

## Design Specifications and Nutrient Accounting for Land Conservation

### Practice Description and Utility

**Purpose:** This chapter defines the practice of land conservation, provides design criteria and implementation specifications, and provides nutrient credit assignments used for compliance with the Falls Lake Nutrient Management Strategy.

**Applicability:** This practice is developed to provide nutrient credits for land conservation towards compliance with Existing Development rules.

**Method:** Land conservation is the protection or conservation of forest, or enhancement of conservation areas, as distinguished by legal easements or other enforceable means. This practice prevents development of high priority conservation areas and prevents the allowable increase in nutrient loading associated with new development. Nutrient Management Strategies allow for nutrient loading rates from new development that are higher than the loading that originates from undisturbed forests. The difference in loading between undisturbed forests and new development is the nutrient credit. This practice will promote long-term, continued improvements of streams, riparian areas, and water quality as permanent easements are required for this practice.

### Nutrient Credit Overview

Nutrient credits for land conservation vary based on the underlying geologic province. The nutrient credit is specified as mass per area per year (lb/ac/yr) and applies to the area of land permanently protected by conservation easement or other enforceable means. The crediting method is based on the allowable loading rates for new development stated in the Falls Lake Nutrient Management Strategy and loading rates for undisturbed forests reported in the literature.

Land conservation projects that are installed to meet the nutrient reduction requirements of Existing Development rules shall be credited using the methods described in this document. Nitrogen credits for this practice range from 0.4 to 1.2 lb-N/ac/yr, and phosphorus credits range from 0.16 to 0.19 lb-P/ac/yr.

### Relative Confidence in Credit Assignments

Land conservation credit estimates are considered to have high confidence based on the well understood methods and availability of local data to calculate the credits. In addition, this practice is passive in nature, and does not depend on routine operation and maintenance for its functionality.

## Design Criteria

Lands set aside for conservation or protection (i.e., conservation areas) earning nutrient credits for compliance with a Nutrient Management Strategy shall implement the following design criteria. Exceptions may be considered and approved on a case by case basis by the State agency or their designee depending on site specific conditions:

- Conservation areas shall be located within an acceptable conservation easement or other enforceable instrument that ensures perpetual protection of the area. The easement must clearly specify how the natural area vegetation shall be managed and boundaries will be marked. The enforcement instrument shall list which activities are permitted and/or restricted. The easement must be held by a qualified conservation entity such as a land trust or local government.
- Nutrient credits for conservation will not be granted for acreages used to comply with other existing local, state, or federal laws (minimum stream buffers, open space requirements, etc.)
- Nutrient credits will only be awarded to sites that include areas identified as critical for conservation or protection by a published conservation plan such as the Upper Neuse Clean Water Initiative plan (UNCWI 2015) plan that was developed by the Conservation Trust for North Carolina, Triangle Land Conservancy, Conservation Fund, Ellerbe Creek Watershed Association, Eno River Association, and the Tar River Land Conservancy. This plan identifies over 232,000 acres of priority conservation areas. Other published plans developed by local, state, or federal agencies or conservation programs may also be used to identify priority areas (e.g., watershed restoration plans, open space plans, and areas identified for the protection of threatened or endangered species). Critical areas may also include land within 1000 feet of a perennial, intermittent, or headwater stream or jurisdictional wetland.
- Areas within 100 feet of a perennial, intermittent, or headwater stream or jurisdictional wetland shall not be disturbed (e.g., cleared, graded, or harvested) except as described below or for specific conservation, restoration, or ecological management purposes. This nutrient crediting document establishes credits for buffers adjacent to ephemeral, intermittent, and perennial streams and waterbodies. Practitioners should use the latest version of the NC Stream Identification Manual (NCSIM) to classify streams (<http://deq.nc.gov/about/divisions/water-resources/water-resources-permit-guidance/wetlands-compliance-assistance/guides-manuals>). The NCSIM uses a series of metrics to assign a score to each stream to classify ephemeral, intermittent, or perennial streams as defined below. A perennial waterbody is one that is connected to a perennial or intermittent stream.
- Residential, commercial, industrial, or institutional development is not allowed within the conservation area. Land developers may not earn conservation credits for open space that is set aside to meet other regulatory requirements (local, state, or federal buffer rules, open space rules, subdivision standards, etc.); conservation credits may only be earned for additional areas that exceed existing rules and requirements relating to the development or any streams or wetlands on site.

- Except within the portion of the property within 100 feet of a perennial, intermittent, or headwater stream or jurisdictional wetland, harvesting of timber, cutting or destruction of trees or other plants, is allowed upon approval of the harvesting or maintenance plan. Tree or vegetation cutting is permitted to maintain trail and road access, and for the maintenance of fences and property lines. Forest management is permitted to generate occasional income from harvest and sale of forest products and to maintain the general health of the forest ecosystem. Harvest plans must be developed by a North Carolina registered forester and prepared in accordance with the North Carolina Division of Forest Resources' Best Management Practices. Local governments are responsible for ensuring that harvest plans are developed by a registered forester and followed accordingly. Timber removal, cutting, logging, construction of logging trails, and mowing or other disturbance or interference of native plants are prohibited within 100 feet of a stream, except selective cutting or clearing of vegetation for fire protection, trail and sewer maintenance, and/or conservation management purposes. Conservation management purposes include but are not limited to prescribed burns or practices conducive to propagation and retention of native plants and wild population of game and non-game species and removal of non-native plants. Protection, maintenance, and management activities shall only be allowed if undertaken in accordance with an approved Forest Management Plan. Prior notice and approval by the local government shall be given for any activity within 100 feet of a stream, including those authorized under a Forest Management Plan that will impact more than 20% of the vegetation within the buffer.
- Conserved areas may allow "Non-intensive Outdoor Recreation" which is defined as dispersed, non-commercial and non-motorized recreational activities that do not generally rely on buildings and have minimal impact on renewable natural resources. Such activities include but are not limited to, hiking, bird watching, camping, picnicking, mountain biking and lawful hunting and fishing, but do not include horseback riding. All recreational activities, including hunting and fishing, should be conducted to preserve and protect threatened and endangered species and their habitats. Roads, trails, and paths may not be constructed within 100 feet of stream without approval by the local government.
- Conserved area may not be used for agricultural use, horticultural use, animal husbandry, and grazing.
- The construction of any building or other structure is prohibited within 100 feet of a perennial, intermittent, or headwater stream or jurisdictional wetland; construction of other buildings on the property may be allowed following approval by the local government. Existing fences may be repaired and replaced, and new perimeter fences may be built to mark property boundaries or protect any ponds, permanent, or intermittent watercourses. Construction of bridges, informational kiosks and benches shall also be permitted so long they are incidental to the uses of the property. Existing sewers and easements may be inspected, repaired, operated, maintained and replaced. With prior written approval by the local government construction and maintenance of a sewer line over and through the property may be allowed to serve adjacent lands.

- There shall be no filling, excavation, dredging, mining, or drilling which materially affects the topography of the land or is detrimental in any material way to the flora and fauna on the property; no removal of topsoil, sand, gravel, rock, peat, minerals or other materials, and no change in the topography of the land in any manner except as necessary to allow the maintenance or construction of approved improvements or to address erosion and flooding issues.
- There shall be no use of pesticides or biocides, including but not limited to insecticides, fungicides, rodenticides, and herbicides, except as to control invasive species. Silvicultural use of biocides is allowed, if prescribed in the Forest Management Plan.
- There shall be no storage or dumping of trash, garbage, abandoned vehicles, appliances, or machinery, or other unsightly or offensive material, hazardous substance, or toxic waste on the Property. There shall be no changing of the topography through the placing of soil or other substance or material such as land fill or dredging spoils, nor shall activities be conducted on the property that could cause erosion or siltation.

## **Nutrient Credit Estimation and Relative Confidence**

### **A. Summary of Nutrient Credit Method**

This section summarizes the nutrient credits awarded towards compliance with the Falls rules. Credit is assigned for the area of land conserved and protected by a conservation easement or other enforceable instrument that ensures perpetual protection of the protected area.

Nutrient credits are calculated based on the difference in nutrient loading from undisturbed forested areas compared to loads allowed for new development under the Falls Lake Nutrient Management Strategy. A study conducted by the NC Forest Service (Boggs et al. 2013) in the Falls Lake Watershed is the primary source of data for this credit. Table 1 summarizes the mean of the annual loading rates across the study period for the Carolina Slate Belt and the Triassic Basin.

**Table 1. Average Areal Loading Rates Observed in Undisturbed Forests (Boggs et al 2013)**

<b>Geologic Province</b>	<b>Annual Nitrogen Loading Rate from Undisturbed Forests (lb-N/ac/yr)</b>	<b>Annual Phosphorus Loading Rate from Undisturbed Forests (lb-P/ac/yr)</b>
Carolina Slate Belt	1.0	0.14
Triassic Basin	1.8	0.17

In 2010, the Environmental Management Commission (EMC) passed the Falls Lake Nutrient Management Strategy, requiring two stages of nutrient reductions (<http://portal.ncdenr.org/web/fallslake/read-the-rules>). The New Development section of the rules applies to development that occurred after implementation of the new development stormwater programs (July 2012). All local governments affected by the Strategy are required to develop stormwater management programs and limit nutrient loading from new development to 2.2 pounds per acre per year of nitrogen and 0.33 pounds per acre per year of phosphorus.

The credit associated with land conservation is calculated as the difference between the average annual loading rate from new development as stated in the Falls Lakes Nutrient Management Strategy and the observed loading rate in undisturbed forests (Boggs et al. 2013). These credits vary based on geologic province as shown in Table 2, and represent average conditions over various hydrologic conditions. The Boggs et al. (2013) study did not include forests in the Raleigh Belt. To estimate credits for land conservation in this part of the watershed, it is assumed that the hydrology and nutrient loading of the Raleigh Belt is similar to that of the Carolina Slate Belt: both of these Belts are comprised of metamorphic rocks while the Triassic Basin contains poorly draining sedimentary rocks including sandstones, mudstones, and clay shales (Boggs and Sun 2011, Voli et al. 2013, and McReynolds (<http://www.rla.unc.edu/Publications/pdf/ResRep29/Ch2.pdf>)). A 10 percent factor of safety is assumed for the Raleigh Belt credits to account for uncertainty with this assumption.

**Table 2. Nutrient Credits for Land Conservation**

<b>Geologic Province</b>	<b>Annual Nitrogen Credit (lb/ac/yr)</b>	<b>Annual Phosphorus Credit (lb/ac/yr)</b>
Carolina Slate Belt	1.2	0.19
Triassic Basin	0.4	0.16
Raleigh Belt	1.1	0.17

Applicability in watersheds other than the Falls Lake watershed will be limited to 1) soil types present in the watershed and availability of data to characterize loading from undisturbed lands and 2) existing regulations limiting nutrient loading from new development to allow calculation of a difference in loading resulting from land conservation.

## **B. Credits Obtained with Practice**

The range of credits in annual nutrient loads associated with land conservation depends on the geologic province of the area. As shown in Table 2, nitrogen credits for this practice range from 0.4 to 1.2 lb-N/ac/yr, and phosphorus credits range from 0.16 to 0.19 lb-P/ac/yr.

## **C. Land Conservation Example Calculation**

The following is an example of how to calculate the nutrient credits for land conservation. The example 50-ac project is located in the Carolina Slate Belt. The following steps are required to calculate the nitrogen and phosphorus credits:

1. Record the area-based *Annual Nitrogen Credit* and *Annual Phosphorus Credit* from Table 2. For this example which is located in the Carolina Slate Belt, the nutrient credits are 1.2 lb-N/ac/yr and 0.19 lb-P/ac/yr.
2. Multiply the area-based nutrient credits by the area of the land conserved. For this example where 50 acres are conserved, the resulting nutrient credits are 60 lb-N/yr ( $1.2 \text{ lb-N/ac/yr} * 50 \text{ ac}$ ) and 9.5 lb-P/yr ( $0.19 \text{ lb-P/ac/yr} * 50 \text{ ac}$ ).

These values may be used toward compliance with the Falls Lake Existing Development Nutrient Management Strategy.

## **D. Relative Confidence in Credit Estimates**

Overall, relative confidence in the credits estimated for the practice is high. Evaluation factors for relative confidence are outlined in the document "*DWR Approval Process for Alternative Nutrient Load-Reducing Measures.*"

A two and one-half year study conducted by the NC Forest Service (Boggs et al. 2013) is the primary source of data for this credit. Boggs et al. (2013) measured flows and nutrient concentrations across the hydrographs of storms occurring between November 2007 and June 2010 in the perennial streams of six forested (mixed pine-hardwood) catchments in the Falls Lake watershed. Both Carolina Slate Belt and Triassic Basin soils were represented by these catchments, and the period represented dry and wet hydrologic conditions. Table 1 summarizes the

mean of the annual loading rates across the study period for the four catchments in the Carolina Slate Belt and the two catchments in the Triassic Basin.

This analysis is based on data collected in the Falls Lake Watershed. Applicability in watersheds other than the Falls Lake watershed will be limited to 1) soil types present in the watershed and availability of data to characterize loading from undisturbed lands and 2) existing regulations limiting nutrient loading from new development to allow calculation of a difference in loading resulting from land conservation.

Confidence in sustained credits is reasonably high given that the design criteria for land conservation includes protection under a conservation easement or other enforceable means. The design criteria also require that eligible projects must be identified by a conservation trust or local government as a high priority for conservation. The methods associated with land conservation are straightforward and are aimed at maintaining forested conditions permanently.

Land conservation is a simple practice, and the nutrient credit calculations are based on a multi-year monitoring study conducted in the Falls Lake watershed. Therefore, the practice and the credit method are well matched and do not introduce a lot of uncertainties.

## **Co-Benefits**

In the case of land conservation, additional benefits received from land conservation may include further reducing other pollutants including total suspended solids (TSS), metals, and bacteria; reducing flooding; improving habitat and animal migration/travel routes; sequestering carbon; reducing streambank erosion in downstream reaches; and providing stream shading that reduces light available for algal and periphyton growth in streams and reduces stream water temperatures.

## **References**

- Boggs, J. and G. Sun. 2011. Urbanization Alters Watershed Hydrology in the Piedmont of North Carolina. *Ecohydrology*, Vol. 4, 256-264, January 2011.
- Boggs, J., G. Sun, D. Jones, and S.G. McNulty. 2013. Effect of Soils on Water Quantity and Quality in Piedmont Forested Headwater Watersheds of North Carolina. *Journal of the American Water Resources Association*, Vol. 49, No. 1, February 2013.
- McReynolds, T.E. Chapter 2 Geology (<http://www.rla.unc.edu/Publications/pdf/ResRep29/Ch2.pdf>).
- Upper Neuse Clean Water Initiative (UNCWI). 2015. Upper Neuse Clean Water Initiative 2015-2045 Conservation Strategy.

Voli, M.T., K.W. Wegmann, D.R. Bohnenstiehl, E. Leithold, C.L. Osburn, V. Polyakov. 2013. Fingerprinting the Sources of Suspended Sediment Delivery to a Large Municipal Drinking Water Reservoir: Falls Lake, Neuse River, North Carolina, USA. *J Soils Sediments* (2013) 13: 1692-1707, September 2013.

## **Supporting Technical Information**

This supporting technical information is provided for the land conservation nutrient crediting document.

Development of the nutrient credit document for this practice included input from representatives from the following organizations:

- North Carolina Department of Environmental Quality Division of Water Resources: Rich Gannon, MEM, CPM; John Huisman; Trish D'Arconte; and Amin Davis, PWD
- Triangle Land Conservancy: Leigh Ann Hammerbacher
- Conservation Trust for NC: Caitlin Burke
- Upper Neuse River Basin Association: Forrest Westall, PE
- Cardno: Alix Matos, PE
- The Center for Watershed Protection, Inc: Neely Law, Ph D

The representatives met several times to review the literature and evaluate approaches to develop a crediting method. One study conducted in the Piedmont of NC was selected as the most applicable for developing the crediting method for this practice.

The design criteria for this practice limits nutrient credits for land conservation to areas identified as priority areas by a conservation program or local, state, or federal entity. The most comprehensive dataset for priority conservation areas developed for the Falls Lake Watershed is the Upper Neuse Clean Water Initiative (UNCWI 2015). This plan integrates input from two local watershed associations and five nonprofit organizations that focus on preservation and management of conservation areas. While other conservation programs and government entities may identify additional priority conservation areas that could be eligible for nutrient credits, the UNCWI 2015 database provides a good starting point to evaluate the extent of credits that could be earned in the Falls Lake Watershed. For this evaluation, the 232,000 acres of priority area identified by the 2015 UNCWI plan (Figure 1) were categorized as high priority given criteria outlined in the 2015 UNCWI plan and their proximity to a water resource (within 50 ft of a stream, wetland, or water supply).



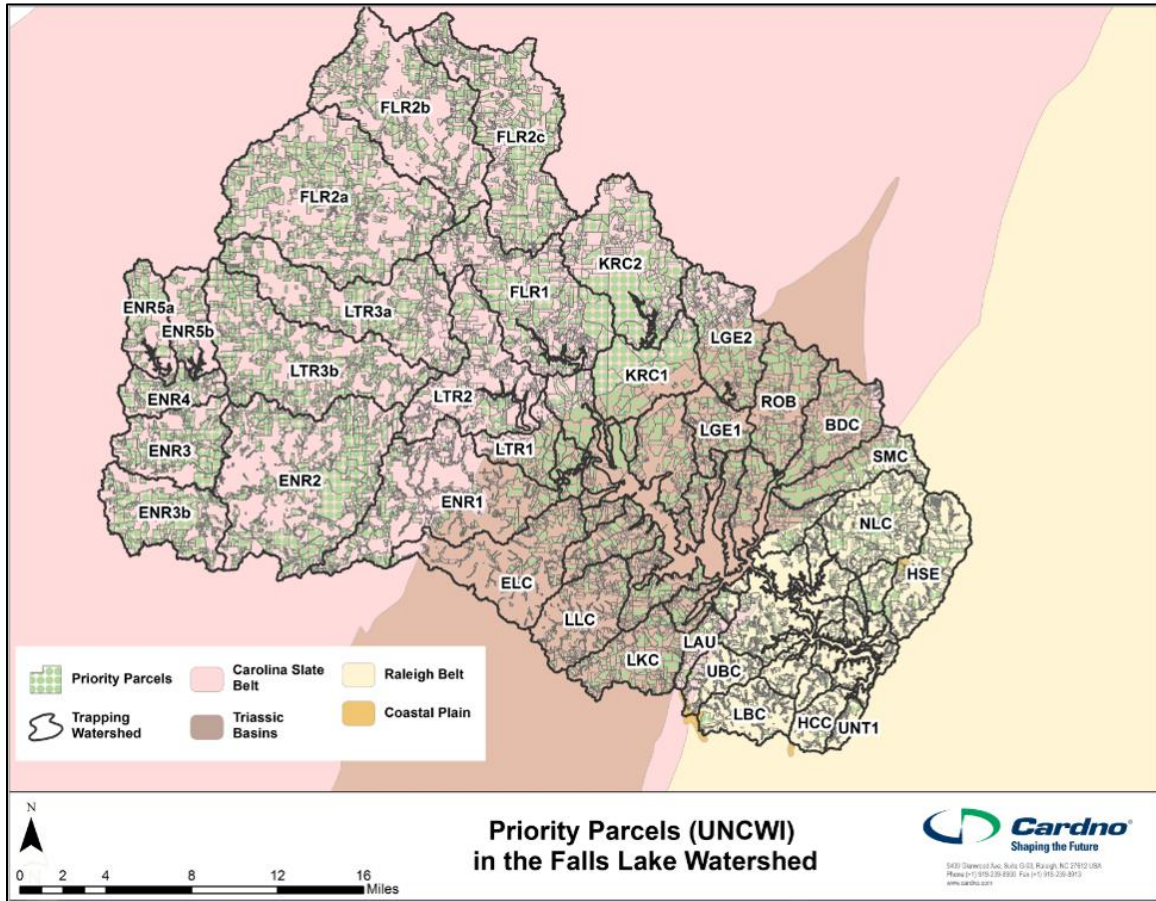


Figure 1. Priority Parcels for Conservation in the Falls Lake Watershed (UNCWI 2015)