Riparian Buffer Technical Advisory Group Report to Steering Committee

High Rock Lake Stakeholder Process

The High Rock Lake Riparian Buffer Technical Advisory Group (TAG) met with representatives from the Division of Water Resources (DWR) four times between February and August of 2023. DWR brought forward a proposal to implement a riparian area protection rule in the watershed that mirrors the rules implemented in the Neuse, Tar-Pamlico, and Jordan Lake watersheds. This proposal defines a 50-foot, two-zone buffer area as protected from encroachment by development, with exceptions granted for ongoing uses and certain forest harvest practices. Buffer TAG members identified a number of factors that differentiate the High Rock Lake watershed from other areas regulated under nutrient management strategy rules, and which necessitate a different approach to riparian protection. Members were unable to come to a unanimous decision, and so this report will present the consensus view of a majority of TAG members, as well as a consensus view of the remaining minority. This report to the Steering Committee first provides a technical foundation for the need for riparian area protection to address ongoing excess nutrient loading in the watershed, followed by individual majority/minority opinions which outline supporting arguments for different proposals to achieve a sufficient level of protection.

Buffer TAG Findings

Overarching Premise – Buffer Protection is Important for Water Quality Protection: In order to protect against further degradation of water quality in the area and to stabilize sediment and limit nutrient delivery from streambanks and upland runoff, streamside riparian vegetation should be protected from encroachment by changing land uses. The value of streamside vegetation for nutrient control has been repeatedly demonstrated. Riparian protection zones improve nitrogen cycling via root interception of shallow groundwater, as well as phosphorus sequestration via controlled erosion and deposition of sediment via stormwater filtration. The EPA estimates that buffers similar to those implemented in other nutrient sensitive watersheds in North Carolina can remove over 90% of total suspended solids and over 90% of total phosphorus from discharge (Schmitt, 1999; Lee K. H., 2000; Lee K. H., 2003). These benefits are not universal, however, as overall width of the protected area has significant impact on the ability of herbaceous or woody streamside vegetation to improve nutrient cycling and sequester pollutants.

If riparian areas are allowed to be removed, altered, or significantly compromised by land use changes, the water quality problems facing High Rock Lake are likely to worsen. With increased sedimentation and nutrient delivery comes an increase in the cost of managing watershed-scale cleanup. Significant negative impacts to fish communities have been demonstrated to occur with increased sedimentation as a result of riparian forest removal in southern Appalachian streams (Dale Jones III, Helfman, Harper, & Bolstad, 1999). This is especially important in light of High Rock Lake's status as a trophy bass fishery and therefore significant generator of regional tourism revenue.

High Rock Watershed Has a Sediment Problem: A significant portion of the nutrient delivery problems facing High Rock Lake stems from poor soils, destabilized streambanks, and upland erosion, all of which are exacerbated by degraded streamside vegetation. The upper portion of High Rock Lake has consistently violated North Carolina's statewide turbidity standard since 2004, and the Yadkin River has been known for delivering huge amounts of sediment downstream since as early as the 1950s (Richter, Korfmacher, & Nau, 1995). Recent sampling indicates that the South Yadkin regularly exceeds the North Carolina turbidity water quality standard between 10% to 20% of annual sampling events (NCDEQ, Yadkin-Pee Dee River Basinwide Water Resources Management Plan, 2022). In turn, this transported sediment delivers large quantities of nutrients (both nitrogen and phosphorus) to High Rock Lake on an almost continuous basis.

As judged by the establishment of turbidity TMDLs, erosion and sedimentation are widespread problems through much of the watershed. Since 2004 approximately 1.8 million acres in the High Rock Lake Watershed have been regulated by DEQ under EPA-approved Total Maximum Daily Loads (TMDL) for exceeding the State's turbidity water quality standard, which is a result of decades of uncontrolled downstream sediment delivery. This includes areas that drain to Abbotts Creek, Ararat River, Hunting Creek, Second Creek, South Deep Creek, South Yadkin River, Third Creek, Muddy Creek, Salem Creek, Grants Creek, Fourth Creek, and the mainstem of the Yadkin River, all of which comprise approximately 73% of the area that drains to High Rock Lake.

Buffers are Cost-Effective Nutrient Controls: Riparian buffer protection has been shown to provide nutrient load control benefits at less than half of the cost per pound of traditional wastewater treatment technologies (EPA, 2012), and also to lower drinking water costs for water users (NCFS, 2017). This includes communities whose intakes lie along the main stem of the Yadkin and South Yadkin Rivers. Buffer TAG members, therefore, consider riparian protection one of the most cost-effective means for managing nutrient delivery in the High Rock Lake watershed and a long-term cost saver for residents in the watershed.

Furthermore, global meta-analyses have found that remediation and recovery of eutrophic lake systems can take many decades to show results (McCrackin, Jones, Jones, & Moreno-Mateos, 2017). This means that the future cost of riparian losses in the High Rock Lake watershed is considerably higher than the cost of protecting those areas from deterioration in the short term. The continued use of High Rock Lake for recreation, fishing, and swimming suggests that near-term stream stability is a critical and irreplaceable component of an overall water quality management strategy, especially on smaller perennial and intermittent headwater streams that contribute outsized pollutant management capacity and thermal regulation.

Majority Report

Synopsis: The majority proposal for riparian protection carries forward the existing buffer protection approach used in most other Nutrient Strategy Watersheds in North Carolina but expands zone 1 from 30 to 50 feet and adds additional limitations to forest harvest zones.

Overall Width: 70 feet

Zone 1: 50 feet, woody vegetation, limited forest harvest

Zone 2: 20 feet, herbaceous or woody vegetation, forest harvest allowable

The Majority believes the current buffer protection rule in other nutrient sensitive watersheds in North Carolina to be inadequate for protection of freshwater resources in the High Rock Lake watershed given several key differences in this watershed.

Steeper Slopes, More Erosive Soils, Need for Greater Phosphorus Control: Notable differences exist between the topography and soil hydrology in this watershed compared to the more eastern and low-lying Neuse and Tar-Pamlico River Basins in the coastal plain. The Yadkin River's reputation as a significant delivery mechanism for sediment and sediment-bound phosphorus highlights the need for more rigorous streamside protection of vegetation and soils. Stormwater velocity is likely significantly higher in this watershed than in others, and so increased buffer widths are critical for allowing sufficient time and space for surface and subsurface filtration to occur. DWR and other stakeholders have noted the importance of phosphorus management in the High Rock Lake watershed, and TAG members believe the buffer protection standard in place in other watersheds in the State is insufficient to control erosive flows in the western piedmont region, especially as precipitation is expected to intensify in the coming decades.

More Severe Lake Impairment: Additionally, the notoriously erosive soils of the High Rock Lake watershed have created a water quality problem that is more severe than the eutrophication problems facing other watersheds and river basins. The coupling of a multi-decadal chlorophyll-a impairment with persistent pH and turbidity impairments necessitates an "all of the above" approach to pollution abatement that recognizes the intensity of downstream sediment and nutrient loss and prioritizes stabilization of streambanks as the last line of defense against continued ecological breakdown. Decades of riverbed and lakebed sediment buildup are clear effects of generations of mismanagement, and the only way to turn the tide on sediment loss is to remove the feedback loop that has consistently allowed rivers and streams to become their own perpetual sources of pollution.

Continued deposition of sediment to High Rock Lake from destabilized upstream catchments has created an ongoing problem both for recreational lake users and also lakeside residents who are increasingly unable to access certain parts of the lake due to sediment accumulation and shoaling (Petryniak & Loveless, 2013). Similar sedimentation and shoaling has been noted by the US Army Corps of Engineers in W. Kerr Scott Reservoir (US Army Corps of Engineers, 2012) and lakeside landowners in various bays in the northeast and southwest parts of High Rock. Additionally, in recent decades the City of Salisbury has had to expend considerable time, energy, and money to keep their drinking water intake on the Yadkin River free of excess sedimentation. Excessive sediment accumulation not only disrupts water intakes, but it also increases treatment costs for water users, even to the point where some municipal

governments are being forced to abandon existing intakes for new locations where sediment deposition is less pronounced.

Wider Zone 1 Addresses High Rock's Needs: Research has shown that improved nutrient management and cycling requires a minimum buffer width of 30 feet, and sediment control and filtration requires a minimum buffer width of 50 feet (Palone, 1997). For this reason, and given the importance of sedimentation control in the High Rock Lake Watershed, an intact wooded riparian zone of at least 50 feet is critical in the High Rock Lake Watershed. Additionally, the steep topography of the High Rock Lake Watershed seems ill-suited for the buffer width standard which has been implemented in the coastal plain areas of North Carolina. Flow velocities are high entering the riparian area, especially in the headwaters of the watershed where streams originate in the Blue Ridge Mountains, and higher flow velocities increase the risk of storm flow bypass during increasingly heavy precipitation events. This bypass scours riparian sediments and delivers accumulated leaf litter and organic matter directly into receiving streams, and if left unchecked or allowed to increase, riparian zones can transform into nutrient sources via the mobilization of sediment that has been allowed to accumulate over time (Dodd, 2016). This has been happening over many decades since the High Rock dam was constructed, and the only way to meaningfully reduce this delivery is to ensure that healthy streamside buffers are not allowed to be eliminated.

Furthermore, recent retrospective reports from DWR have highlighted the frequency at which buffer variances have been granted in other nutrient sensitive watersheds, which has the potential to fragment riparian systems across the landscape and therefore impact their overall effectiveness. Buffer TAG members expect similar magnitudes of buffer impacts to be allowable even under a strict management strategy, and so TAG members believe it critical to establish sufficiently wide protection areas to counteract this expected fragmentation and maintain filtering capacity.

Maintenance of a 2nd Zone Protects Against Flow Bypass: Buffer TAG members also acknowledge that a two-zone system is necessary in the High Rock Lake watershed. EPA's Office of Water recommends a 3-zone minimum buffer concept where the inner zone is designated for bank stabilization, habitat, stream shading, and flood protection, the middle zone promotes mature riparian forest, and the outer zone acts to intersect, slow, and filter stormwater discharge. Like in other nutrient sensitive watersheds in NC, maintenance of an outer zone of filtering herbaceous cover is critical in conjunction with a largely undisturbed inner forested area. The vegetated outer zone protects against the emergence of preferential surface flow paths which allow stormwater to bypass the riparian area altogether once canopy shade inhibits the growth of thick understory.

Early successional growth within a riparian area is efficient at trapping and depositing sediment-laden stormwater via a complex network of woody and herbaceous vegetation, and an outer zone of permanently managed herbaceous cover ensures that stormwater filtration can continue even after the canopy of zone 1 closes at maturity and the understory naturally thins. For this reason, TAG members acknowledge the importance of allowing forest harvest in an outer zone of the protected area.

Recommendations: Based on these findings, members of the majority recommend that DWR protect existing vegetated riparian areas within 70 feet of and adjacent to intermittent and perennial streams, lakes, and ponds in the High Rock Lake watershed. The first 50 feet adjacent to waters should be largely undisturbed forest, while the outer 20 feet may be managed vegetation. Existing, ongoing activities within buffers should be allowed to continue, while a change in land use from rule effective date should

trigger new protections. DWR should communicate to Local Governments their authority to request permission from the Environmental Management Commission to require more stringent buffer protection measures according to § 143-214.23A(d) when necessary to protect local resources. Certain uses of land within the buffer should be identified as exempt, allowable, or allowable with mitigation. TAG members recommend including the existing Table of Uses provided in 15A NCAC 02B .0714(11) as a reference point for future public comment and review by the NC Environmental Management Commission as to their applicability in the High Rock Lake Watershed. All uses not specified in the Table of Uses should be prohibited.

All uses not specified in the Table of Uses should be prohibited. The rule should allow for mitigation where no practical alternatives exist, specify variance requirements and forest-harvesting limitations, and ensure that new developments either avoid or mitigate buffer impacts. DWR should make mitigation options available for certain activities based on avoidance and the following minimization criteria: 1) payment to the riparian buffer restoration fund administered by the Division of Mitigation Services, 2) donation of property, or 3) restoration or enhancement of a non-forested buffer.

Majority Rule Proposal

The riparian buffer protection rule should:

1. Apply equally to all areas of the watershed.
2. Apply to all intermittent and perennial streams, as well as to features that are hydrologically connected to intermittent and perennial streams and to features that fall within the protected riparian buffer area.
3. Protect an area that extends 70 feet horizontally from surface waters.
    a. On intermittent and perennial streams, the protected area should begin at the most landward limit of the top of the bank or the rooted herbaceous vegetation and extend landward a distance of 70 feet on all sides of the surface water
    b. On ponds, lakes, and reservoirs, the protected area should begin at the most landward limit of the normal water level or the rooted herbaceous vegetation and extend landward a distance of 70 feet, measured horizontally on a line perpendicular to a vertical line marking the edge of the surface water or rooted herbaceous vegetation.
4. Delineate zone 1 to protect the first 50 feet, measured horizontally, on either side of a surface water feature.
    a. From 0 feet to 9.99 feet:
        i. No tracked vehicles should be allowed.
    b. From 0 feet to 19.99 feet:
        i. On land that has a certified forest harvest management plan or that is enrolled in the Present Use Value program:
            1. Removal of individual high value trees should be allowed.
            2. Removal of trees with exposed roots on the streambank should not be allowed unless those trees are diseased or at risk of causing damage.
    c. From 20 feet to 49.99 feet:
        i. On land that has a certified forest harvest management plan or that is enrolled in the Present Use Value program:

            1. Harvest of 50% of trees with DBH greater than 5 inches should be allowed.
            2. Harvest should be allowed no more frequently than every 15 years except on tree plantations, where it should be allowed no more frequently than every 5 years.
5. Delineate zone 2 to protect the first 20 feet, measured horizontally, beginning at the outer edge of zone 1.
    a. From outer edge of zone 1 to 20 feet (overall 50 feet to overall 70 feet):
        i. Forest harvest should be allowable with ground cover reestablishment
        ii. Grading with revegetation should be allowed, as long as vegetation in zone 1 is not compromised.
6. Given significant physiographic differences between the High Rock Lake Watershed and other nutrient sensitive watersheds, the following activities should be scrutinized during the rule drafting stage to determine ongoing allowability in the 70 foot buffer:
    a. Soil disturbing site preparation
    b. Logging decks and sawmills
7. The following activities should be allowed anywhere in the 70 foot buffer:
    a. Removal of invasive exotic species
    b. A one-time application of fertilizer at agronomic rates to establish planted vegetation
8. The “Table of Uses” from 15A NCAC 02B .0714 should be preliminarily incorporated during rulemaking but carefully reviewed by DWR to ensure adaptability to the needs of High Rock Lake Watershed stakeholders.

Approved by:

TAG Member	**Affiliation**
Robby Abou-Rizk	Blue Ridge Trout Unlimited
Danica Heflin	Piedmont Triad Regional Council
Edgar Miller	Yadkin Riverkeeper
George Morris	Wild Ones Central North Carolina Chapter

Minority Report

Synopsis: The minority proposal carries forward the existing buffer protection approach used in most other Nutrient Strategy Watersheds in North Carolina with no major changes.

Overall Width: 50 feet

Zone 1: 30 feet, woody vegetation, limited forest harvest

Zone 2: 20 feet, herbaceous or woody vegetation, forest harvest allowable

The minority concurs with the arguments put forward by the majority that erosive conditions across the watershed have precipitated a more severe state of hypereutrophication in High Rock Lake than in most other receiving waters in the state. The importance of sediment management in controlling downstream nutrient delivery to the Lake cannot be overstated, and riparian protection is a key component of a strategy to protect against further deterioration of river and lake water quality.

Fifty Feet is Needed: Close examination of North Carolina's buffer rules suggests that protecting a streamside riparian zone any narrower than 50 feet would result in continuous and irreversible declines in water quality across the nutrient sensitive waters of the State (Burchell, 2016; NCDEQ, 2016). This reiterates the importance of stemming the loss of sediments and nutrients across the broad area of notoriously erosive soils in the headwaters of the Yadkin River. Research has shown that buffer widths of less than 50 feet are significantly more difficult to maintain than wider buffers, and narrow buffers are inadequate for filtration of nutrients and sediment on all except the smallest high-order streams (Palone, 1997). These trends are increasingly important in the western piedmont where steep topography makes the risk of erosion more severe, especially in higher elevations. Given the importance of sedimentation control and phosphorus management in the High Rock Lake Watershed, it is appropriate that 50 feet be protected from further degradation.

Fifty Feet is Accepted and Understood: The minority finds the case for increasing buffer widths beyond the 50-foot standard less compelling. In recommending a complex change in land management at the watershed scale, the minority strongly believes that consistency across various landscapes and in different regions will go a long way toward increasing adoption and compliance by private landowners. Producers and landowners across the State have grown accustomed to standardized buffer rule formats in the largest nutrient-sensitive watersheds. Over the decades since the first nutrient strategies were adopted, various stakeholders and interest groups have improved their outreach and engagement materials to defend the value of a 50-foot buffer to property owners, and administrative consistency improves the efficiency of customer service by land and water management agencies at the state and local level.

The buffer protection template utilized in the Neuse, Tar-Pamlico, and Jordan Lake nutrient strategies has undergone decades of peer review, stakeholder input, and agency revisions. These rules have been honed over time to provide an optimized balance between landowner needs and watershed-scale water quality protection, and existing statutes even provide allowances for local governments who are interested in protecting more than the minimum required by state law (§ 143-214.23A(d)). Beyond the traditional 50-foot width required in other watersheds, the cost effectiveness of protection decreases, as increasing widths provide a decreasing pollutant reduction value per additional foot of protection

(Mayer, 2007). For these reasons, the minority finds it difficult to argue for protection of more than a total of 50 feet.

Recommendations: Members of the minority recommend that DWR protect existing vegetated riparian areas within 50 feet of and adjacent to intermittent and perennial streams, lakes, and ponds in the High Rock Lake watershed. The first 30 feet adjacent to waters should be largely undisturbed forest, while the outer 20 feet may be managed vegetation. Existing, ongoing activities within buffers should be allowed to continue, while a change in land use from rule effective date should trigger new protections. DWR should communicate to Local Governments their authority to request permission from the Environmental Management Commission to require more stringent buffer protection measures according to § 143-214.23A(d) when necessary to protect local resources. Certain uses of land within the buffer should be identified as exempt, allowable, or allowable with mitigation. TAG members recommend moving forward with including the existing Table of Uses provided in 15A NCAC 02B .0714(11) as a reference point for future public comment and review by the NC Environmental Management Commission as to their applicability in the High Rock Lake watershed. All uses not specified in the Table of Uses should be prohibited.

The rule should allow for mitigation where no practical alternatives exist, specify variance requirements and forest-harvesting limitations, and ensure that new developments either avoid or mitigate buffer impacts. DWR should make mitigation options available for certain activities based on avoidance and the following minimization criteria: 1) payment to the riparian buffer restoration fund administered by the Division of Mitigation Services, 2) donation of property, or 3) restoration or enhancement of a non-forested buffer.

Minority Rule Proposal

The riparian buffer protection rule should:

1. Apply equally to all areas of the watershed.
2. Apply to all intermittent and perennial streams, as well as to features that are hydrologically connected to intermittent and perennial streams and to features that fall within the protected riparian buffer area.
3. Protect an area that extends 50 feet horizontally from surface waters.
    a. On intermittent and perennial streams, the protected area should begin at the most landward limit of the top of the bank or the rooted herbaceous vegetation and extend landward a distance of 50 feet on all sides of the surface water
    b. On ponds, lakes, and reservoirs, the protected area should begin at the most landward limit of the normal water level or the rooted herbaceous vegetation and extend landward a distance of 50 feet, measured horizontally on a line perpendicular to a vertical line marking the edge of the surface water or rooted herbaceous vegetation.
4. Delineate zone 1 to protect the first 30 feet, measured horizontally, on either side of a surface water feature.
    a. From 0 to 9.99 feet:
        i. No tracked vehicles should be allowed within the first 10 feet of zone 1.
        ii. On land that has a certified forest harvest management plan or that is enrolled in the Present Use Value program:
            1. Removal of individual high value trees should be allowed.

2. Removal of trees with exposed roots on the streambank should not be allowed unless those trees are diseased or at risk of causing damage.

b. From 10 feet to 29.99 feet:
    i. On land that has a certified forest harvest management plan or that is enrolled in the Present Use Value program:
        1. Harvest of 50% of trees with DBH greater than 5 inches should be allowed.
        2. Harvest should be allowed no more frequently than every 15 years except on tree plantations, where it should be allowed no more frequently than every 5 years.

5. Delineate zone 2 to protect the first 20 feet, measured horizontally, beginning at the outer edge of zone 1.
    a. From outer edge of zone 1 to 20 feet:
        i. Forest harvest should be allowable with ground cover reestablishment
        ii. Grading with revegetation should be allowed, as long as vegetation in zone 1 is not compromised.
6. Given significant physiographic differences between the High Rock Lake Watershed and other nutrient sensitive watersheds, the following activities should be scrutinized during the rule drafting stage to determine ongoing allowability within the 50 foot buffer:
    a. Soil disturbing site preparation
    b. Logging decks and sawmills
7. The following activities should be allowed anywhere in the 50 foot buffer:
    a. Removal of invasive exotic species
    b. A one-time application of fertilizer at agronomic rates to establish planted vegetation
8. The “Table of Uses” from 15A NCAC 02B .0714 should be preliminarily incorporated during rulemaking but carefully reviewed by DWR to ensure adaptability to the needs of High Rock Lake Watershed stakeholders.

Approved by:

TAG Member	**Affiliation**
Richard Cockerham	NC Forest Service
Keith Larick	NC Farm Bureau
Chris Millis	NC Homebuilders Association

Non-Regulatory Recommendations

All members of the Buffer TAG acknowledge that protection of buffers against a change of uses is only part of a broader strategy to improve nutrient management in the High Rock Lake Watershed. Additional protections and improvements can be obtained not just by protecting existing buffers, but also by expanding buffers into areas where uses are not expected to change in the near future or where existing pollutant sources can be eliminated. These types of buffer expansions must be achieved via voluntary measures and with significant cost share assistance from the State. Buffer TAG members recommend the following actions:

1. The General Assembly, Environmental Management Commission, and Department of Agriculture and Consumer Services should promote the Conservation Reserve Enhancement Program and ensure that it receives continued funding. The Division of Water Resources should assist in promoting the value of this program in providing a financial incentive for buffer establishment and preservation.
2. The Division of Water Resources should revise the current nutrient offset crediting procedure for buffer restoration in order to minimize or eliminate market distortions and assign nutrient offset credit that is scientifically defensible. This policy should be revised and adopted before the High Rock Lake Nutrient Management Strategy takes effect.
3. The Division of Water Resources should adopt temporary rules to ensure that mitigation banks are allowed to develop projects in advance of the rules taking effect. This will ensure that as unavoidable buffer encroachments take place after rule adoption, an existing bank of buffer credits will be immediately available to offset those impacts.
4. The Division of Water Resources should encourage the usage of native species for buffer establishment and enhancement, as well as encourage landowners to choose pollinator- and wildlife-friendly species alternatives.
5. The Division of Water Resources should support emerging One Water partnerships and enable and encourage cross-sector collaboration to achieve nutrient management improvements across the watershed.

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