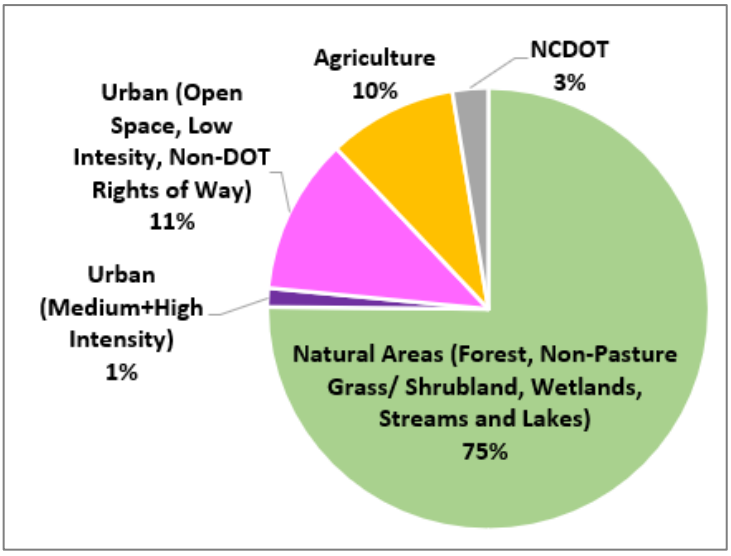
Importance of Precipitation on Nutrient Loading to Falls Lake

Seventy-five percent of the Falls Lake watershed is comprised of unmanaged or natural areas like forests, wetlands, and non-pasture grassland. The remaining 25 percent is split between active agricultural and urban land uses. However, medium or high intensity urban areas make up less than 1.5 percent of the watershed. Therefore, most of the watershed is pervious (not covered by hard surfaces like rooftops and streets).

Delivered nutrient loading to Falls Lake depends on rainfall, stream flows, and water quality concentrations. In watersheds where most of the land is unmanaged, rainfall and hydrology are the primary drivers of variation in nutrient loading from one year to the next.



Nutrients are deposited from the atmosphere to all areas of the watershed. Nutrients may also be applied to urban and agricultural areas. Pervious areas like forests and agricultural fields can store nutrients during dry periods and export them during wet periods.

Nutrient loading from unmanaged and natural areas is not constant. Loads fluctuate based on rainfall conditions. Very large storms can increase delivered nutrient loads to Falls Lake by hundreds of times compared to days with little to no rainfall. Large storm events, exceeding 1 inch of precipitation depth, occur infrequently (approximately 4 percent of days during the UNRBA study period which had above average rainfall).

The NC Division of Water Resources (DWR) developed estimates of nutrient loading to Falls Lake. Annual loads from 2006 to 2019 are provided here. The loads reported for years 2015 to 2019 demonstrate the importance of rainfall on stream flow and delivered loading. Other than a 30 percent increase in annual rainfall, little changed in the watershed to cause an increase in nutrient loading from 2017 to 2018. Similarly, the reduction in delivered loading from 2018 to 2019 was due primarily to reduced rainfall. The next page shows tables from DWR's status report that show this increase and following decrease in nutrient loading to Falls Lake.

The 2021 status report for Falls Lake also includes flow-weighted estimates of nutrient loading back to 2006. These values divide the delivered load by the stream flow volume. DWR reports that flow-weighted total nitrogen loads **decreased by 20 percent** from 2006 to 2019. Flow-weighted total phosphorus loads **decreased by 50 percent**.

Delivered Nutrient Loading to Falls Lake Due to Rainfall and Resulting Stream Flows

- Load is a function of stream flow and concentration
- Nutrient loads are highly variable from year to year based on precipitation
- The DWR 2021 status report for Falls Lake shows that nutrient loads can double from one year to the next based on precipitation and stream flow.
- Annual rainfall at RDU airport:
  - 2015: ~57 inches
  - 2016: ~51 inches
  - 2017: ~45 inches (average)
  - 2018: ~60 inches
  - 2019: ~43 inches

DWR Estimates of Delivered Total Nitrogen Load and Stream Flow to Falls Lake

YEAR	Combined Tributary Total Nitrogen Annual Load Estimate (lbs.)	Total Annual Tributary Flow (Cubic Feet Per Year)
2015	1,171,854	15,121,981,066
2016	1,139,275	14,654,135,866
2017	1,060,060	11,671,222,151
2018	1,806,557	23,243,318,582
2019	1,311,452	18,099,995,832

DWR Estimates of Delivered Total Phosphorus Load and Stream Flow to Falls Lake

YEAR	Combined Tributary Total Phosphorus Annual Load Estimate (lbs.)	Total Annual Tributary Flow (Cubic Feet Per Year)
2015	120,502	15,121,981,066
2016	129,568	14,654,135,866
2017	150,788	11,671,222,151
2018	243,621	23,243,318,582
2019	143,732	18,099,995,832

Data for 2015 to 2019 copied from the NC Division of Water Resources (DWR) 2021 Status Report for Falls Lake. The next report is anticipated in 2026.