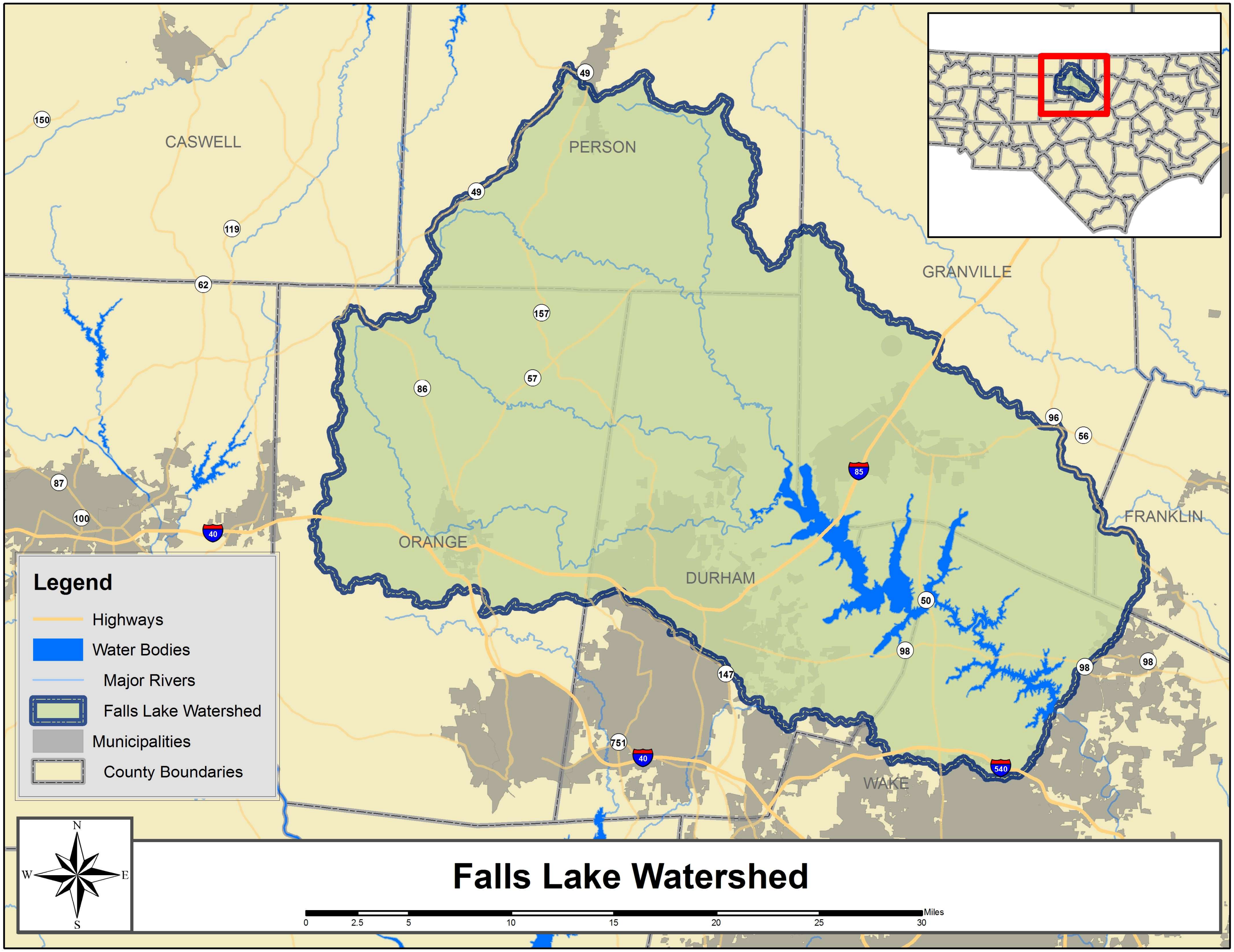
NCDA&CS

2025 Annual Progress Report (Crop Year 2023) on Agricultural Operations' Stage I and Stage II Reductions for the Falls Lake Agriculture Rule (15A NCAC 02B .0280)

A Report to the Division of Water Resources from the Falls Lake Watershed Oversight Committee: Crop Year 2023

Date approved by Falls Lake Watershed Oversight Committee: 3/5/2025
Date submitted to NC Division of Water Resources: 3/5/2025


Falls Lake Watershed
Legend
Highways
Water Bodies
Major Rivers
Falls Lake Watershed
Municipalities
County Boundaries
CASWELL
PERSON
GRANVILLE
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DURHAM
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Summary

This report provides the annual progress report of collective progress made by the agricultural community to reduce nutrient losses toward compliance with Stage I and Stage II of the Falls Lake Agriculture rule, a component of the Falls Reservoir Water Supply Nutrient Strategy. For this report, the Falls Lake Watershed Oversight Committee (WOC) oversaw the application of accounting methods approved by the Environmental Management Commission's Water Quality Committee in March 2012 to estimate changes in nitrogen (N) loss and phosphorus (P) loss trends in the Falls Lake Watershed. This report is for the period between the strategy baseline (2006) and Crop Year (CY) 2023[1]. To produce this report, Division of Soil and Water Conservation staff received, processed and compiled baseline and CY2023 reports from agricultural staff in six counties, for the WOC's review and approval. Agriculture has been successfully decreasing nutrient losses in the Falls Lake watershed since implementation of the Falls Reservoir Water Supply Nutrient Strategy. In CY2023, agriculture collectively exceeded its 20% Stage I and 40% Stage II nitrogen reduction goals for cropland, with a 68% cropland nitrogen reduction. Pastureland nitrogen reduction was calculated using 2022 Census of Agriculture data that was published in February 2024. As of the last five years (2017 to 2022), agriculture is estimated to have achieved a 36% nitrogen reduction on pastureland compared to the 2006 baseline exceeding its Stage I nitrogen reduction goal for pastureland. All six counties are estimated to have exceeded their local 20% nitrogen reduction goals set by the WOC this year.

Falls Lake Watershed Oversight Committee Composition, Falls Agriculture Rule:

1. NC Division of Soil & Water Conservation
2. USDA-NRCS
3. NCDA&CS
4. NC Cooperative Extension Service
5. NC Division of Water Resources
6. Watershed Environmental Interest
7. Watershed Environmental Interest
8. Environmental Interest
9. General Farming Interest
10. Pasture-based Livestock Interest
11. Equine Livestock Interest
12. Cropland Farming Interest
13. Scientific Community

Since the baseline, reductions in nitrogen loss have been achieved through an overall decrease in cropland production, a decrease in nitrogen application rates, and an increase in best management practices (BMPs) such as 20 and 50-foot riparian buffers. In CY2023, reported cropland acres in the watershed decreased by 28,189 acres from baseline acreage. It is assumed that some of the lost agricultural land was converted to development or other uses. Phosphorus qualitative indicators for CY2023 demonstrate that there is no net increased risk of phosphorus loss from agricultural lands in the watershed, with a 29% decrease in animal waste phosphorus production and a 60% increase in cropland conversion to grass and trees since the 2006 baseline.

[1] The 2023 crop year began October 1, 2022 and ended September 30, 2023.

Rule Requirements and Compliance

In January 2011, the Agriculture Rule in the Falls Reservoir Water Supply Nutrient Strategy became effective. The Agriculture Rule provides for a collective strategy for farmers to meet nitrogen (N) loss reduction goals in two stages. The strategy's goal is to reduce the average annual load of nitrogen and phosphorus (P) to Falls Lake from 2006 baseline levels. Stage I requires that agriculture reach a goal of 20% N loss reduction and 40% P loss reduction from cropland and pasture sources by year 2020. Stage II sets goals of 40% N and 77% P reductions, by year 2035, from cropland and pasture sources in the watershed. A Watershed Oversight Committee (WOC) was established to guide the implementation of the rule and to assist farmers with complying with the rule. Six Local Advisory Committees (LACs), previously established through the Neuse Nutrient Sensitive Waters (NSW) Management Strategy Agriculture Rule, were tasked with assisting farmers with complying with the Falls Reservoir NSW Agriculture Rule.

Falls Reservoir Nutrient Sensitive Waters (NSW) Strategy:
The Environmental Management Commission (EMC) adopted the Falls Reservoir Water Supply Nutrient Strategy rules in 2011. The strategy goal is to reduce the average annual load of nitrogen and phosphorus to Falls Lake from 2006 baseline levels. In addition to point source rules, mandatory controls were applied to address non-point source pollution in agriculture, urban stormwater, and riparian buffer protection. The management strategy was modeled after similar nutrient strategies for the Neuse River and Estuary, Tar-Pamlico River and Estuary, and Jordan Lake.

All county Local Advisory Committees (LAC) submitted their twelfth annual reports to the WOC in August 2024. Collectively, agriculture is meeting the cropland nitrogen loss reduction goal, with a 68% N reduction from the 2006 baseline. Qualitative indicators for phosphorus suggest there is no increased risk of phosphorus loss from agriculture in the watershed. Pasture nitrogen loss accounting relies on USDA-NASS data which is gathered via the Census of Agriculture every five years. The 2022 Census of Agriculture data, published in February 2024, was used to generate the latest nitrogen reduction estimation for pastureland in this report. For the 2022 pasture accounting cycle, the six Falls Lake counties achieved a collective 36% reduction in pastureland nitrogen loss compared to the 2006 baseline. This reduction exceeds the rule-mandated Stage I nitrogen reduction goal (20%).

Scope of Report and Methodology

The estimates provided in this report represent county-scale calculations of nitrogen loss from cropland and pastureland agriculture in the watershed made by the NC Division of Soil and Water Conservation (DSWC) using the 'aggregate' version of the Nitrogen Loss Estimation Worksheet (NLEW) and adjusted for the percentage of each county in the Falls Lake Watershed. NLEW is an accounting tool developed to meet the specifications of the Neuse Rule and approved by the Environmental Management Commission's (EMC) Water Quality Committee in March 2012 for use in the Falls Lake Watershed. The NLEW development team included interagency technical representatives of the NC Division of Water Resources (DWR), NC Division of Soil and Water Conservation (DSWC), United States Department of Agriculture (USDA)-Natural Resources Conservation Service (NRCS) and was led by NC State University (NCSU) Soil Science Department faculty. The NLEW captures application of both inorganic and animal waste sources of fertilizer to cropland and pastureland. It is an "edge-of-management unit" accounting tool that estimates changes in nitrogen loss from cropland and pastureland but does not estimate changes in nitrogen loading to surface waters. Separate assessment methods were developed and approved by the Water Quality Committee of the EMC for phosphorus and are described later in the report.

Over time the NLEW tool has been updated to incorporate new data. In 2015, a web-based version of NLEW (v6.0) was created on NC Department of Agriculture and Consumer Services servers. Revised realistic yield and nitrogen use efficiency data from NCSU were incorporated, and some minor calculation errors were corrected for field corn, sweet potatoes, and sweet corn. The modernized web-based NLEW software (v6.0) was updated to pull revised realistic yield and nitrogen use efficiency data from the North Carolina Realistic Yield Database.[2]

Nitrogen Reduction from Cropland from 2006 Baseline for CY2023

All counties submitted their twelfth progress reports to the WOC in August 2024. In CY2023 agriculture is estimated to have achieved a 68% reduction in nitrogen loss from cropland compared to the average 2006 baseline. Figure 1 shows annual loss percent reductions per year since CY2011, calculated with the two different versions of NLEW. Table 1 lists each county's baseline, CY2022 and CY2023 nitrogen (lbs/yr) loss values from cropland, along with nitrogen loss percent reductions for CY2022 and CY2023 from the 2006 baseline.

In 2024, the Division of Soil and Water Conservation was successful in requesting georeferenced Farm Service Agency cropland data for the first time in the history of annual reporting for the Falls Lake watershed. Prior to receiving this new dataset, cropland data in the Falls Lake watershed was approximated by multiplying publicly released FSA county-aggregated cropland data by the percentage of land in the county lying within the Falls Lake watershed. Each year Local Advisory Committees, through member knowledge of farm, operator, and crop planting locations, helped to further refine and adjust county cropland acreage totals in the watershed according to this methodology. The new georeferenced FSA cropland dataset provides the most accurate assessment of cropland acreage in the Falls Lake watershed since reporting began. The Watershed Oversight Committee commends the enhanced collaboration and partnership between USDA-FSA and the NCDA&CS DSWC that made this new stage of data-sharing possible and allows for a more accurate delineation of cropland in the Falls Lake watershed.

Comparing georeferenced CY2023 data to 2006 baseline totals estimated using the previous, best-available methodology at the time, presents some challenges. Three counties in the watershed experienced moderate nitrogen-loss reduction changes between CY2022 and CY2023 (+/- 15%) and remaining counties experienced significant reduction swings. Drops in county nitrogen-loss reductions were precipitated by more cropland acreage reported in the Falls Lake portions of each county than was estimated in the previous crop year. Sharp rises in county nitrogen-loss reductions were caused by substantial reductions of county cropland acreage reported in the Falls Lake watershed. The nitrogen reduction shifts seen in Table 1 are not due to

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[2] The North Carolina Realistic Yield Database is the product of an extensive data gathering and review process conducted by many state and federal partners. The North Carolina Realistic Yield Database is maintained and updated by North Carolina State University.

North Carolina Interagency Nutrient Management Committee. 2014. Realistic yields and nitrogen application factors for North Carolina crops. realisticyields.ces.ncsu.edu North Carolina State University, North Carolina Department of Agriculture and Consumer Services, North Carolina Department of Environment and Natural Resources, Natural Resources Conservation Service. Raleigh NC.

major agricultural management changes or new crop cultivation trends in the watershed or within specific counties.

It is important to note that the small amount of agricultural acreage in Durham, Franklin, and Wake counties already tended to result in magnified year-to-year effects due to the impact cropping shifts have on aggregate nitrogen loss reductions in those counties. Calculation issues in NLEW arose this year for Franklin and Wake counties (and, to a certain extent, Granville county) due to the extremely small amount of remaining cropland acres, and the high amount of riparian buffer acreage reported for those counties. Nitrogen losses in pounds and CY23 percent nitrogen reductions from baseline for Franklin and Wake were not included in Table 1 below. According to FSA geospatial data, Franklin county had 82 acres of cropland in the Falls Lake watershed, an 86% drop from its baseline acreage. Wake county had 137 acres of cropland in the watershed, a 96% drop from its baseline acreage. According to current methodology, riparian buffer acres are reported cumulatively; a county's buffer acreage is never reduced from the previous year's total unless the LAC is made aware of buffered cropland that has been converted into another land use. The WOC has noted in several annual reports that an accurate reassessment of remaining buffer systems for cropland is needed due to the rate at which urbanizing counties have lost agricultural land. Now that georeferenced cropland information is available, the WOC anticipates undertaking a reassessment of cropland buffer acres in the full Neuse Basin (including the Falls Lake watershed) to better inform agricultural nitrogen losses and reductions for all counties with land in the basin.

There are 219 acres of remaining cropland in Franklin and Wake counties, out of 27,780 NLEW-accountable crop acres reported in the Falls Lake Watershed. All the acres in Franklin and Wake are either buffered by forest stands greater than 100 feet wide or are separated from surface water bodies by several hundred feet of roads and houses. Since most of the nitrogen lost from North Carolina cropping systems moves as soluble nitrogen through the soil system into the shallow groundwater, the considerable buffering of remaining agricultural land in Franklin and Wake counties by forest and other land uses is likely having a significant intercepting impact on agricultural nitrogen losses in those counties. Agricultural nitrogen contributions from Franklin and Wake are likely negligible compared to agricultural nitrogen losses in the overall Falls Lake watershed. The overall cropland nitrogen loss reduction for CY2023 shown in Table 1 (68%) was estimated using NLEW results from Durham, Granville, Orange and Person counties.

Nitrogen loss reductions in CY2023 were achieved through a combination of fertilization rate decreases, cropping shifts, BMP implementation, and cropland acreage fluctuations. Most significantly, NLEW-reportable production acres for all major crops (hay, corn, soybeans, tobacco, and wheat) in the Falls Lake watershed have decreased since baseline. When comparing total reported CY2023 cropland acres to baseline totals, acreage has decreased by 76% for hay, 34% for corn, 21% for soybeans, 20% for tobacco, and 34% for wheat. Some of the reported cropland acreage loss can be attributed to permanent loss of agricultural land to development. Changing crop rotations and idle land, which could return to production in the future, may account for some of the reported production acreage losses seen since baseline. It is also possible that some cropland acres are now grazed as pasture, which is accounted for in the pasture NLEW reporting framework described later in this report. Only non-grazed hay acres are accounted for in the cropland NLEW reduction calculation.

Figure 1. Collective Cropland Nitrogen Loss Reduction Percent 2011 to 2023, Falls Lake Watershed

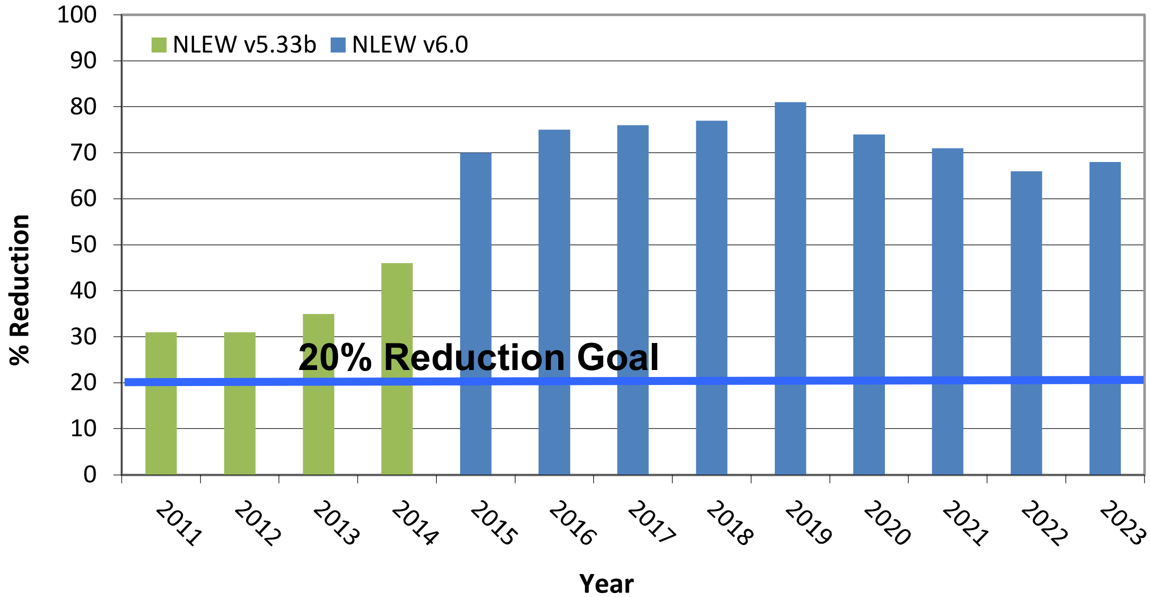


Table 1. Estimated reductions in agricultural cropland nitrogen loss from baseline (CY2006) for CY2022 and CY2023, Falls Lake Watershed

County	Baseline N Loss (lb))§ ¤	CY2022 N Loss (lb)§ ¤	CY2022 N Reduction (%)	CY2023 N Loss (lb) § ¤	CY2023 N Reduction (%)
Durham	146,090	35,011	76%	56,827	61%
Franklin	11,772	4,411	63%	†	†
Granville	127,704	53,666	58%	1,286†	99%†
Orange	347,402	78,352	77%	118,238	66%
Person	484,123	200,551	59%	195,943	60%
Wake	49,746*	29,448	41%	†	†
Total	1,166,837*	401,438	66%	372,294	68%

§ *Nitrogen loss values are for comparative purposes. They represent nitrogen that was applied to cropland in the watershed and neither used by crops nor intercepted by BMPs in an agricultural management unit, based on NLEW calculations. This is not an in-stream loading value.*

¤ *Numbers may include some buffer acres on formerly agricultural land which has been converted to other uses.*

* *Wake's baseline value changed because of a typo entered in NLEW v6.0. These values match current baseline outputs in NLEW v6.0.*

† *Calculation issues in NLEW arose for Franklin and Wake counties (and, to a certain extent, Granville county) due to the extremely small amount of remaining cropland acres, and the high amount of riparian buffer acreage reported for those counties. Agricultural nitrogen contributions from Franklin and Wake, due to the small amount of cropland (< 250 acres) are likely negligible compared to agricultural nitrogen losses in the overall Falls Lake watershed.*

Best Management Practice Implementation

Agriculture is credited with different nitrogen reduction efficiencies, expressed as percentages, for riparian buffer widths ranging from 20 feet to 100 feet (ft). NLEW versions 5.33b and 6.0 for the Neuse River Basin provide the following percent nitrogen reduction efficiencies for buffer widths on cropland shown in Table 2. Note that these percentages represent the net or relative percent improvement in nitrogen removal resulting from riparian buffer implementation.

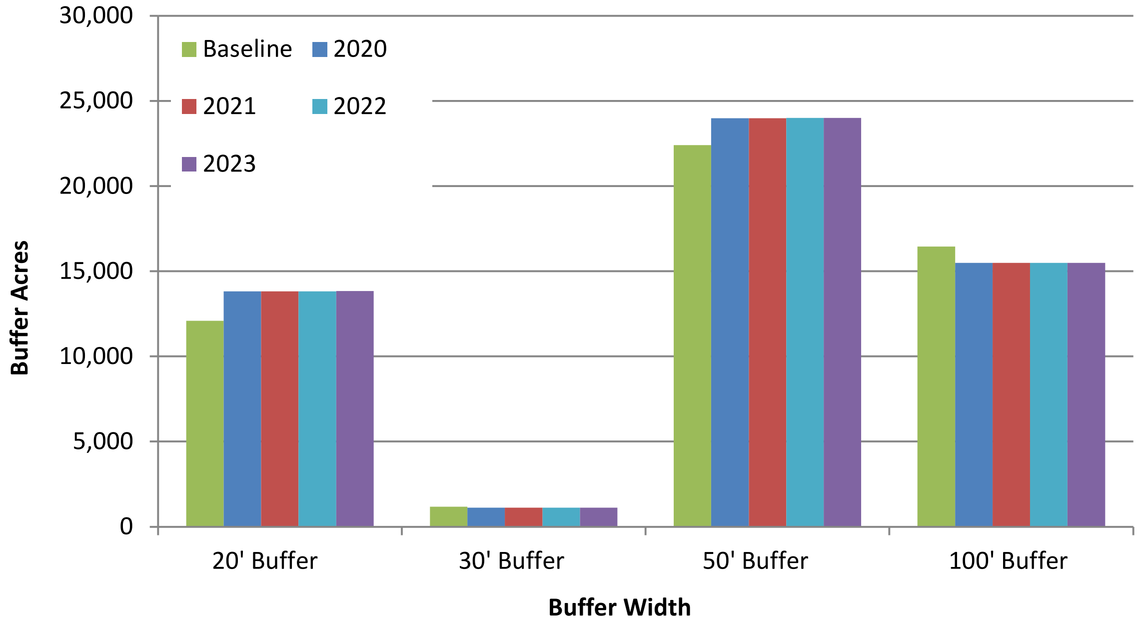
Table 2. Buffer Width Options and Nitrogen Reduction Efficiencies in NLEW

Buffer Width (feet)	NLEW % N Reduction
20 minimum	20%
30 minimum	25%
50 minimum	30%
100 minimum	35%

For the first time since reporting began, an assessment of active agricultural land was able to be completed with the receipt of georeferenced FSA crop data. An accurate reassessment of remaining buffer systems is still needed due to the rate at which urbanizing counties have lost agricultural land. An interim adjustment of Durham's BMP acre totals based on DEQ reports[3] has led to a reduction of 20 ft. buffers by 757 acres, 30 ft. buffers by 683 acres, 50 ft. buffers by 2,123 acres, and 100 ft. buffers by 4,018 acres. These adjusted totals have increased the accuracy of nitrogen loss calculations. Buffer re-assessment and adjustment is needed for Franklin and Wake counties given the significant reduction of FSA reported cropland in those counties. The WOC anticipates undertaking a reassessment of buffer acres in the full Neuse Basin (including the Falls Lake watershed) to better inform nitrogen losses and reductions for counties with land in the basin. All counties with cropland in the Falls Lake watershed, including Franklin and Wake, will likely see buffer acreage adjustments in the coming years with completion of the reassessment of buffer acres in the full Neuse Basin. Figure 2 illustrates the amount of buffers on cropland in the baseline (2006), CY2020 through CY2023.

[3] Osmond, D. L., and K. Neas. (2011). "Delineating agriculture in the Neuse River Basin." Final report to NCDENR, Division of Water Quality for USEPA 319 program. https://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

Figure 2. Nitrogen Reducing Buffers Installed on Croplands from CY2020 through CY2023, compared to Baseline (CY2006), Falls Lake Watershed*



**Some of these buffers may be on land that is now in new development and therefore no longer buffering active agricultural operations.*

BMP data is collected from state and federal cost share program active contracts, and in some cases BMPs that were installed without cost share funding. While there is some variability in the data reported, LACs are reporting the best available information. As additional data is collected, the LACs will review the sources and update their methodology for reporting if warranted.

Reported riparian buffer acre estimates do not account for the entire drainage area treated by buffers in the piedmont, which is generally 5 to 10 times higher than the actual acres of the buffer shown in Figure 2.[4] Riparian buffers have many important functions beyond nitrogen reduction effectiveness. Research has shown that upwards of 75% of sediment from agricultural sources is from stream banks and that riparian buffers, particularly trees, are important for reducing this sediment.[5] In addition, buffers sequester phosphorus and sediment as they move through the riparian zone and provide other critically important functions such as wildlife habitat and stream shading.[6]

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[4] Bruton, Jeffrey Griffin. 2004. Headwater Catchments: Estimating Surface Drainage Extent Across North Carolina and Correlations Between Landuse, Near Stream, and Water Quality Indicators in the Piedmont Physiographic Region. Ph.D. Dissertation. Department of Forestry and Environmental Resources, North Carolina State University, Raleigh, NC 27606.

[5] Sweeney, B. et al., 2004, Riparian deforestation, stream narrowing, and loss of stream ecosystem services, PNAS 101:39, 14132-14137; Sweeney and Newbold, 2014.

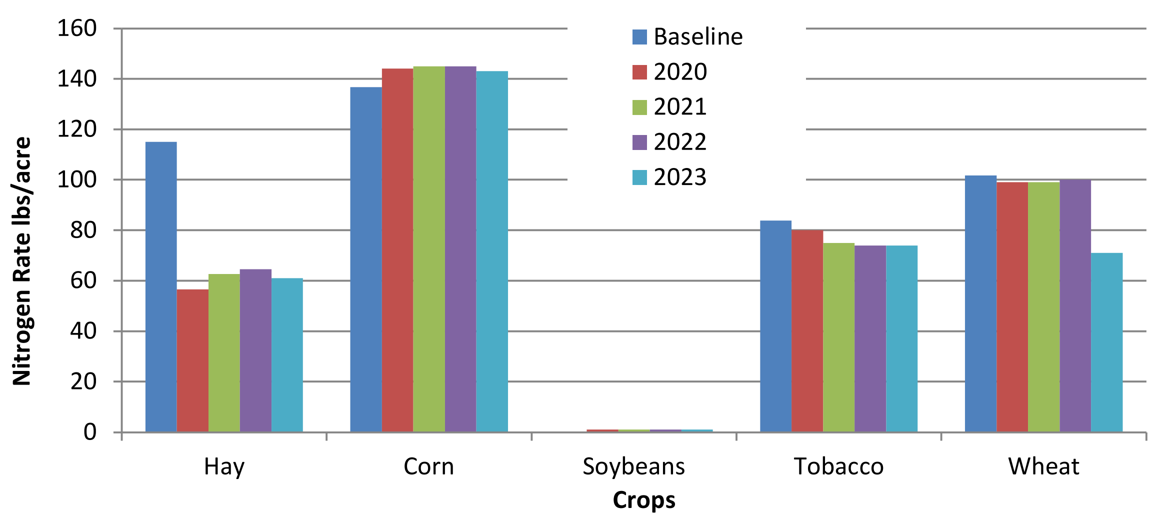
[6] Spruill, T.B., 2004, Effectiveness of riparian buffers in controlling ground-water discharge of nitrate to streams in selected hydrogeologic settings of the North Carolina Coastal Plain, Water Science and Technology 49:3, 63-70.

Fertilization Management

Since baseline, reduced nitrogen application rates have resulted from improved agronomic decision making, economic conditions, and fluctuating farm incomes. Commodity prices and low profit margins have impacted the application rates of nitrogen on farms in the Falls Lake Watershed. For most crops, farmers have reduced their nitrogen application rates from baseline levels. Figure 3 displays the nitrogen application rates in pounds per acre for the major crops in the watershed. Nitrogen application rates for hay are 54 pounds/acre lower than during the baseline (2006). Wheat application rates decreased by 29 pounds/acre from CY2022 rates. This fluctuation in wheat application rates was largely impacted by a single fertilization rate change in Person County, which grew 68% of the wheat in the Falls Lake watershed in CY2023. The Person LAC reported that a majority of the growers in the Neuse portion of the county are applying much less than the recommended rate on wheat farmers grow as a grain crop. Many farmers in Person county grow and harvest wheat for cover crop seed production instead of wheat for grain production. Corn, soybeans, and tobacco nitrogen rates remained relatively stable (less than 5 pounds/acre fluctuations) between CY2022 and CY2023. Fertilization rates are revisited annually by county local advisory committees using data from farmers, commercial applicators and state and federal agencies' professional estimates.

Agriculture in the six counties within the Falls Lake watershed is focused primarily on pasture-based systems, with pasture ranging from 29-64% of agricultural land use. On hay and pasture, nitrogen application rates are significantly less than NC State University recommendations and only small amounts of phosphorus are added. Available data suggest hay production acres are under-fertilized in the Falls Lake Watershed.[7]

Figure 3. Average Annual Nitrogen Fertilization Rate (lb/ac) on Cropland from CY2020 through CY2023, compared to Baseline (CY2006), Falls Lake Watershed



[7] Osmond, D. L., and K. Neas. (2011). "Delineating agriculture in the Neuse River Basin." Final report to NCDENR, Division of Water Quality for USEPA 319 program. https://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

Cropping Shifts

Cropland acreage is calculated annually by utilizing crop data reported by farmers to the Farm Service Agency. In 2024, the Division of Soil and Water Conservation was successful in requesting georeferenced Farm Service Agency cropland data for the first time in the history of annual reporting for the Falls Lake watershed. Georeferenced cropland provides better field estimations of commodities grown in individual counties and within the entire Falls Lake watershed. Because each crop type requires different amounts of nitrogen and uses applied nitrogen with a different efficiency rate, changes in the mix of crops grown can have a significant impact on the cumulative yearly nitrogen loss reduction.

Fluctuating weather conditions impact annual cropping shifts by affecting farmers' ability to prepare fields for harvest and planting as well as overall crop health and yield. The winter of 2022-2023 was generally warm (January, February) and dry (December, February); however, the month of December was distinctly cool, and January had higher than typical precipitation.[8] Overall, 2023 concluded as a year characterized by oscillations from the norm. Cooler seasons were atypically warm and warmer seasons began uncharacteristically cool. Late April precipitation brought localized flooding in eastern counties and a significant, extended period of drought followed in the fall (September to November). The year is among the state's top ten warmest years on record[8] and record corn yields were reported throughout the state.

Between CY2022 and CY2023, Durham County experienced moderate increases in hay and tobacco acreage, but the largest crop fluctuations the county experienced was a 625 acre increase in corn and a reduction of 269 acres of soybeans and 216 acres of wheat. Franklin County experienced slight decreases in hay, corn, tobacco, and wheat acreage (less than 50 acres), but reported a 180 acre drop for soybeans between CY2022 and CY2023. Granville County experienced significant reductions in hay and soybean acreage between CY2022 and CY2023 (1,019 acres and 1,592 acres respectively) along with moderate decreases for corn and tobacco and a moderate increase in wheat acreage. Orange County saw a significant increase in hay acreage in CY2023 (1,624 acres), but otherwise it only experienced moderate crop acreage decreases (for corn, cotton, soybeans, and tobacco) and increases (for wheat). Person County experienced larger crop fluctuations between CY2022 and CY2023. In CY2023, the county grew 1,665 more acres of soybeans and 825 more acres of corn and saw tobacco drop by 245 acres and wheat by 520 acres. In CY2023 Wake County experienced a 994 acre drop of soybeans from the CY2022 total, but otherwise only saw moderate decreases for other key crops (hay, tobacco, and wheat). Some of the increases and decreases in crop acreage for individual counties can be explained by the use of the new geospatial FSA crop dataset.

Annual cropping shifts seen in CY2023 can be explained by regular crop rotations, which are necessary to minimize the risk of disease from year to year. A host of other factors from individual choice to global markets can impact annual selection. Between CY2022 and CY2023, in total, wheat, tobacco, soybeans, and cotton decreased by 447 acres, 563 acres, 1,490 acres, and 108 acres respectively. In the same period, total hay and corn acres increased by 605 acres and 971 acres. The WOC anticipates that the basin will see additional crop shifts in the upcoming year based on changing commodity prices and weather.

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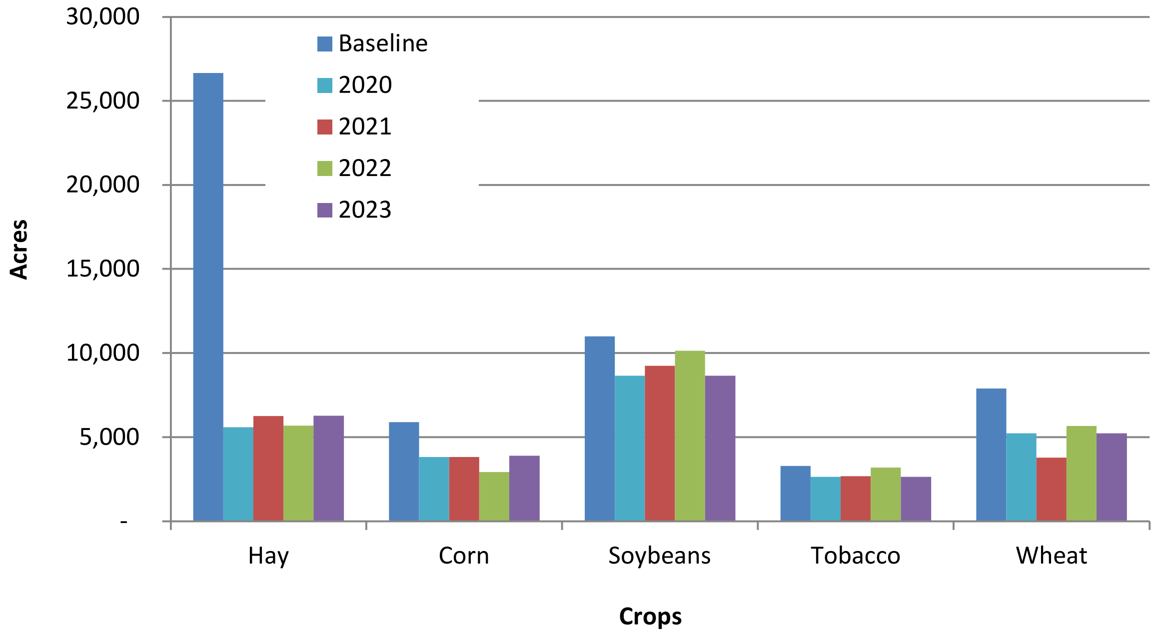
[8] Davis, C. 2023. Winter Recap 2022-23: Snow is Scarce, Blooms Come Early. Prepared by North Carolina State Climate Office for the Climate Blog, Climate Summary. https://climate.ncsu.edu/blog/2023/03/winter-recap-2022- 23-snow-is-scarce-blooms-come-early/

Figure 4 shows crop acres and shifts for CY2023 compared to the baseline. When comparing CY2023 totals to baseline, NLEW reported production acreage for all major crops (hay, corn, soybeans, tobacco, and wheat) has declined by over 28,000 acres in total since baseline. None of the hay acres reported in Figure 4 are grazed by livestock.

Figure 4. Reported Acreage of Major Crops from CY2020 through CY2023, compared to Baseline (CY2006), Falls Lake Watershed

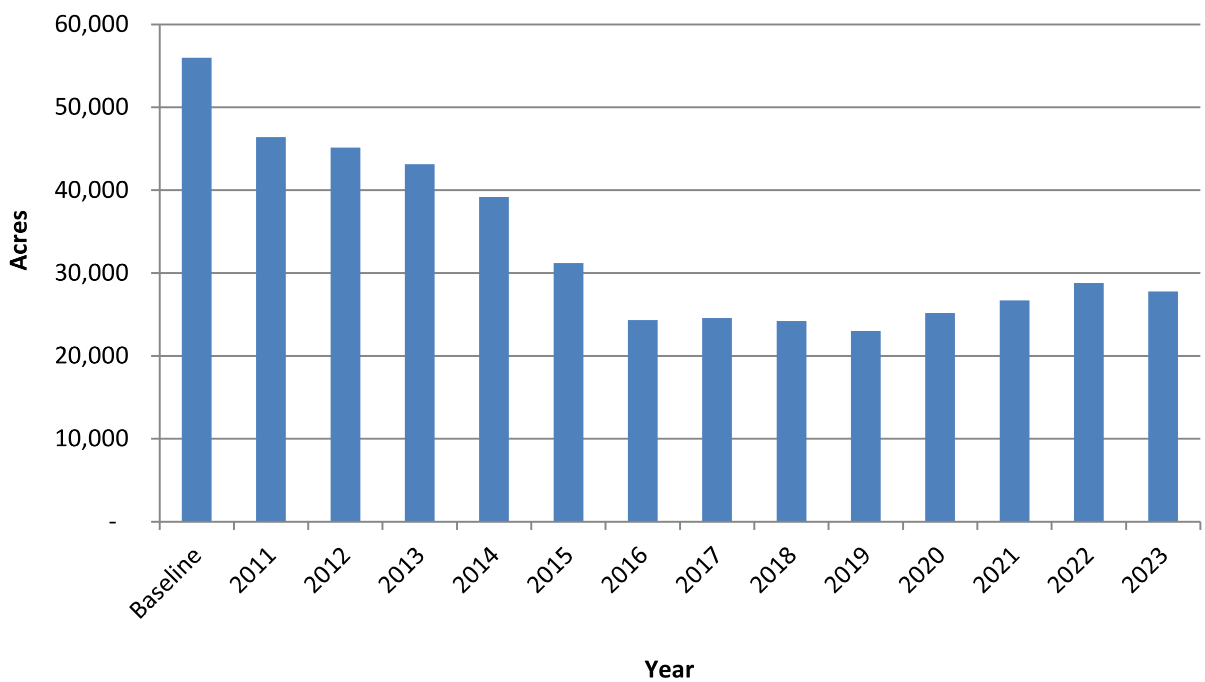


Land Use Change to Development and Cropland Conversion

The number of cropland acres fluctuates every year in the Falls Lake Watershed. Each year, some cropland is either permanently lost to development, converted to grass or trees and likely to be ultimately lost from agricultural production, or temporarily taken out of production. Idle land represents agricultural land that is currently out of production but could be brought back into production at any time. In CY2023, 27,780 NLEW-accountable crop acres were reported in the Falls Lake Watershed along with 10,769 acres of idle land.

As shown in Figure 5, it is estimated that since the 2006 baseline there has been a decrease in 28,189 acres of NLEW-accountable crops (50% of total reported cropland in baseline). Reported cropland in Figure 5 does not include idle land acreage. Based on accounting methodologies developed at the county level and best available data, between baseline and CY2015, 4,708 acres of agriculture land were estimated to have been permanently converted to development. Agriculture land acres lost to development have not continued to be tracked since CY2015 due to ongoing reporting inconsistencies between local governments and an inability to separate cropland and pastureland loss to development. The georeferenced cropland data from FSA that the DSWC was able to receive and process beginning this year is a major advancement for the WOC to report active agricultural land in the Falls Lake watershed. An accurate reassessment of buffer systems remains needed due to the rate at which urbanizing counties have lost agricultural land. Cropland conversion totals supported by state or federal cost-share funds continue to be tracked and updated annually. From baseline to CY2023, 2,437 cropland acres in the Falls Lake watershed have been converted to grass or trees.

Figure 5. Total Reported Cropland Acres in the Falls Lake Watershed, Baseline (2006), 2011-2023



Phosphorus Indicators for CY2023

The Phosphorus Technical Advisory Committee (PTAC) was created to establish a phosphorus accounting method for agriculture in the Tar-Pamlico River Basin. In 2005, the PTAC determined that a defensible, aggregated, county-scale accounting method for estimating phosphorus losses from agricultural lands was not feasible due to "the complexity of phosphorus behavior and transport within a watershed, the lack of suitable data required to adequately quantify the various mechanisms of phosphorus loss and retention within watersheds of the basin, and the problem with not being able to capture agricultural conditions as they existed in [baseline year] 1991." The PTAC instead developed recommendations for qualitatively tracking relative changes in practices in land use and management related to agricultural activity that either increase or decrease the risk of phosphorus loss from agricultural lands on an annual basis. In 2010, the PTAC reconvened to make minor revisions for the tool's use in the Falls Lake Watershed, all of which were approved by the Water Quality Committee of the EMC. The qualitative indicators included in Table 3 show the relative changes in land use and management parameters and their relative effect on phosphorus loss risk in the watershed for baseline (CY2006) and CY2021 through CY2023.

Table 3. Relative Changes in Land Use and Management Parameters and their Relative Effect on Phosphorus Loss Risk in the Falls Lake Watershed

Parameter	Units	Source	Baseline 2006	CY2021	CY2022	CY2023	% change '06-'23	P Loss Risk +/-
Reported Cropland (annual)	acres	FSA, LAC	55,969	26,667	28,807	27,780	-50%	-
Cropland conversion to Grass & Trees (cumulative)	acres	USDA-NRCS & NCACSP	1,527	2,290	2,410	2,437	+60%	-
Conservation tillage (active contract)	acres	USDA-NRCS & NCACSP	277	3,448†	3,668†	2,619†	+845%	-
Vegetated buffers (cumulative)	acres	USDA-NRCS & NCACSP	52,139	54,425¤	54,449¤	54,456¤	+4% ¤	-
Unfertilized Cover Crop (annual)	acres	LAC	0	1,651	1,626	1,531	+1,531%‡	N/A
Tobacco (annual)	acres	FSA, LAC	3,288	2,684	3,194	2,631	-20%	-
Animal waste P (annual)	lbs of P/ yr	NC Ag Statistics	586,612	465,598	454,608	415,769	-29%	-
Soil test P median (annual)	P Index	NCDA&CS	77	76	78	74	-4%	-

† *Conservation tillage is being practiced on additional acres, but this number only reflects estimated acres under active cost share contracts approximated by a rolling ten-year window (2013 – 2023).*

¤*This number may include some buffer acres on formerly agricultural land which has been converted to other uses (see page 6).*

‡*The percent change for unfertilized cover crop acres is assumed to have increased from 1 due to the problem with calculating a percentage difference from zero.*

Most of the parameters in Table 3 indicate less risk of phosphorus loss from agricultural management units than in the baseline period. Factors significantly contributing to the reduced risk of phosphorus loss in the Falls Lake Watershed include:

- Fifty percent reduction in cropland from baseline;
- Twenty-nine percent decrease in Animal waste P from livestock and poultry from baseline; and
- Cropland conversion to other uses.

Based on field office reports, conservation tillage acres remain high even after contracts expire due to farmer satisfaction with the practice after implementation. Additionally, because some farmers have adopted the use of conservation tillage without cost share assistance, a higher percentage of agricultural land is currently being cultivated with reduced tillage than was reported during the baseline due to the overall reduction in agricultural acres. Agricultural survey results indicate counties that are part of the Falls Lake watershed have a high percentage of pasture and hay land use and conservation tillage management is common, particularly in Orange, Durham, and Person counties.[9] With this reasoning, the phosphorus loss risk is reduced for that tracked parameter.

The soil test phosphorus median number reported for the watershed fluctuates each year due to the nature of how the data is collected and compiled. The soil test phosphorus median numbers shown in Table 3 are generated by using North Carolina Department of Agriculture and Consumer Services (NCDA&CS) soil test laboratory results from voluntary soil testing on agriculture land and the data is reported by the NCDA&CS. The number of samples collected each year varies but was approximately 9% lower in CY2023 than the number of samples used to determine the soil test phosphorus median number in baseline. The data does not include soil tests that were submitted to private laboratories. The soil test results from the NCDA&CS database represent data from entire counties in the watershed and have not been adjusted to include only those samples collected in the Falls Lake Watershed.

Given the key role of phosphorus in the Falls Lake nutrient strategy, the Falls WOC recommends that phosphorus accounting and reporting follow a three-pronged approach:

1. Annual Qualitative Accounting: Conduct annual qualitative assessment of likely trends in agricultural phosphorus loss in the Falls watershed relative to 2006 baseline conditions using the method established by a 2005 PTAC report that added tobacco acres and removed water control structures.
2. Phosphorus Loss Assessment Tool (PLAT): The PLAT has been developed to assess potential P loss from cropland to water resources. A survey of the Falls Lake watershed counties was conducted in 2010, with the next survey to be conducted in the future if funding is available. The results of the 2010 survey demonstrated that the potential for phosphorus loss is very low (< 0.35 lbs/ac/yr) for four of the five counties surveyed. Phosphorus loss in Orange County (1.07 lbs/ac/yr) is rated at the low end of the PLAT medium range (1.1 – 2 lbs/ac/yr). Even with the installation of buffers along all streams and the discontinuation of phosphorus application (fertilizer, biosolids, or animal waste), there would be limited potential for additional phosphorus loss reduction.

[9] Osmond, D. L., and K. Neas. (2011). "Delineating agriculture in the Neuse River Basin." Final report to NCDENR, Division of Water Quality for USEPA 319 program. (pp. 49 – 50). https://content.ces.ncsu.edu/delineating-agriculture-in-the-neuse-river-basin

3. Improved understanding of agricultural phosphorus management through studies using in-stream monitoring: Quantitative in-stream monitoring should be conducted. Such monitoring is contingent upon the availability of funding and staff resources. An appropriate water quality monitoring design would be a paired-watershed study of sub-watersheds with only agricultural land use. This design would allow estimates of phosphorus loading for different management regimes and load reductions after conservation practices have been implemented. However, funding for this study is currently unavailable.

The WOC recommends that no additional management actions be required of agricultural operations in the watershed at this time to comply with the phosphorus goals of the agriculture rule. The WOC will continue to track and report the identified set of qualitative phosphorus indicators to DWR annually, and as directed by the rule to the Environmental Management Commission. The WOC expects that BMP implementation may continue to increase throughout the watershed in future years, and notes that BMPs installed for nitrogen, pathogen and sediment control often provide significant phosphorus benefits as well.

Pasture Accounting

Pasture nitrogen loss is also calculated using NLEW and is based on the total number of pasture acres, pastured livestock, and implemented livestock exclusion systems in the watershed. Pasture acres and pastured livestock numbers are gathered from USDA-NASS Census of Agriculture data which is published every five years. The latest Census of Agriculture – the 2022 Census – was published in February 2024 and was utilized to estimate the latest pasture-based nitrogen loss calculation. The reference periods for the 2022 Census of Agriculture were similar to those used in the 2017 Census. Crop production is largely measured for the calendar year except for a few crops for which the production year overlaps the calendar year. Livestock and poultry inventories are measured as of December 31 of the Census year.

Implementation data for exclusion systems is collected from Soil and Water Conservation District and NRCS staff in the watershed. Exclusion systems installed with various setback widths are assigned in the NLEW the nitrogen loss reduction percentages shown in Table 4. These reduction percentages include the elimination of direct deposition of waste into surface waters by livestock in addition to the filtration of nitrogen by vegetated buffer areas.

Table 4. Percentage nitrogen reduction from pastureland for different BMPs

Pasture BMP	N Reduction
Exclusion fencing with a 10’ stream setback	30%
Exclusion fencing with a 20’ buffer	35%
Exclusion fencing with a 30’ buffer	40%
Exclusion fencing with a 50’ buffer	45%
Exclusion fencing with a 100’ buffer	50%

Using 2022 Census data and BMP pasture data reported by Districts from the last five years it is estimated agriculture achieved a 36% reduction in nitrogen loss from pastureland compared to baseline in this last pasture accounting cycle. For pasture accounting 2007 is the baseline year because the closest possible Census of Agriculture to the Falls Lake strategy baseline of 2006 was the 2007 Census. Figure 6 below shows overall watershed nitrogen loss percent reductions for each pasture reporting cycle since 2007. Table 5 lists each county’s baseline alongside estimated nitrogen loss (lbs/yr) values and nitrogen loss percent reductions from the baseline for the last two pasture reporting cycles (2017 and 2022). Pastureland nitrogen loss reductions achieved result from a combination of pastureland loss, fertilization and stocking rate changes, and BMP implementation. Table 6 displays how each of these factors have changed in each reporting cycle since the 2007 baseline.

Figure 6. Collective Pastureland Percent Nitrogen Loss Reduction 2012, 2017, and 2022, Falls Lake Watershed.

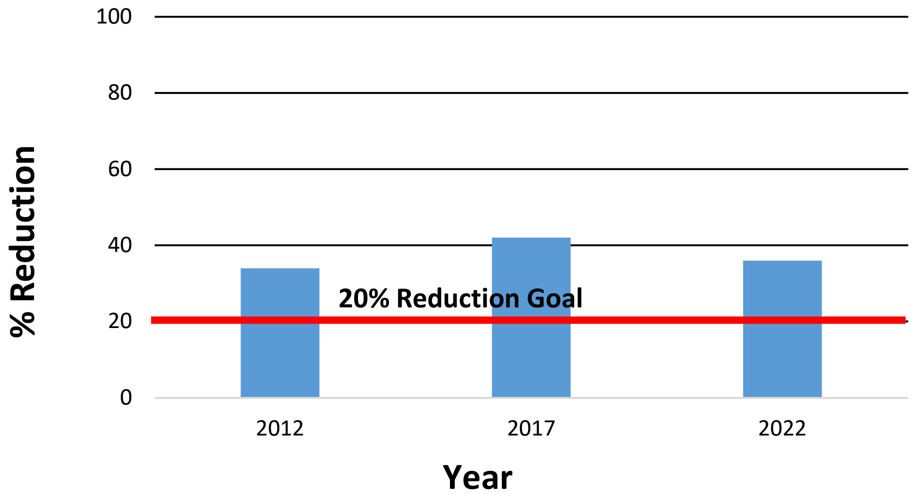


Table 5. Estimated reductions in agricultural (pastureland) nitrogen loss from baseline (2007) for 2017 and 2022 Cycles, Falls Lake Watershed*

County	Baseline N Loss (lbs)	2017 N Loss (lbs)	2017 N Reduction (%)	2022 N Loss (lbs)	2022 N Reduction (%)
Durham	55,564	36,348	35%	35,414	36%
Franklin	1,600	1,631**	-2%**	689	57%
Granville	104,474	59,288	43%	80,138	23%
Orange	47,689	23,864	50%	16,539	65%
Person	50,088	29,078**	42%	32,048	36%
Wake	5,747	3,795	34%	3,890	32%
Total	**265,162**	**154,004****	**42%**	**168,717**	**36%**

**The reduction percentages reported above result from a combination of pastureland loss, fertilization decreases, stocking rate changes, and BMP implementation.*

*** These values match the numbers in NLEW v.6.0. These are slightly different from the values that appeared in the 2020 Annual Progress report for Crop Year 2018 that first detailed pasture accounting information from the 2017 cycle. The overall pasture N loss reduction for the 2017 cycle (42%) did not change.*

Table 6. Pasture operation changes from baseline (2007) for 2012, 2017, and 2022, Falls Lake Watershed

Factor	Baseline (2007)	2012	2017	2022	2022 Cycle % Change from Baseline
Pastureland (acres)	40,565	29,816	26,584	25,031	-38%
Fertilization Rate (lbs N/acre)†	92	80	86	98	+7%
Stocking Rate (Animal Units/acre)	0.54	0.62	0.65	0.71	+31%
Cumulative Livestock Exclusion System Implementation (acres affected)	454	927	1,531	1,783	+293%

†*Total fertilization rate equals direct waste deposition times volatilization factor plus supplemental application.*

BMP Implementation Not Tracked by NLEW

Not all types of conservation BMPs are tracked by NLEW such as: livestock-related nitrogen and phosphorus reducing BMPs, BMPs that reduce soil and phosphorus loss, and BMPs that do not have enough scientific research to support estimating a nitrogen benefit. The WOC believes it is worthwhile to recognize implementation of these practices. Table 7 identifies BMPs and tracks their implementation in the watershed since the end of the baseline period. Table 8 indicates the total number of BMPs not accounted for in NLEW, which are under active contract (approximated by a rolling ten-year window from CY2013to CY2023).

Table 7. Best Management Practices Not Accounted for in NLEW, Baseline to CY2023, Falls Lake Watershed*

BMP	Units	2006 – 2021	2022	2023
Critical Area Planting	Acre	558	558	558
Composting Facility	Number	12	12	13
Diversion	Feet	31,424	32,224	35,909
Dry Stack	Number	9	9	9
Fencing (USDA programs)	Feet	85,510	85,510	86,559
Field Border	Acre	30,286	30,286	30,287
Grassed Waterway	Acre	115	120	125
Nutrient Management Plan	Acre	906	906	906
Pasture Renovation	Acre	326	326	326
Stream Crossing	Number	5	6	6
Sod-Based Rotation	Acre	17,462	17,517	19,700
Tillage Management	Acre	4,857	5,172	5,172
Terraces	Feet	4,988	4,988	4,988
Trough or Tank	Number	102	102	107
Waste Storage Facility	Number	5	5	5

**Cumulative data quantified by adding BMPs implemented with State and Federal cost share program funding each Crop Year to cumulative totals reported the previous Crop Year. Additional BMPs may exist in the watershed as practices may be installed by farmers without cost share assistance.*

Table 8. Best Management Practices Not Accounted in NLEW installed from CY2013 to CY2023, Falls Lake Watershed*

BMP	Units	BMPs Installed (CY2013-CY2023)
Critical Area Planting	Acre	555
Composting Facility	Number	10
Diversion	Feet	18,977
Dry Stack	Number	3
Fencing (USDA programs)	Feet	48,180
Field Border	Acre	705
Grassed Waterway	Acre	52
Nutrient Management Plan	Acre	425
Stream Crossing	Number	5
Sod-Based Rotation	Acre	12,797
Tillage Management	Acre	2,619
Trough or Tank	Number	76
Waste Storage Facility	Number	3

**Values represent active contracts in State and Federal cost share programs quantified by subtracting CY2013 cumulative totals from CY2023 cumulative totals. Additional BMPs may exist in the watershed as producers may maintain practices after the life of a cost share contract, and other practices are installed by farmers without cost share assistance.*

Looking Forward

The Falls Lake WOC will continue to report on and encourage rule implementation, relying heavily on the local Soil and Water Conservation Districts working directly with farmers to assist with best management practice design and installation.

Because cropping shifts are susceptible to various pressures, the WOC is working with all counties to continue BMP implementation on both cropland and pastureland that provides for lasting reductions in nitrogen and phosphorus loss in the watershed while monitoring cropping changes.

The WOC recognizes several factors affecting agriculture:

- Urban encroachment
- Market Fluctuations
- Changes in government programs (e.g., commodity support or environmental regulations)
- Weather (e.g., long periods of drought or rain)
- Scientific advances in agronomics (e.g., production of new types of crops or improvements in crop sustainability)
- Plant disease or pest problems (e.g., viruses or foreign pests)

Funding

Ongoing agriculture rule reporting has incorporated data processing efficiencies and improvements over time. NLEW upgrades have allowed LAC members to more actively participate in the compilation of data and analysis of nitrogen loss trends, and the Division of Soil and Water Conservation's digital contracting system has helped optimize BMP documentation efforts.

In CY2023, Soil and Water Conservation Districts spent over $196,857 through the Agriculture Cost Share Program for nutrient-reducing BMP implementation in the Falls Lake Watershed. The Natural Resources Conservation Service spent over $200,000 through the Environmental Quality Incentives Program for BMP implementation in the counties lying in the Falls Lake Watershed. Funds were also expended for installation of these practices by local farmers and landowners either through participation in these cost share programs, or by installing practices at their own cost. Participation by so many members of the local agricultural community demonstrates a commitment toward achieving the nutrient strategy's long-term goals.

Sufficient funding for technical assistance and BMP implementation incentivization is indispensable for continued achievement and maintenance of agricultural nitrogen reduction and phosphorus loss risk reduction goals. Local demand for funding, to support experienced staff versed in conservation planning and cost-share program implementation in addition to supporting adoption of water-quality improving BMPs, far outstrips existing resources. Local levels of technical assistance for BMP implementation have changed since the Falls Reservoir Water Supply Nutrient Strategy Rules were adopted in 2011. As of Fiscal Year (FY) 2016, previously funded basin and watershed technicians assisting farmers with nutrient reducing BMP implementation are no longer supported by granting state entities. Concurrent budget changes at the USDA also resulted in statewide restructuring of North Carolina NRCS field staff, leading to a reduction in federally funded technical capacity at the local level. Consequently, ongoing responsibility for conservation practice planning and installation now largely depends on local Soil and Water Conservation District staff with escalating workload and capacity demands. Additionally, while two EPA 319(h) grants ($238,643 in total) were obtained between 2012 and 2017 to support livestock exclusion system implementation and BMP implementation on equine operations, more funding, through existing cost-share programs or outside grants, continues to be needed to incentivize conservation activity in the Falls Lake Watershed. In FY2025, Soil and Water Conservation Districts lying within Falls Lake Watershed requested nearly three times more Agriculture Cost Share Program funding beyond the fiscal year's allocation. Funding of state and federal cost share programs is essential for continued progress in reducing nutrient losses from agricultural land.

Funding is also necessary for continued agricultural data collection and annual reporting. With the loss of grant-supported basin and watershed technicians as of FY2016, annual data collection, compilation and reporting duties for the Falls Lake Watershed and all other basins and watersheds subject to existing NSW Management Strategies with Agriculture Rules were assigned to the NCDA&CS Division of Soil and Water Conservation's Nonpoint Source Planning Coordinator. The Division of Soil and Water Conservation expends approximately $90,000 on agricultural reporting staff support annually, using funds received through an EPA 319(h) grant administered by the Department of Environmental Quality. Annual agricultural reporting is required by the rules; therefore, continued funding for the DSWC Nonpoint Source Planning Coordinator position is essential for compliance.

Reductions in funding and staffing necessitate implementing a more centralized approach to agricultural data collection and verification for annual progress reports. This evolving approach may include developing additional GIS analysis tools, streamlining FSA acreage documentation, and training LACs on how to handle changing methods. New tools will be vetted by the WOC and may be incorporated into the agriculture rule accounting methodology. While necessary with existing funding and staffing limitations, centralizing and automating data collection and verification may come at the expense of local knowledge.

Previously, funding was available for research on conservation practice effectiveness. Due to grant eligibility changes and other funding constraints, new data can only be developed intermittently. Prior funding sources for such research, which provided much of the scientific information on which NLEW was based, are no longer available. As new funding is made available, additional North Carolina-specific research information will be incorporated into future NLEW updates. The NLEW software (v6.0) is currently configured to pull revised realistic yield and nitrogen use efficiency data from the North Carolina Realistic Yield Database, which is intermittently updated when new research becomes available. The WOC also sees the need for additional research on accounting procedures for pasture operations, and supports such research being conducted. Should readily accessible information from DEQ become available for permitted biosolids applications to agricultural acres in the watershed, including rate, nutrient content, and spatial application information, the WOC will consider whether separate accounting for those applications of nutrients is feasible and appropriate.

Phosphorus accounting and reporting will continue to address qualitative factors and evaluate trends in agricultural phosphorus loss annually. Periodic land use surveys with associated use of PLAT may be needed if trends indicate increased phosphorus loss risk from agricultural lands. Additionally, an understanding of agricultural phosphorus management could be improved through in-stream monitoring contingent upon the availability of funding and staff resources.

Lastly, members of the Falls Lake WOC will continue working with DWR on issues regarding nutrient offsets that arise from trades involving agricultural land.

Conclusion

The Falls Lake WOC will continue to monitor and evaluate crop trends. The current shift to and from crops with higher nitrogen requirements may continue to influence the yearly reduction. Significant progress has been made in agricultural nitrogen loss reduction, and the agricultural community is achieving its 20% Stage I and its 40% Stage II nitrogen reduction goals for cropland. The agricultural community is achieving its 20% Stage I nitrogen reduction goal for pastureland and is very close to achieving its 40% Stage II nitrogen reduction goal for pastureland. However, the measurable effects of implemented BMPs on overall in-stream nitrogen reduction may take years to develop due to the nature of non-point source pollution. Nitrogen reduction values presented in this annual summary of agricultural reductions reflect “edge-of-management unit” calculations that contribute to achieving the staged nitrogen loss reduction goals. Significant quantities of agricultural BMPs have been installed since the adoption and implementation of the nutrient management strategy, and agriculture continues to fulfill its obligations toward achieving the overall nutrient reduction goals for Falls Lake.