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North Carolina Department of Environment and Natural Resources

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Division of Water Quality

October 25, 2005

Ms. Annie Godfrey, Acting Chief
East Standards, Monitoring and TMDL Section
USEPA Region 4
61 Forsyth Street, S.W.
Atlanta, GA 30303-8960

Re: EPA/State North Carolina Nutrient Criteria Implementation Plan (NCIP)

Dear Ms. Godfrey:

In accordance with both the proposed EPA FY 06 106 plan and the US EPA/State mutual agreement letter dated September 20, 2004, the State of North Carolina is required to provide a status report on activities to date. This letter constitutes our status report. A modified North Carolina Division of Water Quality Nutrient Criteria Implementation Plan dated October 25, 2005 is also enclosed. The modifications are primarily timeline issues, and explanations are outlined below.

The State of North Carolina General Assembly convened in January of 2005 and passed a Session Law entitled "Drinking Water Supply Reservoir Protection" (SL 2005-190 - copy enclosed). This law directs the Environmental Management Commission (EMC) to (1) study water quality in the drinking water supply reservoirs in the state, (2) to adopt nutrient control criteria for water supply reservoirs, (3) to develop and implement a nutrient management strategy for certain drinking water reservoirs that are impaired or may become impaired, (4) restrict both new and increased nutrient loading to any impaired reservoir and (5) to report to the Environmental Review Commission (ERC), of the North Carolina General Assembly, on progress toward those goals. This law and our current plan (NCIP) have been reviewed for inconsistencies in timelines, and necessary modifications to meet the State mandates are being proposed in order to move forward with the development and implementation plan.

SL 2005-190 requires the Division of Water Quality (DWQ) to review existing data, identify waters meeting current water quality standards and report those findings to the ERC by May 1, 2006. The NCIP originally submitted indicated that complete retrieval and compilation of pertinent, existing DWQ data would be completed by January 2005. However, the final US EPA mutual agreement approval was not received until September 20, 2004. Due to pertinent staff vacancies, there was not sufficient time and resources available to complete the task by the targeted date. However, data have been compiled, and we have made a decision to complete this summer's data collection efforts, thereby ending our term of "existing" data for SL 2005-190 purposes and the NCIP on September 30, 2005. We are defining "existing data" to include both DWQ data and any defensible quality controlled "outside" data.

- **Modification:** By January September 2005: Complete retrieval and compilation of pertinent, existing DWQ data.

In accordance with the NCIP, the State identified and contracted through The North Carolina Water Resources Research Institute (WRI)/Duke University to begin preliminary data analysis and user surveys of lakes in North Carolina. After numerous budget related delays, the contract was awarded June 22, 2005 and is scheduled to end in October of 2006. The tentative milestone requirement to be met by the contractor is to have a "Final Technical Report" due to the State by October 30, 2006. Our original NCIP target of March 2005, to complete the preliminary data evaluation, has been modified to coincide with this contractual arrangement.

- **Modification:** By ~~March 2005~~ October 2006- Complete preliminary data evaluation. Identify data gaps. Determination of appropriate research methods (both field and modeling aspects). Determine additional data study needs. Identify financial resource requirements necessary for study completion. Use outside research assistance, if necessary.

Based upon the WRI/Duke University contracted study - user surveys, statistical analysis and expert elicitation, DWQ will reevaluate data collection needs and complete any additional monitoring data during the next lakes monitoring cycle. This will ensure coordination between the Water Quality Standards and Monitoring programs so that any revised needs are incorporated into the State's monitoring and Section 303(d) programs. In addition, phytoplankton analysis has been initiated for samples that exceed 20 ug/L chlorophyll *a* to begin further review/analysis of possible Tier 1 levels. With a delivery date of October 30, 2006 for the contracted study, we anticipate that we will have sufficient time to initiate any needed modifications /additions to the monitoring plan by the following date:

- **Modification:** By December ~~2006~~ 2007- Complete additional data collection required to fill identified data gaps.

North Carolina DWQ will be required under SL 2005-190 to identify any "nutrient control criteria necessary" (for the drinking water reservoirs specified) by January 1, 2009. The NCIP had originally identified a target of December 2007 for the development of the draft regional criteria. A modification to December 2008 is needed to attempt to accomplish both goals. It is important to note here that our immediate focus would be to accomplish identification, for the EMC, of "any nutrient control criteria necessary to prevent excess nutrient loading in each drinking water supply reservoir..." as directed by State law.

- **Modification:** By December ~~2007~~ 2008 - Complete final data analysis and evaluation. Reach conclusions regarding cause and effect relationship between TN and TP levels, chlorophyll *a* levels, water body trophic status, and impairment of designated uses. Develop draft regional nutrient criteria. . Initiate stakeholder process. Use outside research assistance, if necessary.

Once final data analysis and evaluation is complete, we anticipate approximately six months to initiate rulemaking. The Session Law has an inconsistency that may affect the rule-making for the drinking water supply reservoirs. Session Law 2005-190 has the same accomplishment dates for 1) development of a management strategy and 2) adoption of the rules for that same

management strategy (July 1, 2008). We are anticipating some modifications of Session Law 2005-190 to rectify the conflict, but we can not estimate the revised calendar date.

- **Modification:** By ~~June 2008~~ June 2009 – Initiate NC Administrative Procedures Act (APA) rulemaking process for the adoption of proposed nutrient criteria for non-flowing waters, including lakes, reservoirs, and estuaries. Develop final plans for implementation of proposed nutrient criteria.

Session Law 2005-190 requires us to adopt final “nutrient control criteria” by May 1, 2010. Our original NCIP target will, therefore, be modified for drinking water lakes to accommodate the Session Law dates. The timeline for the remaining slow moving water bodies is tentatively still June 2010.

- **Modification (added text):** By May 2010 – Nutrient criteria adopted in NC Water Quality Rules for drinking water supply reservoirs. Criteria implementation plans finalized and initiated.

Development and implementation of North Carolina’s NCIP is structured such that there is a strong cross-program involvement with both the State’s monitoring and National Pollutant Discharge Elimination System (NPDES) permitting program. Likewise, SL 2005-190 requires the same linkage. The EMC must report, to the ERC, by May 2006 on the status of all drinking water lakes with a determination as to whether or not the lakes are meeting existing water quality standards. If nutrient control criteria for any drinking water supply reservoir are not being achieved, enhanced monitoring is mandated, and in specific waters, the Session Law provides for a moratorium on any direct or indirect, new or increased nutrient loading allocations until a permanent nutrient management strategy for that reservoir becomes effective. As the State moves forward with implementation of the NCIP, we think these policies will only enhance our efforts to better manage nutrient loadings.

Progress and modifications to Section B (flowing waters) are as follows:

- **Modification:** (per your request) The two remaining uses of the term “impairment tier” have been eliminated and replaced with the term “category.”

Timeline: The State of North Carolina Division of Water Quality is currently working with the NC Ecosystem Enhancement Program (EEP) to obtain adequate funding to support the required research, sampling, data collection and analysis. EEP is hoping to fund a full-time, time limited position (Environmental Biologist II) to aid in the periphyton assessment as outlined in the original plan. Through a memorandum of understanding, the EEP will continue funding for the Watershed Assessment Team. The Watershed Assessment Team’s focus is to characterize water quality in small watersheds for EEP. There is a section of the MOA that funds development of alternative methods to assess water quality. One of these alternatives is the development of a method using algae (including periphyton). A portion of the MOA is excerpted below (note Item 4):

"Applied Methodologies and Guidance Development. DWQ (WAT, BAU, ATU, the Ecosystems Unit, EEP GIS and others as available) will develop and assess the following methods. Once the methods are deemed suitable, they may be incorporated into the LWP data collection process for appropriate watersheds.

1. Detailed data analysis of benthic and fish databases and to expand our understanding of species distribution in various ecoregions and habitats;
2. Produce guidance documents for interpreting biological data collected under many conditions and environments;
3. Development of methods for toxicity screening of ambient waters utilizing various biological taxa; and
4. Development of methods for assessing water quality based on algal or diatom community composition and structure."

Acquisition of Appropriate Funding: The State is currently processing the required paperwork for the above-mentioned Environmental Biologist II position. Due to the fact that this is a new position, current State regulations require us to process the position and its description through several legislative processes. We expect that it may take six months to a year to complete the regulatory and hiring processes.

We are currently seeking additional funding sources and researching costs associated with diatom analysis of the collected samples.

Draft Monitoring Strategy: A comprehensive monitoring strategy that will provide the data necessary to support the implementation of this plan is still *in the formative* stages, pending funding of the study and associated personnel. As stated in our NCIP, "Implementation of the proposed plan, and its associated timeline, are dependent upon the ability of the State to obtain adequate funding for the projects. Any delays in funding will create associated delays in the research and implementation of the plan." The basic study plan for evaluating the use of Diatom metrics is outlined here for your information only, we welcome any comments and suggestions:

- **Goal:** Evaluate the use of metrics based upon diatom assemblages to assess nutrient concentrations in wadeable streams. Metrics will be evaluated for their consistency over the sampling period, their correlation with the North Carolina Index of Biotic Integrity (NCIBI) and their relationship to observed nutrient concentrations.
- **General Study Plan:** Diatoms and nutrient samples will be collected concurrently with macrobenthos assessments as part of the Biological Assessment Unit (BAU) program. The diatom samples will be sent out to a contractor for analysis. Diatom assemblage data will be used in metrics to infer environmental conditions.
- **Sampling Schedule:** Sampling schedule will follow BAU's basinwide assessment schedule. In 2006, *if funding is secured*, the Yadkin-Pee Dee and Lumber river basins

will be sampled. The French Broad, Little Tennessee and Tar-Pamlico river basins would be sampled in 2007.

- Diatom Sampling Methodology and Design: Samples will be qualitatively collected from substrates (microhabitats) in runs, riffles and pools (macrohabitats) where available. Macro and microhabitats may not always be present and one or more of these samples may be omitted. Microhabitats should include if present;
 - Rocks: scrape at least 5 riffle rocks and 2 rocks each from runs and pools in high gradient streams; scrape 3 rocks from each macrohabitat present in low gradient streams.
 - Wood: scrape at least 5 pieces of wood in low-gradient streams; scrape 3 pieces of wood in high-gradient streams.
 - Animals: scrape algae from the backs of turtles, snails and crayfish.
 - Root mats: squeeze water from mats into container, discarding the solids.
 - Sand: scoop surface layer of sand depositional areas where available.
 - Mud: scoop surface layer of mud depositional areas where available.
 - Leaf packs: squeeze water from at least 2 leaf packs into a container, discarding the solids
 - Aquatic vegetation: squeeze water from at least 2 aquatic plants into a container, discarding the solids.

Microhabitats would be sampled relative to their abundance at the site's macrohabitats. The number and types of microhabitats sampled (i.e. rocks, wood, leaf packs) will be recorded along with observational data.

- Observational data collection: Observational data may include:
 - Whether or not filamentous growths exist and their percent coverage.
 - Relative abundance of total periphytic coverage (absent sparse, moderate or dense).
 - Any other observations that could help in the assessment (e.g. scouring evident).
- Sample collection, handling, preservation and analysis will follow methodology to be determined by the contractor. Methods will be in accordance with US EPA and/or USGS protocols. The objective here is to make the data usable to others in the process of nutrient criteria development.
- Data analysis: Six metrics of biotic integrity based on diatoms will be evaluated for their consistency over the sampling period, their correlation with the NCIBI and observed nutrient concentrations:
 1. Total Number of Diatom Taxa.
 2. Shannon Diversity.
 3. Pollution Tolerance Index.
 4. *Cymbella* Group Richness.
 5. *Fragilaria* Group Richness.
 6. % *Navicula*, *Nitzschia*, *Surirella*.

The pollution tolerance index will be based upon values currently used in Kentucky; however, the State may use other pollution tolerance indices as knowledge of the subject improves.

References:

EPA Rapid Assessment Protocols, Chapter 6, Periphyton Protocols

<http://www.epa.gov/owow/monitoring/tech/chap06.html>

The Kentucky Division of Water Algae Program <http://www.water.ky.gov/sw/swmonitor/sop/>

We would like to recognize, here, the efforts of Ed Decker, US EPA. The thoughtful suggestions and comments provided are sincerely appreciated and have been extremely beneficial in the development of this innovative new assessment plan.

A revised North Carolina Nutrient Criteria Implementation Plan, dated October 25, 2005, which incorporates revisions as noted above, is enclosed. We thank you for your consideration of this modified plan and we again seek "mutual agreement" so that we may continue with both development and implementation. We are confident that these changes to the timelines do not create problems, and we are dedicated to resolutions in the most expeditious manner possible. Should you have any questions or concerns about this letter or the enclosures, please contact Connie Brower at 919-733-5083, extension 380 or by e-mail at Connie.Brower@ncmail.net.

Sincerely,



Alan W. Klimek, P.E.

AWK:cub

Enclosure(s)

cc: Gail Mitchell, USEPA Region 4
Ed Decker, USEPA Region 4
Lisa Perras-Gordon, USEPA Region 4
Jim Harrison, USEPA Region 4

North Carolina Nutrient Criteria Implementation Plan

Revised – October 25, 2005

Introduction to Overall North Carolina Approach

North Carolina firmly believes that a proactive management strategy based on adaptive management techniques is the most viable method to control excessive nutrients from point and non-point sources. North Carolina has established itself as a leader in the field of site-specific, flexible nutrient control strategies through the implementation of a comprehensive nutrient management program for its surface waters. This existing program has included nutrient response criteria, ambient monitoring programs, use support methodologies, nutrient TMDLs, nitrogen and phosphorous permit limits, and an innovative supplemental classification of "Nutrient Sensitive Waters (NSW)" for certain waters of the State. The full details of the extent of this current program are presented in Attachment 1 of this document.

The State of North Carolina recognizes that additional proactive nutrient control measures are warranted based upon the latest advances in the science of nutrient management and the continued eutrophication of waters. Accordingly, the North Carolina Division of Water Quality (NCDWQ) has developed a plan for a "second phase" of nutrient control for NC's surface waters. This follow-on plan is designed to build upon and refine the nutrient control achievements that have already been attained in the State. It is the goal of this plan to reduce and protect surface waters from eutrophication by developing regionally-specific nutrient response criteria that will be augmented by site-specific nitrogen and phosphorous control mechanisms. Additional information that provides a defensible linkage of cause to response to effect will be a prerequisite to a complete understanding of the causal variable data. It is the proactive policy for the development and implementation of this "phase two" nutrient control strategy that is detailed in this implementation plan.

Introduction to "Phase 2" of NC's Nutrient Control Strategy

For the purposes of the second phase of Nutrient Criteria development and implementation, North Carolina has chosen to divide the waters of the State into two sub-groups. These sub-groups are defined as:

1. Non-Flowing Waters: The non-flowing waters category generally includes:
 - a. Lakes – Lakes are defined as natural (not man-made) geologic features, which impound water. In North Carolina, natural lakes are predominantly located within the Coastal Plains ecoregion and are generally shallow, elliptical lakes referred to as Carolina Bay Lakes.
 - b. Reservoirs – Reservoirs are man-made (not natural) fresh water impoundments. North Carolina reservoirs may be used as sources for drinking water, energy production, flood control, commercial water use, aquatic life habitat, and/or recreation. Reservoirs are

found throughout the State and are the dominant lake form in the Piedmont, Sandhills, and Mountain ecoregions.

- c. Estuaries – Estuaries are natural coastal features where there is an interaction of fresh and salt waters. These waters are tidally influenced, which, in turn, periodically influences changes in salinity, nutrients, water depth, etc. Estuaries along the coast of North Carolina are predominantly drowned river valleys, which became inundated by the rising sea level during the last glacial retreat.
2. Flowing Waters: The flowing waters category includes rivers and streams.

A. Nutrient Criteria Development & Implementation for Non-Flowing Waters in Phase Two

Data Status Inventory

1. **Available data:** Thousands of ambient observations have been taken from approximately 423 stations located in over 150 water bodies grouped by region. Measured parameters include chlorophyll a, total nitrogen (TN), and total phosphorous (TP). The time frame for this data ranges from the early to mid 1980s to present. Data/water bodies are grouped according to the following regions in North Carolina: mountains, piedmont, sandhills, coastal plains, and estuaries. (See Attachment 2 for an overview of inventory of existing data for nutrient criteria development for the non-flowing waters.)
2. **Data needs:** Available data will be evaluated according to the plans proposed under Criteria Development Approach (p. 3). This initial evaluation will be completed under the schedule proposed in the Timeline (p. 5) included in this document and will include the assistance of outside researchers and experts, as necessary. Based upon the advice of these outside experts, and NCDWQ's own evaluation of the data, data gaps and needs will be identified and refined. These data gaps will be filled by subsequent targeted data collection to be completed according to the proposed schedule. Resource requirements for data evaluation and collection are delineated in a later section of this plan (Resource Requirements p. 6).

Projects Planned to Address Data Needs

As discussed above, data gaps will be identified based upon a thorough evaluation and examination of the available data. Only after these data gaps have been identified will it be possible to develop specific data collection plans. Data collection projects can be submitted for review at that time. Data gaps will be identified, data collection plans will be developed, and data collection will be performed in accordance with the schedule presented in the Timeline section of this document (p. 5).

Criteria Development

1. **Selected Parameters:** For the non-flowing waters category NCDWQ intends to pursue a phytoplankton measure as its primary approach for nutrient criteria development. Towards this end, DWQ intends to develop new instream criteria for chlorophyll a and site-specific TN and TP optimization levels. The State of North Carolina has a predominance of reservoirs, with only six natural lakes. The inclusion of a water clarity parameter, therefore, is subject to further research and evaluation. Common non-algal turbidity has been historically and consistently identified in NC's waters, making the use of a water clarity parameter an ineffective tool as a measurable response variable for nutrients in this State. The selected parameters are proposed to be developed on a region-specific basis. Therefore, the final proposed parameters will have a unique value for each of the following designated non-flowing water regions: mountains, piedmont, sandhills, coastal plains, and estuaries.
2. **Parameter Type:**
 - a. Chlorophyll a: At this time, NCDWQ envisions adopting region-specific, quantitative chlorophyll a criteria. NCDWQ believes that this action will require significant modifications to the current chlorophyll a criteria language. The State intends to conduct a complete scientific evaluation and review in order to determine the most effective methodology available with which to implement a revised chlorophyll a water quality standard for the control of nutrients. Anticipated outcomes of this review may lead to the incorporation of seasonal growing averages, instantaneous maximums, and frequency and distribution response criteria incorporated into the new, revised chlorophyll a standard. As previously discussed, regionally-specific chlorophyll a criteria will be developed for the mountains, piedmont, sandhills, coastal plains, and estuary regions of North Carolina. Based upon the detailed evaluation and analysis of the relationship between TN, TP, chlorophyll a, and trophic status of the water (discussed below in "Approach" p. 4), two categories of quantitative chlorophyll a parameters will be proposed for each of the five regions presented above. One category (the lower numeric value of the two) will be established at a threshold level that, if exceeded, would indicate that the water body in question had become "nutrient enriched" and in danger of eventually becoming impaired. These "nutrient enriched" water bodies would be designated as such and would be subject to the development and implementation of a nutrient management strategy (discussed below in "Nutrient Translator" p. 4). This management strategy and its associated controls on point source and non-point source nutrient loading would be designed to *prevent* further nutrient enrichment and to *preclude* subsequent impairment of the river or stream in question. The second category (the higher value of the two) would be designated as the "impairment level" criteria. Exceedance of this impairment level criterion would indicate that the water body had become impaired and was not maintaining one or more of its designated uses. This "impairment level" chlorophyll a criteria would be applicable for use support attainment and 303(d) listing decisions. Waters on the 303 (d) list will be scheduled for additional study or development of a TMDL as deemed appropriate.. (Note: The use of the term "nutrient parameters" will be used throughout this document to include both the lower value "nutrient enrichment" threshold level and the higher value "impairment level" nutrient criteria.)

- b. **Total Nitrogen (TN) & Total Phosphorous (TP):** Site-specific TN and TP control levels will be developed for those waters that are determined to be "nutrient enriched" under the provisions of this plan. When a specific water body equals or exceeds the "nutrient enriched" chlorophyll a quantitative level, a translation process will be required for that specific water body. This translation process (which is described in further detail below) will address both the point and non-point source nutrient loading to the nutrient-enriched waters and will result in the development of site-specific TN and TP control levels that are sufficient to prevent the subsequent nutrient impairment of the water body in question.

Criteria Development Summary: This management strategy and its associated controls on site-specific point source and non-point source nutrient loading would allow NCDWQ to *prevent* further nutrient enrichment, preclude subsequent impairment of the waters (exceedances of the impairment level chlorophyll a criteria) and to *protect* all existing and designated uses.

3. **Nutrient Translator:** As currently planned, NCDWQ will implement the following actions in those non-flowing water bodies that become "nutrient enriched," as described above:
 - a. NCDWQ will require optimization of TN and TP removal for major dischargers to non-flowing water bodies identified as "nutrient enriched." These optimization levels will be established to *prevent* further nutrient degradation of the waters while the second part of this translation process is executed.
 - b. As a second step, the Division will develop and implement a comprehensive, site-specific nutrient management strategy for all "nutrient enriched" waters. This strategy and its associated modeling will address both point and non-point nutrient sources and will detail the steps necessary to effectively control those sources in a manner that will prevent further nutrient enrichment and the impairment of the water body in question. NCDWQ will implement the plans developed under this nutrient management strategy to the extent necessary to ensure that all designated and existing uses of the threatened waters remain *protected*. If necessary, nutrient management plans may be extrapolated upstream to flowing waters in order to adequately protect a downstream non-flowing water body.
4. **Approach:** North Carolina's overall approach for the establishment of nutrient criteria in the non-flowing waters will be founded on the results of a comprehensive cause and effect based study and analysis. The goal of this research study (which is outlined under Timeline, p. 5) will be to categorize the State's non-flowing water bodies into the previously described five regions and then analyze and evaluate the relationship between TN and TP levels and chlorophyll a levels, trophic state of the water body in question, and ultimately, designated use impairment. One goal of this study would be to create a regional trophic state matrix that would compare and contrast the regional location of the non-flowing waters with their associated trophic state, ambient level of TN, TP, and chlorophyll a levels. These results will ultimately be utilized to establish regional, multi-leveled quantitative chlorophyll a parameters and will be incorporated into the development and implementation of the nutrient translator. This comprehensive study may be expanded to also include an analysis of the

effectiveness of North Carolina's existing nutrient control strategies to determine if any "lessons learned" from the implementation of these programs can be used to improve the effectiveness of the State's future nutrient control programs.

5. **Classification:** At this time, North Carolina anticipates adopting uniform nutrient parameters for all the classifications of the non-flowing waters of a specific region, irrespective of designated use categories. Analysis and evaluation of results of the nutrient cause and effect study may indicate the need to implement site-specific proactive criteria to prevent the occurrence of response variables of identified concern. Different nutrient parameters will be adopted for the rivers and streams located in that same region.
6. **Prioritization of Waters:** Water will be prioritized to the extent that the non-flowing waters of the State (lakes/reservoirs/estuaries) and rivers and streams will have their associated nutrient parameters developed according to the appropriate timeline presented in this Implementation Plan.
7. **N & P Criteria for all Waters:** The successful execution of this implementation plan will result in the development of N and P control levels and translator guidance for all lakes, reservoirs, estuaries, rivers, and streams in the State that become "nutrient enriched."
8. **Timeline:** The following timeline is proposed for the development and implementation of Nutrient Criteria for the non-flowing waters (lakes/reservoirs/estuaries) of North Carolina. The proposed timeline is directly tied to the ability of the Division to obtain sufficient funding to support the plans detailed in this document. 106(b) grants are currently considered to be the primary source for the additional funding necessary to execute this plan. Any delays in funding could limit the implementation of the proposed plan. [This timeline is based upon North Carolina and EPA agreeing to implement this proposed plan by September 2004. Any delay in concluding that agreement will result in a corresponding delay in the dates presented in this timeline.]:

By September 2005: Complete retrieval and compilation of pertinent, existing DWQ data.

By October 2006: Complete preliminary data evaluation. Identify data gaps. Determination of appropriate research methods (both field and modeling aspects). Determine additional data study needs. Identify financial resource requirements necessary for study completion. Use outside research assistance, if necessary.

By December 2007 – Complete additional data collection required to fill identified data gaps.

By December 2008 – Complete final data analysis and evaluation. Reach conclusions regarding cause and effect relationship between TN and TP levels, chlorophyll a levels, water body trophic status, and impairment of designated uses. Develop draft regional nutrient criteria. Initiate stakeholder process. Use outside research assistance, if necessary.

By March 2009 – Initiate NC Administrative Procedures Act (APA) rulemaking process for the adoption of proposed nutrient criteria for non-flowing waters, including lakes, reservoirs, and estuaries. Develop final plans for implementation of proposed nutrient criteria.

By May 2010 – Nutrient criteria adopted in NC Water Quality Rules for drinking water supply reservoirs. Criteria implementation plans finalized and initiated.

By June 2010 – Nutrient criteria adopted in NC Water Quality Rules. Criteria implementation plans finalized and initiated.

9. **Resource Requirements:** The following additional resources will be required to complete the implementation of the proposed nutrient control strategy as outlined in this document:

Outside Research Assistance for analysis of data and evaluation of relationship between TN & TP levels, and chlorophyll a levels, water body trophic state, and impairment.

Field data collection to fill identified data gaps and support nutrient cause and effect study. Estimated Cost: Unknown at this time due to the fact that the scope and the extent of the data collection effort have yet to be determined. Execution of proper field data collection is dependent upon obtaining adequate funding for the project.

Potential Funding Sources for additional resource requirements: 106 grants, 104(b) grants, 319 grant funds, and any other grant sources that may be associated with the implementation of nutrient criteria.

B. Nutrient Criteria Development & Implementation for Flowing Waters in Phase Two

Data Status Inventory

1. **Available data:** Baseline available data consists of the data collected at approximately 175 sites in rivers and streams located throughout North Carolina for which there is both nutrient (ambient) sampling results and benthic macroinvertebrate sampling results. For some sites this data dates from the mid-1980's to the present. Data has routinely been collected at these benthic/nutrient sites according to the 5-year basinwide planning cycle. These river and stream sites and their associated sampling results will be grouped for evaluation purposes according to the following regions: mountains, piedmont, sandhills, and coastal plains.
2. **Data needs:** Sufficient data concerning the periphyton assemblages of these sites will need to be collected over a period of time to allow NCDWQ research staff to ascertain the relationship between the algal biomass and/or diatom indices of biotic integrity (DIBI) and total nitrogen (TN) & total phosphorous (TP) levels, chlorophyll a levels, and designated use impairment. DWQ projects that a data collection effort spread over several years will be necessary to fill these data requirements.

Projects Planned to Address Data Needs

As discussed above, DWQ expects that an extensive, multi-year biotic data collection effort will be necessary in order to acquire sufficient scientific information to complete the requirements outlined in this implementation plan. An integral part of this research effort will be an algal assessment study at the selected sites, which will be designed to determine the type of algae present at the site, the quantity of algae present, and its associated assemblage structure. In order to reduce the extent and/or completion time of this collection effort, a probabilistic monitoring approach may be considered. All data collection projects will be executed in strict accordance with approved EPA/USGS protocols. Due to the fact that this implementation plan is in the initial stages of development, detailed data collection plans have not yet been formulated. Detailed plans will be developed and executed in accordance with the Timeline for flowing waters presented in this document (p. 9).

Criteria Development

1. **Selected Parameters:** Nutrient parameters for flowing waters will be based upon a quantifiable periphyton assessment. NCDWQ believes that development of a measure of algal biomass for flowing waters would benefit the state's goal of protection for all water bodies. Prior research has shown that chlorophyll a may not be the best estimate of nutrient enrichment in flowing waters. The state therefore intends to evaluate chlorophyll a, percentage coverage, diatom indices of biotic integrity (DIBI) and cell density to determine if alternatives to chlorophyll a would be a scientifically more defensible judgement for nutrient parameters in flowing waters. The research will also investigate the use of combined indices for impact evaluation purposes. Algal biomass is to be measured and assessed through the utilization of the field based rapid periphyton survey. Algal biomass and DIBI parameters will be established with unique values for each of the following regions: mountains, piedmont, sandhills, and coastal plains.
2. **Parameter Type:**
 - a. **Periphyton Assessment:** As previously discussed, a periphyton measurement consisting of either the biomass of algae determined by the field based rapid periphyton survey and/or the DIBI will be the primary nutrient parameter for flowing waters. These parameters will be quantitative and regionally-specific. Based upon the analysis of the relationship between the algal biomass, DIBI, TN, TP, and designated use impairment, region-unique periphyton assessment criteria values will be established at two category levels for the rivers and streams of the State. These multi-leveled parameters will be implemented in a manner very similar to the methodology already proposed for the implementation of the chlorophyll a parameters for North Carolina's non-flowing waters. The lower category value of the periphyton measurement will be established at a level that, if exceeded, would indicate that the river or stream in question was nutrient enriched and in danger of eventual impairment if no action is taken. Flowing waters exceeding this benchmark would be considered "nutrient enriched" and would be subject to the development and implementation of a nutrient management strategy (discussed below). This management strategy and its associated controls on point source and non-point source nutrient loading would be designed to *prevent* further nutrient

enrichment and to *preclude* subsequent impairment of the river or stream in question. The second tier (the higher value of the two categories) would be designated as the "impairment category" criteria. Exceedance of this second category would indicate that the water body had become impaired and was not maintaining one or more of its designated uses. This "impairment category" periphyton criterion would be applicable for use support attainment and 303(d) listing decisions.

b. Total Nitrogen (TN) & Total Phosphorous (TP): Site-specific TN and TP control levels will be developed for those flowing waters that are determined to be "nutrient enriched" as described above. A site-specific nutrient translation process will be required whenever the "nutrient enriched" periphyton assessment value is exceeded in a river or stream. This translation process (which is described in further detail below) will address both the point and non-point source nutrient loading to the nutrient-enriched waters and result in the development of site-specific TN and TP control levels.

Criteria Development Summary: This management strategy and its associated controls on site-specific point source and non-point source nutrient loading would allow NCDWQ to *prevent* further nutrient enrichment, *preclude* subsequent impairment of the waters (exceedances of the impairment periphyton criteria) and to *protect* all existing and designated uses.

3. **Nutrient Translator:** As currently planned, NCDWQ will implement the following actions in those flowing waters that become "nutrient enriched," as described above:
 - a. Optimization of TN and TP removal will be required for all major point source dischargers to the waters in question. These levels will be established to prevent further nutrient degradation of the river or stream while the second part of this translation process is executed.
 - b. As a second step, the Division will develop and implement a comprehensive, site-specific nutrient management strategy for all "nutrient enriched" flowing waters. This strategy and its associated modeling will address both point and non-point nutrient sources and will detail the steps necessary to effectively control those sources in a manner that will prevent further nutrient enrichment and the impairment of the water body in question. NCDWQ will implement the plans developed under this nutrient management strategy to the extent necessary to ensure that all designated and existing uses of the threatened waters remain protected.
- 4 **Approach:** North Carolina's nutrient control strategy for flowing waters will be based on the results of comprehensive research and analysis. As currently envisioned, this proposed research will utilize multiple approaches, incorporating elements of both a reference based approach and a cause and effect study. Comprehensive algal assessments will be performed at selected sites along with the collection of data regarding the levels of TN, TP, and chlorophyll a and the attainment of designated uses at these locations. This data will be compared and contrasted with similar data collected at sites identified as the minimally/least-impacted rivers and streams in a given region. It is expected that a thorough analysis and evaluation of this information will provide insight into the relationship between the

filamentous algae density, DIBI, TN, TP, chlorophyll a levels, and designated use impairment in NC's rivers and streams on a regional basis. This information will then be utilized to establish regional, multi-leveled, quantitative periphyton parameters and will be further used to develop and implement both elements of the nutrient translator for flowing waters. This comprehensive evaluation may be expanded to also include an analysis of the effectiveness of North Carolina's existing "Nutrient Sensitive Waters (NSW)" management strategies to determine if any "lessons learned" from the implementation of these programs can be used to improve the effectiveness of the State's future nutrient control programs.

5. **Classification:** At this time, North Carolina anticipates adopting uniform nutrient parameters for all the classifications of the flowing waters of a specific region, irrespective of designated use categories.
6. **Prioritization of Waters:** Water will be prioritized to the extent that the non-flowing waters of the State (lakes/reservoirs/estuaries) and the flowing waters (rivers and streams) will have their associated nutrient parameters developed according to the appropriate timeline presented in this Implementation Plan.
7. **N & P Criteria for all Waters:** The successful execution of this implementation plan will result in the establishment of site-specific N and P control levels and translator guidance for all lakes, reservoirs, estuaries, rivers, and streams in the State that are determined to be "nutrient enriched" under the guidelines of this plan.
8. **Timeline:** The following timeline is proposed for the development and implementation of Nutrient Criteria for the flowing waters of North Carolina [Implementation of the proposed plan, and its associated timeline, are dependent upon the ability of the State to obtain adequate funding for the projects. Any delays in funding, will create associated delays in the research and implementation of the plan.] :

Immediately Following Mutual Agreement between EPA and NCDWQ on Proposed Implementation Plan: Commence efforts to procure suitable funding to support required research, sampling, and data collection.

3 Years Following the Acquisition of Appropriate Funding: All necessary sampling and required data collection completed according the North Carolina's basinwide schedule.

2 to 3 Years Following the Completion of Sampling/Data Collection: Data analysis testing and evaluation completed. Region-specific periphyton assessment benchmarks developed and reviewed.

2 Years Following the Development and Review of Criteria: Nutrient control strategy for flowing waters fully implemented into North Carolina Water Quality Program.

9. **Resource Requirements:** The following additional resources will be required to complete the implementation of the proposed flowing waters nutrient control strategy as outlined in this document:

Outside Research Assistance for analysis of data and evaluation of relationships between filamentous algae density, DIBI, TN & TP levels, chlorophyll a levels, and designated use impairment. Assistance may be required from the Philadelphia Academy of Sciences. This institution is capable of providing necessary diatom identification, QA/QC, taxa lists, and other information and analysis required for program development.

Field work to perform algal assessments and complete necessary data collection efforts. Estimated Cost: Unknown at this time due to the fact that the scope and the extent of this task have yet to be determined. Execution of proper field data collection is dependent upon obtaining adequate funding for the project. Delays in funding will create delays in both data collection and final implementation of the plan.

Potential Funding Sources for additional resource requirements: 106 grants, 104(b) grants, 319 grant funds, and any other grant sources that may be associated with the implementation of nutrient criteria.



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

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DIV. OF WATER QUALITY
DIRECTOR'S OFFICE

Alan W. Klimek, P.E. Director
Division of Water Quality
North Carolina Department of Environment and Natural Resources
1617 Mail Service Center
Raleigh, NC 27699-1617

Re: EPA/State Mutual Agreement on Numeric Nutrient Criteria
Development Plan for North Carolina revised October 2005

Dear Mr. Klimek:

This letter documents mutual agreement between the Environmental Protection Agency (EPA) and the North Carolina Department of Environment and Natural Resources (NCDENR) in regard to the State's revised voluntary numeric nutrient criteria development plan, entitled, North Carolina Nutrient Criteria Implementation Plan Revised (Revised Plan) submitted to EPA on October 25, 2005. Clarification of activities outlined in the Revised Plan were discussed during a conference call on April 20, 2006.

Nutrient over-enrichment of the nation's waters is a serious problem, but determination of appropriate levels for protection is very complex, and implementation of that protection will be challenging. EPA recognizes that the Revised Plan represents considerable effort undertaken by the State to address this issue. We especially appreciate the continued support of your staff and their participation in the Regional Technical Advisory Group (RTAG), the follow-up to the Regional Periphyton workshop, the All-States meeting in Dallas and the Southeastern Plains Instream Nutrient and Biological Response Study (SPINBRS).

EPA's review of your Revised Plan was coordinated between the Regional Nutrient Coordinators, the Regional Nutrient Task Force, the Science and Ecosystem Support Division and the Water Quality Standards State Coordinator assigned to your state. Based upon our review, we believe this Revised Plan describes a reasonable process by which the State can develop appropriate protective numeric nutrient criteria for adoption into State water quality standards; and that completion of this process by the target dates indicated in the Revised Plan should provide increased protection of state waters from the effects of nutrient over-enrichment. For your consideration, we have enclosed our September 20, 2006, comments on the original plan that may continue to be useful in the further refinement and implementation of your Revised Plan.

At the end of December, 2006 (and annually thereafter), EPA will use the Revised Plan to evaluate the State's progress and determine whether or not the State is likely to complete numeric nutrient criteria development and adoption within the agreed

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upon time frames. If the State has not met the milestones as scheduled, EPA will evaluate whether a federal promulgation would be appropriate. At that time, the Administrator may determine that new or revised standards are necessary to meet the requirements of the Clean Water Act (CWA), and choose to promulgate water quality criteria for nutrients applicable to surface waters within North Carolina in accordance with Section 303 of the CWA. However, the Revised Plan submitted by NCDENR and agreed to here makes this possibility unlikely. EPA will make every effort to assist the State in developing nutrient criteria in a manner consistent with your Revised Plan. We expect the continued cooperation and communication between the State and EPA to lead to scientifically defensible and protective nutrient criteria for the State's waters.

By this agreement, EPA is acknowledging that this Revised Plan reflects a reasonable course of action by which the State can proceed to develop numeric nutrient criteria; but this agreement does not, nor should it in anyway be interpreted to constitute an approval, or conditional approval of State water quality standards. EPA's agreement at this time does not reflect an in-depth review or a judgement that the resulting criteria will, or will not be protective, or otherwise consistent with the CWA.

According to the time-line projected in your Revised Plan, we will expect you to submit numeric water quality standards for nutrients for associated waterbody types to EPA for approval during the respective Triennial Review. In the interim, we request that the State provide updates to EPA to document progress according to the Revised Plan through the established State review process. In the event that the Revised Plan needs to be modified again, changes can be made with mutual agreement, and EPA will update this letter to document our agreement with the revisions.

We applaud the State for making such a significant commitment of time and resources toward completion of this Revised Plan and appreciate your efforts to prepare and submit it in a timely manner. We look forward to future collaboration and NCDENR's productive contributions to the Region 4 nutrient criteria development effort.

If you have any questions now, or in the future, regarding this matter, please feel free to contact the North Carolina Water Quality Standards Coordinator on my staff, Lisa Perras Gordon at 404-562-9317.

Sincerely yours,



James D. Giattina
Director, Water Management Division

Enclosure

cc: Connie Brower, NCDWQ

Review of North Carolina's Nutrient Plan for Mutual Agreement
Environmental Protection Agency Comments
September 2004

By letter dated, June 1, 2004, North Carolina Division of Water Quality (DWQ) provided a revised Nutrient Criteria Implementation Plan (Plan) for mutual agreement with the U.S. Environmental Protection Agency (EPA). North Carolina's Plan consists of the existing Nutrient Criteria Management Strategy (Attachment 1) and a proposed approach for "Phase 2" Nutrient Control Strategy. EPA's review incorporates both portions of the strategy and views them in their entirety working together to create an overall nutrient management strategy for the State. EPA provides the following comments and thoughts which may be helpful in the further refinement of the Plan and development of nutrient water quality standards.

General Comments

- North Carolina's existing Nutrient Criteria Management Strategy, which has been in place since the mid-90s, includes many of the provisions of a successful approach to nutrient control. Through this plan the State has implemented a state-wide program to monitor for nutrient "response variables" including chlorophyll *a*, dissolved oxygen and pH, in order to assess the State's waters for nutrient enrichment. The State has made substantial progress in evaluating and responding to significantly enriched water bodies and is to be commended for the actions taken to date, including the innovative use of the "Nutrient Sensitive Water" supplemental classification.
- The existing plan includes site-specific measures for responding to elevated response variables, including the use of legislatively mandated limits on the discharge of nitrogen and phosphorus into waters designated as "Nutrient Sensitive Waters." This mandated response links causal and response variables in a flexible and site-specific manner.
- "Phase 2" of the Plan provides the needed compliment to further enhance the State's response to nutrient overload. "Phase 2" includes the innovative process of identifying a threshold at which a water body is identified as nutrient enriched but not impaired. This innovative threshold determination will provide a way to evaluate State waters for potential enrichment due to nutrients and allow the State to react in a proactive manner to prevent the waters from becoming impaired.
- EPA acknowledges North Carolina's determination to not use water clarity as a response indicator at this time. EPA supports North Carolina's intention to further 'research and evaluate' this parameter and to include it as part of the Plan should a definable relationship between clarity and causal parameters be demonstrated.
- The State's "Phase 2" Nutrient Control Strategy includes the intention to develop new ambient criteria for chlorophyll *a*. The plan states that a scientific review may lead to outcomes including a growing season average, instantaneous maximums and frequency and distribution response criteria. EPA supports North Carolina's reevaluation and

encourages the State to include specific reference to frequency, duration and magnitude in the new criteria.

- EPA commends the State on its intention to utilize periphyton assessment in streams. We appreciate the difficulty of characterizing response to nutrients in flowing waters, and support the State's efforts to evaluate various parameters for quantification in periphyton assessment.
- The Plan indicates that the intention of developing the lower nutrient response level is to pro-actively take action once a water body has become "enriched" and work to prevent it from exceeding the numeric criterion and becoming impaired. EPA is concerned that the time frames under which the initial response is taken may be lengthy and may not be effective for preventing further degradation of the water body. North Carolina states that it will review available nutrient response criteria ambient data for a five-year window. Once a determination is made on that data that the water body is enriched, the State will, 1) request optimization of TN and TP removal studies for all major permittees, and 2) the Division will develop and implement a comprehensive, site-specific nutrient management strategy for all enriched waters. The State is encouraged to evaluate the length of time that it is anticipated that these actions may take. For example, is it reasonable to assume that after reviewing 5 years worth of data, it may take another 2 years to do optimization studies, more time for the full water body study and another year to implement the results?
- On page 8 of the plan, the state is still using the terms "impairment tier", which should be changed to "category".

Cross Program Coordination

Development and implementation of North Carolina's Nutrient Plan is structured such that there is a strong cross-program involvement with both the State's monitoring and National Pollutant Discharge Elimination System (NPDES) permitting program. The use of a single response variable places the burden for determining nutrient enrichment on the State's monitoring program. Once it is determined that a water body is enriched it will be the responsibility of the North Carolina permitting staff to contact dischargers and require that optimization studies be conducted. As the State moves forward with implementation of the Plan, we think it will be particularly important for North Carolina to work with related programs, and consequently EPA recommends the State integrate required actions into the guiding documents of those programs, such as the North Carolina Monitoring Strategy. The following comments primarily address recommendations for NPDES permitting and monitoring as it relates to the implementation of the Plan.

- In the section discussing the Nutrient Translator, the Plan states that North Carolina Department of Water Quality will require "optimization of TN and TP removal for major

dischargers to...water bodies identified as nutrient enriched." This is an initial response to nutrient enriched waters to be enacted while a comprehensive nutrient management strategy is developed. EPA recommends further defining how this will be accomplished. The State confirmed that this refers to major NPDES permittees and provided language that will be used to "require" major discharges to conduct the optimization study. North Carolina should include clear reference to the authority by which it will compel the facilities to comply, such as using the "reopener clause" of existing permits or a reasonable potential evaluation for new and renewing permits.

- Once newly optimized levels of N and P are determined for NPDES facilities, EPA recommends that the State clearly delineate how these will be implemented and under which state authority they are implemented. (The Plan states that the studies will be done, but there are no details regarding what happens after the study.) If they are to be placed into the permit as enforceable limits, we recommend the State define at what point this will be accomplished. For example, will they only be enacted once the permit comes up for renewal, or is there another vehicle by which these are implemented, such as a compliance schedule.
- North Carolina's June 1, 2004, letter states that, "(a)t this time, North Carolina would not require minor facilities to perform this study due to their minimal impact, individually, on the receiving water." EPA recommends that the data and information reviewed which led to that conclusion be more fully expanded. While it may be argued that individually each minor NPDES permittee may not have significant impact, they may have a significant cumulative impact when considered across an entire watershed and should not be eliminated from consideration. EPA encourages North Carolina to include minor facilities in this process.
- North Carolina should evaluate what, if any, increase of resources will be needed under the State's monitoring program to assess the State's waters for the response indicators. The State should ensure coordination between the Water Quality Standards and Monitoring programs so that the new guidelines and criteria are incorporated into the State's monitoring and Section 303(d) programs.

