Iredell	8	80,428	*	2,424,566
Johnston	31	*	799,507	15,904,675
Lee	13	38,543	*	4,840,168
Lenoir	9	91,080	*	*
McDowell	5	125,084	*	*
Montgomery	11	53,281	*	2,267,753
Moore	23	86,987	66,300	22,583,226
Nash	23	80,505	761,770	20,768,883
Northampton	19	254,404	*	20,677,157
Onslow	6	62,934	*	439,738
Pender	26	435,554	2,276,009	178,340,460
Randolph	16	97,089	68,947	7,166,419
Richmond	12	124,962	*	3,184,523
Robeson	41	1,727,970	*	26,268,414

County	Unique Operations ¹	Annual Average Daily ² Ground	Annual Average Daily ² Surface	Daily Withdrawal Capacity ³
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
Rockingham	14	*	103,402	10,662,383
Rowan	5	15,002	*	*
Sampson	105	2,146,576	*	54,718,082
Surry	10	61,413	*	*
Union	23	183,709	*	9,827,583
Wake	23	75,486	*	14,969,842
Warren	11	51,026	210,540	8,725,751
Wayne	25	457,542	*	9,534,874
Wilkes	10	74,399	*	1,610,952
Yadkin	6	71,121	*	1,169,461
Other Counties ⁴	265	5,790,245	38,238,465	478,126,515
State	1025	16,931,763	43,227,079	1,200,116,130

*** disclosure - one operation is greater than 60% of total or less than 3 operations reported. ¹ represents the unique number of operations which withdrew surface and or ground water ² represents the average across all days of the year ³ includes ground and surface ⁴ includes nondisclosed data from the table above and all data for Alamance, Alleghany, Ashe, Avery, Bertie, Brunswick, Buncombe, Burke, Cabarrus, Caldwell, Camden, Carteret, Caswell, Catawba, Cherokee, Chowan, Clay, Craven, Cumberland, Currituck, Dare, Davie, Durham, Forsyth, Franklin, Gaston, Graham, Granville, Greene, Harnett, Haywood, Henderson, Hoke, Hyde, Jackson, Jones, Lincoln, Macon, Madison, Martin, Mecklenburg, Mitchell, New Hanover, Orange, Pamlico, Pasquotank, Perquimans, Person, Pitt, Polk, Rutherford, Scotland, Stanley, Stokes, Swain, Transylvania, Tyrrell, Vance, Washington, Watauga, Wilson, Yancey, as well as non-disclosed data from the published counties.*

2018 North Carolina Water Use - Hydrologic Unit Code Summary

Hydrologic Unit Code	Unique Operations ¹	Annual Average Daily ² Ground	Annual Average Daily ² Surface	Daily Withdrawal Capacity ³
	<i>Number</i>	<i>Gallons</i>	<i>Gallons</i>	<i>Gallons</i>
03010203	26	342,520	2,164,162	40,914,509
03010204	10	106,781	*	8,274,744
03020101	40	120,025	376,484	40,659,243
03020102	15	94,666	670,367	12,159,350
03020103	17	251,700	*	30,680,207
03020201	62	490,676	1,213,123	42,778,780
03020202	16	179,704	94,018	7,569,851
03020203	42	1,329,469	1,273,234	50,061,840
03020204	6	68,271	*	518,361
03030002	34	*	435,293	36,463,180
03030003	44	240,949	230,321	25,177,477
03030004	29	241,687	*	10,651,960
03030006	128	2,238,257	1,973,501	164,405,334
03030007	153	3,795,738	3,250,743	219,594,482
03040101	36	326,192	*	23,896,078
03040102	13	98,390	111,854	4,476,758
03040103	59	862,496	*	61,153,926
03040104	11	74,765	*	1,908,290
03040203	39	1,319,757	*	22,857,883
03040204	39	985,967	*	15,364,726
03050105	10	140,302	*	1,554,698
Other HUC⁴	196	3,623,449	31,433,979	378,994,453
State	1025	16,931,763	43,227,079	1,200,116,130

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

¹ represents the unique number of operations which withdrew surface and or ground water ² represents the average across all days of the year ³ includes ground and surface ⁴ includes nondisclosed data from the table above and all data for 03010102, 03010103, 03010104, 03010106, 03010107, 03010205, 03020104, 03020105, 03020301, 03020302, 03030005, 03040105, 03040201, 03040206, 03040208, 03050101, 03050102, 03050103, 05050001, 06010103, 06010105, 06010106, 06010108, 06010202, 06010203, 06010204, 06020002, 06020003

2018 Central Coastal Plain Total Water Use by Month ¹

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	182	3,404,075	1,345,640	3,642,469	1,524,973
February	187	3,645,591	1,590,604	4,002,182	2,109,173
March	195	3,872,225	2,326,428	6,707,424	10,527,232
April	204	5,856,419	4,472,391	15,942,679	20,090,655
May	214	4,822,012	3,236,209	12,185,028	8,824,626
June	226	10,619,187	8,304,058	23,408,352	22,223,245
July	221	12,251,259	8,908,236	28,813,074	21,171,661
August	216	7,150,574	6,494,147	18,030,043	21,474,707
September	199	5,080,760	4,690,475	15,063,592	19,517,893
October	193	6,553,640	5,780,003	11,154,619	12,591,066
November	186	5,846,154	3,725,677	11,777,655	9,511,453
December	180	3,275,462	1,248,846	3,650,118	1,581,536
Annual Average		6,031,447	4,343,560		

Operations:

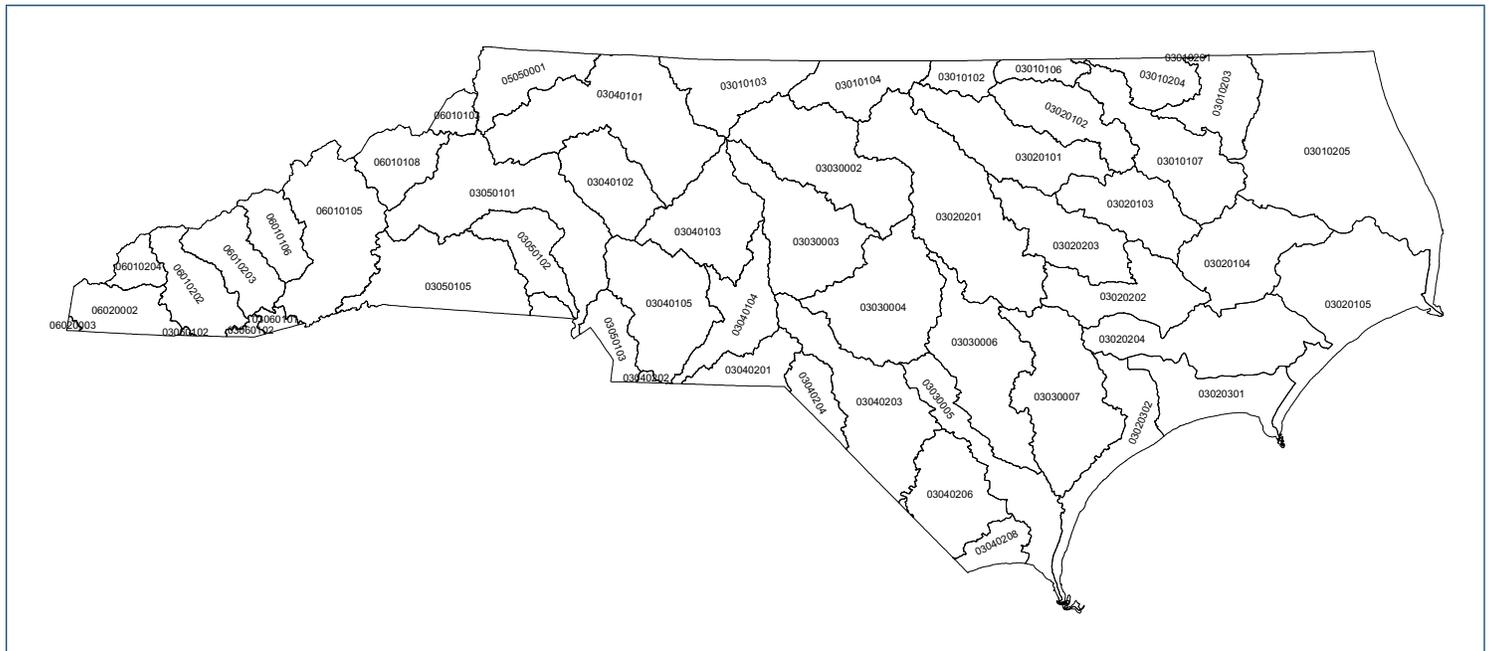
236 Total Operations

Daily Withdrawal Capacity (incl. ground & surface):

167,881,198 Gallons

¹ 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 DEQ by June 10, 2019 have been excluded. The total 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 3,200 such operations were contacted and included farms with a history of withdrawing more than 10,000 gallons on any one day from surface or ground sources. 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 80% 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. When reasonable, non-respondents' usage was estimated based on their own historical reports.

Taking the above steps, including conducting a census of all known farm operations that use at least 10,000 gallons of water on any one day, results in **zero** sampling error around the estimates and **minimal** non-sampling and coverage error. Response rates in 2018 reached a point where individual non-response estimation was no longer feasible. Thus, a nonresponse adjustment expansion factor was applied. It was derived by dividing the universe count by the count of records with usable data.

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.

