Georgia's Plan for the Adoption of Water Quality Standards for Nutrients

Revision 2.0

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By

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Executive Summary

The U.S. Environmental Protection Agency (EPA) has published a National Strategy for the Development of Regional Nutrient Criteria. The strategy describes the approach the EPA will follow in developing information concerning the role of nutrients in waters, and how it will work with States to develop numeric nutrient criteria. The EPA's primary goal is to work with States to establish the necessary criteria to reduce nutrient over-enrichment of all of the nation's waters. Nutrient over-enrichment is defined as the accumulation of nutrients from human activities and natural sources that impairs the beneficial uses of a waterbody.

The EPA recognizes that each state will have its own solution to deal with nutrient issues. On March 16, 2011, EPA developed a framework of key elements that state programs should incorporate to maximize progress toward the development of numeric nutrient criteria. The following "Recommended Elements of a State Nutrient Framework" are a guide to help the ongoing collaboration between EPA Regions and states in their effort to reduce nitrogen and phosphorus pollution.

1) Prioritize watersheds on a statewide basis for nitrogen and phosphorus loading reductions
2) Set reduction goals for each of the targeted watersheds
3) Ensure permits in these targeted watersheds are effective in reducing nutrient pollution
4) Work in partnership with the Agriculture sector in these targeted watersheds to reduce nonpoint sources of nutrient pollution
5) Use state/local tools to reduce nutrient pollution from stormwater and septic sources
6) Develop accountability and verification measures to ensure load reduction practices are in place
7) Establish and implement annual reporting on implementation activities
8) Develop a workplan and schedule for numeric nutrient criteria development

To address Element 8, the EPA has requested each State develop a strategy for adopting nutrient water quality standards. The EPA will review the plans and work with States in developing a plan that has the mutual agreement of the States and the EPA. The EPA expects to use the mutually agreed upon plan to evaluate a State's progress towards the goal of developing and adopting nutrient standards that protect waters from the adverse effects of nutrient over-enrichment. This document presents Georgia's plan for developing and adopting nutrient standards.

Nutrient Management History

The Georgia Board of Natural Resources was authorized, through the *Rules and Regulations for Water Quality Control* promulgated under the Georgia Water Quality Control Act of 1964, to establish water use classifications and water quality standards for the waters of the State. The Georgia Water Quality Control Board first established water use classifications and water quality standards for intrastate waters in 1967. The water use classification system was applied to interstate waters in 1972. For each water use classification, water quality standards were developed creating a framework to be used by the Water Quality Control Board, and later the Environmental Protection Division (GA EPD), in making regulatory decisions.

In the latter 1960's and 1970's, water quality impairment was a significant problem in Georgia that involved poorly treated wastewater containing oxygen-demanding materials and excess

nutrients. Significant improvements in wastewater treatment implemented over the years have dramatically improved water quality in the State. These improvements included the reduction of nutrient loadings to many lakes, rivers, and streams across the State.

Georgia implemented additional nutrient control strategies in the 1990s. In 1990, the Georgia General Assembly adopted legislation for a statewide ban on high phosphate detergents. The General Assembly also passed legislation in 1990 to require comprehensive studies of major publicly owned lakes and development of lake-specific water quality standards. GA EPD completed studies and developed lake-specific water quality standards for six major publicly owned lakes that the State of Georgia has adopted as supplemental lake water quality standards into its *Rules and Regulations for Water Quality Control*. The standards consist of lake-specific numeric criteria for chlorophyll *a*, total phosphorus, total nitrogen, dissolved oxygen, pH, water temperature, and fecal coliform bacteria. In addition to developing and adopting the numeric criteria, GA EPD has implemented a program for monitoring and assessing compliance with the supplemental water quality standards.

Historically, Georgia has generally addressed nutrient issues on a site-specific basis in response to documented water quality impairment. Numeric nutrient criteria are a comprehensive approach to protect the highest attainable use of the waterbody and do not require a narrative violation before restoration actions are taken. The implementation of the supplemental lake water quality standards for the six major publicly owned lakes has led to nutrient control strategies in their respective watersheds. Georgia has also been proactive in managing nutrients discharged from permitted surface water discharges to potentially nutrient sensitive waters. Such measures include an aggressive total phosphorus permitting strategy (please see Appendix A for a copy) consisting of total phosphorus effluent limitations, as well as the implementation of total phosphorus and ortho-phosphorus monitoring and reporting. This strategy addresses not only permitted discharges in targeted watersheds (Element 3 of the Stoner memo), but also permitted discharges throughout the State. As a result of these nutrient control reductions and strategies, phosphorous levels have decreased over the decades in Georgia's streams/rivers and total nitrogen levels have generally remained level (please see Appendix B). These results indicate GA EPD is taking the right steps towards reducing nutrient pollution, and as part of these steps, GA EPD is developing and will adopt numeric nutrient criteria for the waters of the State.

Conceptual Approach to Nutrient Criteria Development

The development of nutrient criteria and adoption of nutrient standards for waters of the State will present difficult and complex challenges having profound effects on the assessment and management of water quality in Georgia. The precise cause and effect relationships of nutrients in the water environment are not well quantified; the methods for determining a waterbody's nutrient assimilative capacity are not well developed; and the impacts to designated uses are difficult to quantify. Therefore, the strategy for nutrient criteria development must be flexible and adaptable in order to accommodate the criteria development process and regulatory decisions that will be made in the evaluation of evolving nutrient information. The strategy must also be well conceived and produce scientifically defensible standards that are carefully implemented in order to protect the State's waters from nutrient over-enrichment. In addition, the strategy should not create an unnecessary water quality management burden for Georgia.

Key elements of the strategy include developing an inventory of all state waters, characterizing the various waterbodies, determining water quality parameters to be used as criteria, developing the technical approaches to be used to select criteria, and coming to a mutual consensus with the EPA on the methods for assessing waters for compliance. The approaches that will be used to inventory State waters include reviewing available GIS coverage's and where appropriate conducting focused validation of new water supply reservoirs. The GIS coverage's to be

reviewed include National Hydrography Dataset (NHD), 2006 National Land Cover Dataset (NLCD), Ecoregion Level III or IV, populated places, NPDES point sources, LAS, CAFOs, and landfills. This information will help characterize waters and assist in prioritizing them. The development and adoption of rules for nutrient criteria will be an ongoing endeavor of the GA EPD for a number of years.

To maximize manpower and resources, the plan will be implemented in a phased approach. The nutrient criteria development process will begin with large public lakes because they have the greatest human exposure as they are used for public drinking water supplies and for recreation and fishing. As Georgia works through refining the nutrient criteria for the large public lakes, other waterbody types will be phased into the process. This phased approach will allow the State to move forward in a timely manner and learn as the process proceeds. During this process, the plan will be updated and modified to reflect new information and circumstances that may affect the plan. The sequence in which nutrient criteria will be developed for waterbody types is large lakes (>500 acres), minor lakes that will be defined in the future, wadeable streams, non-wadeable streams, estuaries, and wetlands.

Waterbody Types

To accommodate the various waterbody types, the waters of the State will be divided into four groups: lakes and reservoirs, streams and rivers, estuaries and coastal marine waters, and wetlands. GA EPD intends to develop nutrient criteria for lakes and reservoirs, streams and rivers, and estuaries and coastal marine waters. GA EPD will address wetlands last since the EPA did not develop the guidance for developing nutrient criteria for wetlands until September 2007. Each waterbody type may be further subdivided into categories, as appropriate, based primarily on distinguishing characteristics that are shown to affect nutrient conditions.

To distinguish between waterbodies in the variety of chemical and biological environments throughout the State, nutrient criteria will be developed according to either Georgia's Level III or IV Ecoregions or some aggregation thereof. The Ecoregions will provide a spatial and geographic framework for criteria development and may be accompanied by secondary frameworks such as river basins.

Water Quality Parameters and Criteria

Water quality parameters related to both the causes of and responses to nutrient over-enrichment will be investigated for use in nutrient criteria. It is anticipated that the causal parameters, such as total nitrogen and total phosphorus, will be investigated for all waterbody types, while response parameters such as algae, periphyton, zooplankton, macroinvertebrates, turbidity, transparency (Secchi disk), and dissolved oxygen will be investigated according to the appropriate waterbody type. For instance, chlorophyll *a* concentration, an indicator of algal biomass, will be a probable response criterion for lakes and reservoirs, and possibly estuaries. GA EPD's intent will be to consider the use of response parameters in conjunction with causal parameters as nutrient criteria. The nutrient criteria strategy needs to be adaptable in order to incorporate the increased understanding resulting from new information and data collection. It is possible that the inclusion of additional parameters could be phased into criteria as new data, information, and relationships are developed. This will be necessary since the majority of existing water quality data and current monitoring programs have focused on causal parameters and not response parameters.

During the implementation of the strategy, not only will the choice of parameters and criteria be decided, but also what type of structure the nutrient water quality standard will have. For example, one structure may be to have a single criterion for a given waterbody type in a given ecoregion. Another would be to have an action level approach in which there would be criteria

effective for Clean Water Act purposes, as well as action level(s) for triggering other management activities to avoid future impairment (i.e. nutrient sensitive water). GA EPD will work closely with the regulated community and the EPA to ensure that the criteria selected will be effective for all purposes under the Clean Water Act including permitting, 303(d) listing, and TMDL development.

Equally important is the development of nutrient criteria and the conditions in which they apply. This is particularly necessary when determining whether a waterbody is impaired and in developing waste load allocations for surface water discharges and Total Maximum Daily Loads (TMDLs). For instance, should criteria be normalized for stream flow conditions, or should the criteria duration be a select period of the year such as the growing season. In addition to the magnitude of the criteria, other important factors to consider are the frequency and duration of the criteria, as well as the minimum number of samples needed to assess the standard. Identifying the conditions in which the criteria are assessed has a significant role in deciding whether a particular waterbody should be identified as impaired or not and what regulatory actions will be taken to protect a waterbody. GA EPD expects to incorporate these factors into the water quality nutrient criteria or its implementation (i.e., assessment, TMDL development, and/or permitting).

Technical Approach

The strategy to develop nutrient criteria will employ a phased technical approach in order to benefit from new information, data, and knowledge that will be gained over the course of criteria development, and to facilitate criteria refinement. Initially, the technical approach for developing nutrient criteria for each waterbody type will be based on existing and new water quality data collected at sites within Georgia. Water quality data from neighboring states with similar ecoregions, particularly data for minimally impaired reference sites, will be used where appropriate.

The criteria development process will begin with an evaluation of the adequacy of existing data for the development of nutrient criteria for each waterbody type and ecoregion. Much of Georgia's water quality data is maintained in the Water Resource Database (WRDB). This database will be data mined for both nutrient and response parameters.

With implementation of the River Basin approach to wastewater point-source sampling in the early 1990s, a group of parameters collectively termed "Nutrient Series" was defined. All point sources sampled since that time have included analyses of the Nutrient Series parameter suite. The parameters that constitute a Nutrient Series include ammonia-nitrogen, Total Kjeldahl Nitrogen (TKN), nitrate/nitrite, and total phosphorous. The nutrient data collected by GA EPD's Facilities Monitoring Unit (FMU) from point source dischargers including major municipal, minor municipal and industrial discharges will be retrieved from the EPD Water Quality Laboratory for calendar years 2005 through the present. These facilities are distributed geographically throughout the State and the data from these facilities will be analyzed in conjunction with the in-stream data.

In addition, communities in Georgia with wastewater treatment facilities that are new, expanding, or greater than 1 million gallons per day (MGD) are required to conduct a Watershed Assessment. Watershed Assessments require chemical and biological water quality monitoring. These efforts provide data on in-stream nutrients, habitat, and macroinvertebrate and fish communities. Results from these studies will assist in evaluating the effects of nutrients on aquatic life and will be used in developing nutrient criteria that are protective of all of Georgia's designated uses.

Where data are insufficient, additional data collection programs will be developed and implemented according to available staff and financial resources. The GA EPD will continue to take advantage of available grants, funding, and assistance from federal, state, and local agencies, as well as other interested stakeholders. Where possible, the GA EPD will partner with the EPA for technical assistance to accelerate the development of nutrient criteria in Georgia. Technical assistance that the EPA could provide GA EPD includes assistance in determining the cause and response relationship for various waterbody types, assistance in determining the most effective means of measuring the response, assistance with appropriate statistical analysis, and training of personnel in correct field procedures. In addition, the EPA could provide GA EPD with additional financial support. The technical approach will need to be refined during the development of criteria to accommodate available resources and new data and information. When and where data are considered to be sufficient for initial criteria development, two types of analytical methods will be employed to screen preliminary criteria. One method will apply a statistical analysis to the entire water quality data set for all waters of a given waterbody type, ecoregion, and applicable category. The second method will apply a similar statistical analysis method to a subset of these waters considered to be minimally impacted or reference waters. Results from these analyses will be compared for the purposes of assessing preliminary numeric criteria. In addition, these preliminary results will be refined with further statistical analyses with the goal of linking the criteria to a biological response.

Various statistical analyses will be performed. The goal for each waterbody type is to statistically link causal variables with biological response variables to establish nutrient criteria. To ensure multiple lines of evidence support an appropriate nutrient level, a statistical distribution of the data will also be performed. When one parameter is analyzed, such as total phosphorus in various ecoregions and/or waterbody types, the mean, standard deviation, and various percentiles (5^{th} percentile, 25^{th} percentile, 75^{th} percentile, and 95th percentile) will be determined. When multiple parameters are analyzed, such as nutrient levels and biological responses, multivariate and/or regression statistical analyses will be performed. However, this data analysis technical approach may not describe the underlying cause and response relationships and other influencing factors that characterize nutrient over-enrichment. In addition, it does not address the potential nutrient assimilative capacity of a specific waterbody. Therefore, the data analysis approach will be supplemented, where needed, by a waterbody specific and biological effects based approach for waterbodies where water quality issues justify and investigative resources can support such an evaluation. GA EPD will consider the use of biological indicators in assessment before any water quality criteria is implemented for listing purposes.

In addition, as part of the State Water Plan Resource Assessments, GA EPD will develop water quality modeling tools that can be used to evaluate the cause and response relationships in waters. The purpose of the State Water Plan is to develop Regional Water Plans to guide each region in managing its water resources in a sustainable manner. This means not only planning for growth, but also maintaining the ecological and biological health of the State's rivers, lakes and estuaries, as well as protecting state water quality standards.

Water quality models will be developed for selected streams, rivers, watersheds, lakes and estuaries throughout the State of Georgia to determine the available assimilative capacity in these waters. The assimilative capacity results evaluation will focus on dissolved oxygen, nutrients (nitrogen and phosphorus), and chlorophyll *a*. Watershed and lake models will be developed for the Chattahoochee, Flint, Coosa, Lower Savannah, Upper Ocmulgee, and Upper Oconee River Basins, and a watershed and estuary model will be developed for the Satilla River Basin. The development of these watershed and lake models that cover a major portion of the State will further aid in nutrient criteria development in these basins. For example, nutrient loadings can be determined for watershed rivers/streams based on protecting the biological health of downstream lakes and estuaries.

The convergence of professional ideas and experiences will be an important component for nutrient criteria development in Georgia. With the State's varying geography, we recognize the importance of bringing to the table professionals with knowledge and data representative of their agency's historical monitoring efforts with all types of waters. The GA EPD intends to collaborate with these professionals by developing a Technical Planning Group consisting of representatives from GADNR's Environmental Protection Division, Wildlife Resources Division, and Coastal Resources Division; the Georgia Water Environment Federation (GWEF); and the Georgia Association of Water Professionals (GAWP). In addition, technical advisors representing local academia, agriculture, and industry will be invited to participate in the Technical Planning Group. The GA EPD will retain the lead in coordinating all planning, data collection, assessment, and decision making activities so that criteria development stays on schedule for all waterbody types. In addition, GA EPD personnel will continue to attend and participate in nutrient criteria workshops and conferences.

Milestones and Products

The following milestones and products will result from the work performed to develop nutrient criteria for the various waterbodies:

- Develop an inventory and spatial database (Complete).
- Develop a nutrient water quality database (Complete).
- Analyze existing data (Complete).
- Identify data gaps (Ongoing).
- Develop and implement a study plan to collect needed data (Ongoing).
- Develop water quality models that can be used to evaluate the causal response relationship (Ongoing).
- Evaluate nutrient impacts on designated uses and related water quality parameters (Ongoing).
- Relate potential numeric criteria to response parameters where possible (Ongoing).
- Develop nutrient criteria technical support documents describing the derivation and proposed implementation of nutrient criteria including methodology for assessment of violations and determination of waterbody impairment (Incomplete).
- Propose nutrient criteria using existing data where appropriate (Incomplete).
- Adopt nutrient standards (Incomplete).

Adoption Process

Draft nutrient criteria will be proposed for adoption into *Georgia's Rules and Regulations for Water Quality Control*. It is anticipated that the nutrient standard adoption process will proceed in phases over time. The process of adoption will involve public notification of the proposed standards, public hearings, and a public comment period before submittal for adoption by the Georgia Board of Natural Resources.

Schedule

There are many factors that will affect the schedule for adopting nutrient standards. These factors primarily involve the need for additional data and information, which is contingent upon funding and staff resources, and the time required to develop scientifically defensible criteria from the data. Georgia's goal for continuing to adopt nutrient standards into its *Rules and Regulations for Water Quality Control* is 2014 when Georgia intends to propose standards for Lake Oconee and Lake Sinclair. By this time GA EPD may have sufficient data and calibrated models to perform the necessary analyses to propose scientifically defensible standards for

selected nutrient parameters. Scientifically defensible nutrient standards for other waterbodies will be proposed after additional data collection and analyses.

GA EPD initiated implementation of this plan in 2004 with the inclusion of nutrient monitoring in its ambient water quality monitoring plan for 2005. Additional development of the framework and supporting information necessary to implement the nutrient criteria plan continued in 2006 and beyond, as staff and financial resources allowed. In 2006, GA EPD began biological monitoring of periphyton in selected rivers and streams. Starting in 2008, GA EPD began monitoring the basin lakes monthly during the growing season starting with Banks Lake in the Suwannee River Basin. Each year a new basin group has been added to the annual monitoring schedule. In 2009, zooplankton sampling was added to the routine chlorophyll *a* sampling in our standard lakes. In 2010, GA EPD began sampling chlorophyll *a* in several of the State's estuaries. In 2011, GA EPD began collecting data on the physical characteristics and biotic integrity of wetland systems in Georgia as part of several wetland grants. GA EPD's intent is to evaluate whether there is a causal response relationship between these biological indicators and nutrient levels to aid in criteria development. A schedule of milestones and products is outlined later in this document.

GA EPD has hired six additional monitoring staff, to bring the total staff to 18. The monitoring staff has been relocated to several GA EPD district offices including Cartersville, Tifton, Brunswick and Atlanta. With staff located in northwest, southwest, southeast, and central Georgia, this allowed GA EPD to move from a basin rotation monitoring cycle to an annual state-wide monitoring program. However, GA EPD still has the need for additional monitoring staff in east central Georgia in order to cover the entire state (i.e., Savannah basin lakes), which is dependent upon sustained state funding sources. Based on this information, the GA EPD will maximize the use of EPA funding opportunities to further Georgia's goal of establishing nutrient criteria for State waters. The ultimate schedule for adopting nutrient criteria for all waterbody types will be dependent on the available resources to collect and analyze data, develop scientifically defensible numeric nutrient criteria, and coordinate and complete the water quality standards adoption process.

Nutrient Criteria Development by Waterbody Type

The primary category for developing nutrient criteria will be waterbody types. For this purpose the waters of the State will be placed into four categories including lakes and reservoirs, streams and rivers, estuarine and coastal waters, and wetlands. These waterbody types are consistent with guidance provided by the EPA for nutrient criteria development. Because of the diverse characteristics of waters within each waterbody type, it will be necessary to further subdivide these waterbody types into categories according to distinguishing characteristics that are shown to affect nutrient related conditions or based on different approaches for developing criteria. These categories may include ecoregion, watershed, or other physical, chemical, or biological characteristics. The following sections describe the strategy for developing nutrient criteria according to waterbody types.

Waterbody types will be grouped according to ecoregions in order to provide a spatial or geographic component to the framework for nutrient criteria development. GA EPD will use primarily the Level III Ecoregion boundaries identified within the State in order to group waterbody types for numeric nutrient criteria. In some cases, criteria may be similar for different ecoregions, however, the Level III Ecoregion identification will be maintained, but could involve further refinement (i.e., Level IV Ecoregions) to define criteria boundaries.

In general, GA EPD will consider three potential phases of nutrient criteria development for each waterbody type. A first phase of criteria development will be to determine general nutrient criteria representing an acknowledged level of impairment that would apply to waterbody types

in an ecoregion. For instance, a maximum chlorophyll *a* concentration for all lakes and reservoirs in an ecoregion may be considered. A second phase of criteria development may be implemented when more data and information becomes available to support refined nutrient criteria according to waterbody type categories, such as wadeable and non-wadeable streams. A third phase may be used for developing site-specific criteria that addresses existing impaired waters, nutrient sensitive waters, and other waters with qualifying circumstances.

Lakes and Reservoirs

There are thousands of impounded waterbodies in Georgia that range in size from small ponds with surface areas of a few acres to reservoirs with surface areas of 100 square miles, and all sizes in between. Except for a few Carolina Bays and hydrological isolated oxbows in the coastal plain, the lakes in Georgia are not natural and have been formed by damming streams and rivers. This is where their similarity ends and their differences begin. Therefore, lakes and reservoirs may need to be subdivided into categories according to their physical characteristics in order to assign nutrient criteria that are appropriate.

GA EPD has maintained a monitoring program for Georgia's public lakes for many years. In the late 1960's, lake water quality studies were conducted on Lake Sidney Lanier and Jackson Lake. Also at that time a comprehensive statewide study was conducted to assess fecal coliform bacteria levels at public beaches on major lakes in Georgia as the basis for water use classifications and establishment of water quality standards for recreational waters. In 1972, GA EPD staff participated in the EPA National Eutrophication Survey that included fourteen lakes in Georgia. Additional lake monitoring continued through the 1970s. The objectives of these studies were primarily to identify and solve problems, and the results served as the basis for regulatory decisions. Georgia's water quality monitoring network collected long-term data from sites in four major lakes including Lake Sidney Lanier, West Point Lake, Lake Harding, and Jackson Lake.

During 1980-1981, the GA EPD conducted a statewide survey of public access lakes. The study was funded in part by the EPA Clean Lakes Program funds. The survey objectives were to identify lakes with public access, assess each lake's trophic condition, and develop a priority listing of lakes needing restoration and/or protection. In the course of the survey, data and information were collected on 175 lakes. The lake data collected included depth profiles for dissolved oxygen, temperature, turbidity, pH, specific conductance, Secchi transparency, and chemical analyses for chlorophyll *a*, total phosphorus, and nitrogen compounds. The three measures of Carlson's Trophic State Index are calculated for each lake and combined into a single trophic state index (TTSI), which are used with other field data and observations in assessing the trophic condition and to categorize lakes needing restoration and/or protection. Monitoring efforts have continued since the 1980-1981 Lake Classification Survey with a focus on lakes needing restoration and protection as well as major public lakes (those with a surface area greater than 500 acres). The monitoring of major lakes (> 500 acres) since 1984 has continued to use the TTSI as a tool to measure trophic state trends.

Initially, monitoring of major lakes was a part of Georgia's rotating river basin management process, in which the major lakes in a river basin are monitored once every five years. In addition to monitoring for the required parameters of chlorophyll *a*, pH, total nitrogen, phosphorus and fecal coliform bacteria, water quality profile data are collected at each lake monitoring site.

Georgia has developed and implemented water quality standards for selected publicly owned reservoirs for several years. Therefore, the nutrient criteria development strategy for lakes and reservoirs will incorporate Georgia's existing supplemental water quality standards for lakes. The Georgia General Assembly passed a Senate Bill (O.C.G.A 12-5-23.1) in 1990, known as

the Lake Law, which required GA EPD to develop supplemental water quality standards for publicly owned lakes of 1,000 or greater acres.

The Lake Law required site-specific minimum water quality standard parameters that included:

- Chlorophyll *a* concentration
- Total phosphorus loading (in pounds/acre-foot/year)
- Total nitrogen concentration
- Dissolved oxygen concentration
- Water temperature
- pH
- Fecal coliform bacteria
- Total phosphorus loading from major lake tributaries

According to the Lake Law, the site-specific standards could only be developed after a comprehensive study of the lake had been performed, although no funding provision was included in the legislation. These lake studies were subsequently funded by the Clean Lakes Program. As a direct result of the Lake Law, the *Georgia Rules and Regulations for Water Quality Control* Chapter 391-3-6 includes numerical water quality standards for lakes and major lake tributaries in section 391-3-6-.03(16) for six lakes.

Publicly owned lakes having supplemental water quality standards and the year in which standards were adopted and implemented are listed below:

- West Point (1995)
- Jackson (1997)
- Walter F. George (1997)
- Sidney Lanier (2000)
- Allatoona (2000)
- Carters (2002)

GA EPD conducts an annual monitoring and assessment program to evaluate compliance with the water quality standards for these lakes. The program consists of monthly lake monitoring for the selected parameters during the April through October growing season, and monthly major lake tributary sampling for estimating annual total phosphorus loadings. In 2009, zooplankton sampling was added to the routine chlorophyll *a* sampling in the State's standard lakes. GA EPD is currently working on evaluating the relationship between zooplankton, chlorophyll *a*, and nutrient concentrations.

In 2008, GA EPD enhanced its monitoring program for major lakes currently without numeric criteria. GA EPD was able to do this due to funding from the Georgia Comprehensive State-Wide Water Management Plan, which resulted in the hiring of six new monitoring staff. A monthly monitoring program during the growing season was added for Banks Lake in the Suwannee River Basin. This lake will continue to be monitored annually over the growing season. Each year a new basin group is added to the annual monitoring schedule. In 2009, GA EPD began annual growing season monitoring of Lake Oconee, Lake Sinclair, Lake Juliette, Lake Tobesofkee, and High Falls Lake in the Oconee and Ocmulgee River Basins. In 2010, annual monitoring of Lake Seminole, Lake Blackshear, Lakes Chehaw/Worth, Lake Andrews, Lake Oliver, Goat Rock Lake, and Harding Lake in the Flint and Chattahoochee River Basins began. In 2011, GA EPD staff began annual monitoring of Lake Blue Ridge, Lake Nottely, and Lake Chatuge in the Tennessee River Basin. This monitoring is being done in an effort to expand the water quality database and information for the public access lakes that were previously only sampled quarterly on a five-year river basin rotation. Annual monitoring of the

remaining lakes currently without numeric nutrient criteria will be added as additional personnel are hired. Table 1 lists the basin lakes and the year annual monitoring began.

Table 1. Major Lakes Monitoring Program (lakes currently without numeric nutrient criteria)

Andrews (2010)	Harding (2010)	Rabun (2013)*
Banks (2008)	Hartwell (2013)*	Seminole (2010)
Blackshear (2010)	High Falls (2009)	Sinclair (2009)
Blue Ridge (2011)	Juliette (2009)	Tobesofkee (2009)
Burton (2013)*	Nottely (2011)	Tugalo (2013)*
Chatuge (2011)	Oconee (2009)	Worth (2010)
Clarks Hill/Thurmond (2013)*	Oliver (2010)	
Goat Rock (2010)	Russell (2013)*	

* Monitoring on these Lakes is contingent upon hiring of additional staff

Several of the State's major lakes (Allatoona, Lanier, Carters and Walter F George) have been placed on Georgia's 305(b)/303(d) List of Waters resulting in the need for the development of Total Maximum Daily Loads (TMDLs). The listing of these lakes has resulted in GA EPD prioritizing these lakes' watersheds as outlined in Element 1 of the Stoner memo for nitrogen and phosphorus load reductions. The GA EPD has shifted a significant amount of its monitoring resources of the State's major lakes to collect data to develop, calibrate, and validate water quality models for TMDL development as a result of the intensive watershed tributary and lake data needed to develop TMDLs for chlorophyll *a*. The models that will be used in the TMDL development process are:

- Loading Simulation Program in C++ (LSPC) for watersheds
- Environmental Fluid Dynamics Code (EFDC) for lakes

The lakes where intensive watershed monitoring has taken place to date include: Lake Allatoona where the Lake Allatoona/Upper Etowah Watershed Partnership began collecting data in 2005; Lake Weiss and the Coosa River Modeling Project where GA EPD conducted intensive field work in 2005 and 2006; Lake Lanier where GA EPD and the EPA conducted detailed monitoring in 2007; Carters Lake where GA EPD and the EPA conducted monitoring in 2008; W. F. George where a variety of data was collected by USGS, GA EPD, ADEM and the EPA in 2008; and Lake Sinclair and Lake Oconee where intensive monitoring was conducted by GA EPD in 2009. The intensive data collection efforts included:

- Watershed flow data - the data from continuous USGS flow gages in the watershed will be used either directly as model input to the lake model or to calibrate the watershed model. GA EPD will also monitor flow and develop rating curves at additional locations in the watershed to determine a relationship between gauged and ungauged streams. The data will also be used in calibration of the LSPC watershed model.

- Watershed water quality sampling – discrete water quality samples will be collected twice a month from rivers and tributary streams in the watershed. These data will be used to calibrate the LSPC watershed model and will provide valuable information for assessing water quality in the areas. Samples will be analyzed for BOD5, TKN, NH3, NO2-NO3, total phosphorus, dissolved ortho-phosphate, and TOC and field measurements will include pH, DO, temperature, and specific conductivity.

- Lake water quality monitoring - in-lake data will be collected by the GA EPD at several standard monitoring sites and non-standard sites from the lake being studied. Vertical pH, DO, temperature, and specific conductivity profiles will be

measured. A depth composite water sample from the photic zone will be collected and analyzed for chlorophyll *a*, nutrient series (see above), and fecal coliform. In addition, the light penetration will be determined using a Li-Cor and the Secchi depth will be measured. These data will be used for water quality assessment and to calibrate the EFDC model.

- Continuous water quality monitoring – continuous water quality monitors will be installed and maintained in the lake for the duration of the growing season (April – October). The monitors will record DO, pH, temperature, specific conductivity, and depth at one-hour increments. These data will be used for the calibration of the WASP model for the lake.

- Wastewater treatment facility sampling and data collection – GA EPD will sample major dischargers into the watershed twice during the study period and minor dischargers once during the study period. This data will supplement data gathered from the self-monitoring reports provided by the dischargers.

- Special studies – additional special studies may be conducted by the EPA. Algal growth potential tests will be used to determine the limiting factor. SOD rates with nutrient flux will be measured in the field, as well as photosynthesis and respiration rates. This information is required for the EFDC model. Additional information, such as nutrient loads concentrated animal feeding operations (CAFOs), septic tanks, and wet weather events from various land uses, may also be incorporated in the models.

- Meteorological data – data will also be secured from available meteorological stations. Data will include barometric pressure, air temperature, relative humidity, dew point, rainfall, evaporation, wind speed, solar radiation, and cloud cover.

Based on the results of the lake and watershed modeling, GA EPD has found that several of the lakes need to have their chlorophyll *a* and nutrient criteria revised. Typically, the lake standards were developed based on two to three years of data. With over ten years of data that have been collected since the standards were adopted, there is a better understanding of the impact climatological conditions have on chlorophyll *a* levels and the seasonal changes that occur in these levels. Other factors, such as flow dynamics and contributions from urban, agricultural, forest, lake sediments, and point sources are also being evaluated to refine the lake standards. As a result, chlorophyll *a* and nutrient standards have been revised for Lake Allatoona, and are planned for Lake Lanier, Carters Lake, and West Point Lake.

Element 2 of the Stoner memo requires reduction goals for each of the targeted watersheds. In order to accomplish this, the proposed TMDLs for the Allatoona, Lanier, Carters, and Walter F. George watersheds need to be finalized. The watershed and lake models for the Upper Etowah River Basin and Lake Allatoona were developed and the TMDL for Lake Allatoona was publicly noticed in March 2012. The Lake Allatoona TMDL requires an 80% reduction in the urban load, a 40% reduction in the agricultural load, and a 50% reduction in failing septic tanks. The watershed and lake models for Lake Lanier are complete and once the chlorophyll *a* criteria for Lake Lanier are revised and adopted, the TMDL will be issued sometime in 2013. The TMDL will require an 80% reduction in the urban load, a 40% reduction in the agricultural load, and a 50% reduction in failing septic tanks. The watershed and lake models for Carter's Lake are complete, and once the chlorophyll *a* and nutrient criteria for Carters Lake are revised and adopted, the TMDL will be issued sometime in 2013. The TMDL will require a 40% reduction in the agricultural load. The watershed and lake models for Lake Walter F George are currently under development. Once these models are complete, which may support revising nutrient and chlorophyll *a* criteria, a TMDL will be developed, probably in 2014. All these TMDLs will be used to help develop nutrient reduction goals for these respective watersheds.

As described in Element 3 of the Stoner memo, all of these TMDLs require nutrient limits that are incorporated into the permits of facilities that discharge within these targeted watersheds. These permit limits will ensure effective reductions in nutrient pollution within the Allatoona, Lanier, Carters and Walter G. George watersheds. The TMDL wasteload allocations (WLAs) for the major permitted facilities in the Allatoona watershed require all facilities at future flows to meet a total phosphorus limit of 0.16 mg/L and will also set total annual nitrogen loads for each discharger. The Lake Lanier TMDL will require a load reduction from two point sources in the upper watershed and will require all major facilities in the Lanier watershed to meet total phosphorus limits of at least 0.13 mg/L. Until September 2011, point sources in the Carters Lake watershed were only required to monitor their effluent for total phosphorus. Currently, the major point sources in the Carters Lake watershed have permitted total phosphorus limits of 1 mg/L. This has resulted in a 90% reduction in the amount of total phosphorus discharged in the Carters Lake watershed. The nutrient limits that will need to be incorporated into the permits of the Walter F George watershed have not been determined yet.

Georgia is consistently among the top three states in the U.S. in terms of poultry operations and north Georgia is one of the most prevalent places for chicken farming. For this reason, as outlined in Element 4, GA EPD has partnered with the Georgia Poultry Federation and the University of Georgia to develop the methodology to model chicken landuse nutrient loading and develop the TMDLs in the targeted watersheds to address this source. GA EPD will continue to work with the Georgia Poultry Federation and the Poultry Integrators, as well as other agricultural groups, on the need to develop nutrient management plans and to reduce nutrient loads in the Allatoona, Lanier, and Carters Lake watersheds.

In 2009-2011, GA EPD worked on a State-wide Comprehensive Water Management Plan (State Water Plan). As part of the State Water Plan, GA EPD conducted a resource assessment of the surface water, ground water and assimilative capacity. The assimilative capacity resource assessment includes four work plans that involve developing watershed, lake, and estuary models to determine current and future assimilative capacity. Watershed models have been developed for the Chattahoochee River Basin from Buford Dam to Lake Seminole, the entire Flint River Basin, the Ocmulgee River Basin from the headwaters to Lake Jackson, the Oconee River Basin from the headwaters to Lakes Oconee and Sinclair, the Savannah River from Thurmond Dam to the Savannah Harbor, and the Coosa River Basin from Lake Allatoona and Carter's Lake to Lake Weiss. Lake models will be developed for West Point, W. F. George, Blackshear, Worth, Seminole, Jackson, Oconee and Sinclair. In addition, a watershed and estuary model was developed for the Brunswick Harbor. GA EPD is currently in the process of developing a Request for Qualifications (RFQ) to hire a contractor to develop watershed, lake and estuary models for the rest of Georgia. These various models will provide information that will be used to help develop nutrient standards for different waterbody types in Georgia Based on an analysis of these model results, the GA EPD also plans on identifying and targeting reductions in the subwatersheds with the highest nutrient loads as outlined in Element 1 of the Stoner memo.

The first task of the technical approach for developing criteria for lakes and reservoirs will be to assess the population of lakes and reservoirs in the State. A product of this task will be an inventory and spatial database of Georgia's lakes, with an emphasis on publicly owned lakes. The database will include data such as lake name (if available), surface area, volume, Level III or IV Ecoregion, and designated use classification. Lakes will be classified by size and nutrient criteria development will be prioritized based on this information.

Georgia has 60,000 lakes that cover over 580,000 acres. Approximately 60% of all lakes are less than two acres in size. Many of these are private farm ponds. Figure 1 shows the distribution of all the lakes in Georgia by size.

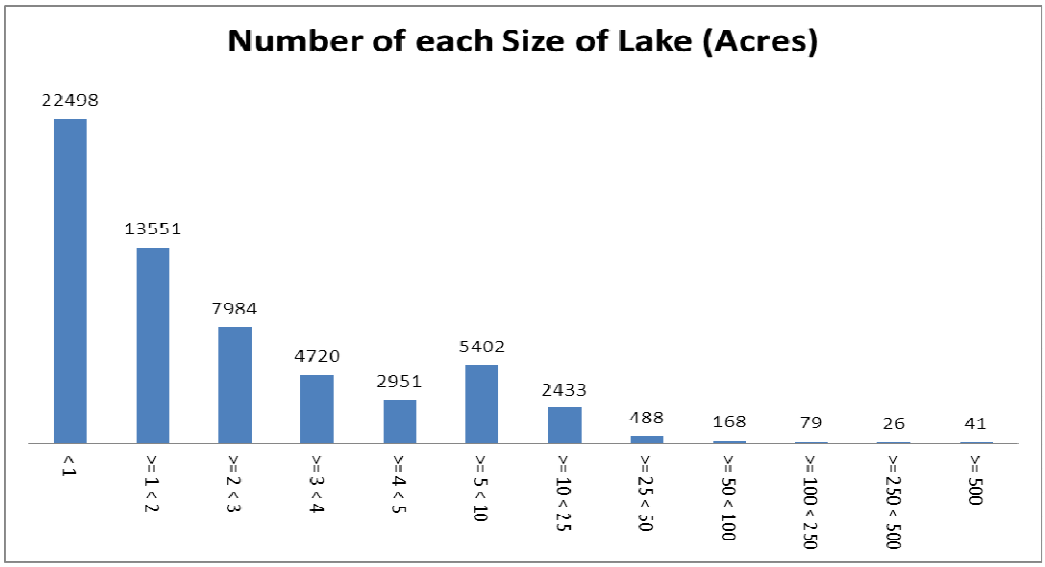


Figure 1. Number of the Various Lake Sizes

The standard lakes make up 20% of the total lake acreage. In addition, GA EPD monitors 22 large lakes that include most of the lakes greater than 500 acres and cover approximately 44% of the total lake acreage (see Figure 2). Lakes over 500 acres compose almost two thirds of the total lake acreage in Georgia.

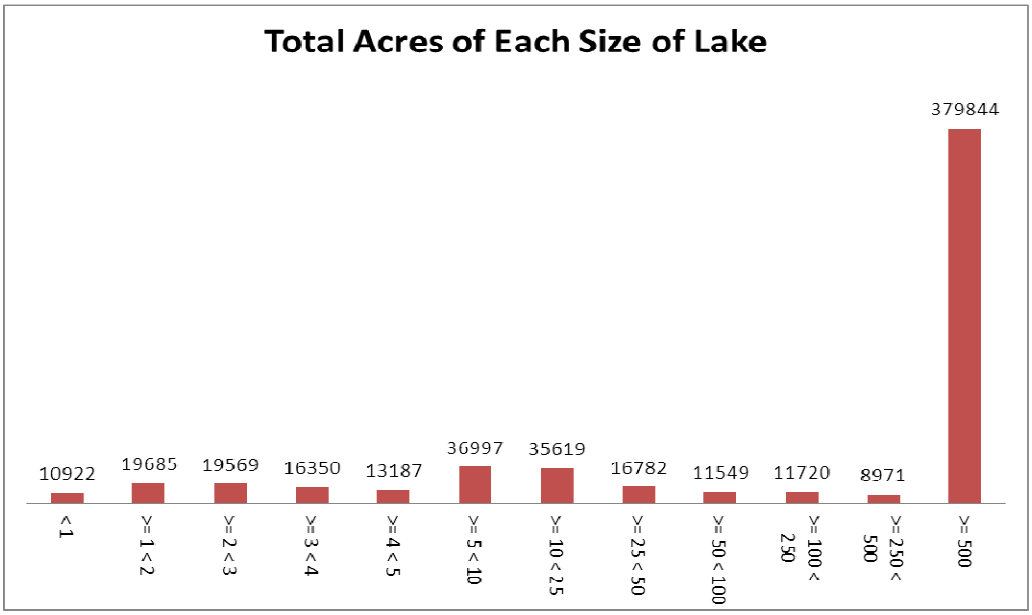


Figure 2. Total Acres of the Various Size Lakes

Existing available water quality data for lakes and reservoirs in the State will be obtained and maintained in the nutrient water quality database. Data sources other than the GA EPD will be investigated for inclusion in the nutrient water quality database. The State's primary data source for nutrient data for lakes and reservoirs will come from its Major Lakes Monitoring Program.

At this time, there are insufficient nutrient related water quality data to proceed with developing scientifically defensible numeric nutrient criteria for minor lakes and reservoirs in Georgia. Although there is on-going lake water quality monitoring programs, they include a limited number of lakes and reservoirs, and are limited to the larger lakes and reservoirs. Therefore, it is likely a new narrative nutrient criterion will be established for these minor lakes to support the designated uses. The threshold for what defines 'minor' lakes will be redefined in the future.

The water quality data collected will focus on nutrient causal parameters, phosphorus and nitrogen, as well as response parameters including chlorophyll *a*, turbidity (Secchi transparency) and dissolved oxygen. Other water quality parameter data and information will also be collected, if warranted, as part of the monitoring program, at a monthly frequency.

Based on past experience, a minimum of five years of data are needed in order to develop scientifically defensible numeric nutrient criteria that represent a variety of climatological and hydrological conditions, thereby reducing the need to revise these standards in the future. Additional data collection will be required if the climatological and hydrological conditions are not varied enough during the initial monitoring period to be representative of a range of conditions. Monitoring programs will also need to document biological community characteristics and responses to the varying nutrient conditions. A significant increase of both personnel and laboratory resources, beyond current levels of staffing and funding, will be required to conduct this comprehensive lakes monitoring program. GA EPD will continue to utilize funding opportunities offered through the EPA to support these efforts. GA EPD plans to use the watershed and lake models, along with the annual growing season average data, to develop nutrient standards for those lakes greater than 500 acres that currently do not have numeric nutrient criteria.

GA EPD plans to propose rules for numeric nutrient criteria for Lake Oconee and Lake Sinclair in 2014. Standards for the other lakes that are monitored given in Table 1, which are greater than 500 acres, will be established once the water quality watershed and lake models are developed, and there are sufficient data, as described above, that covers a variety of climatological conditions (see Figure 3).

Streams and Rivers

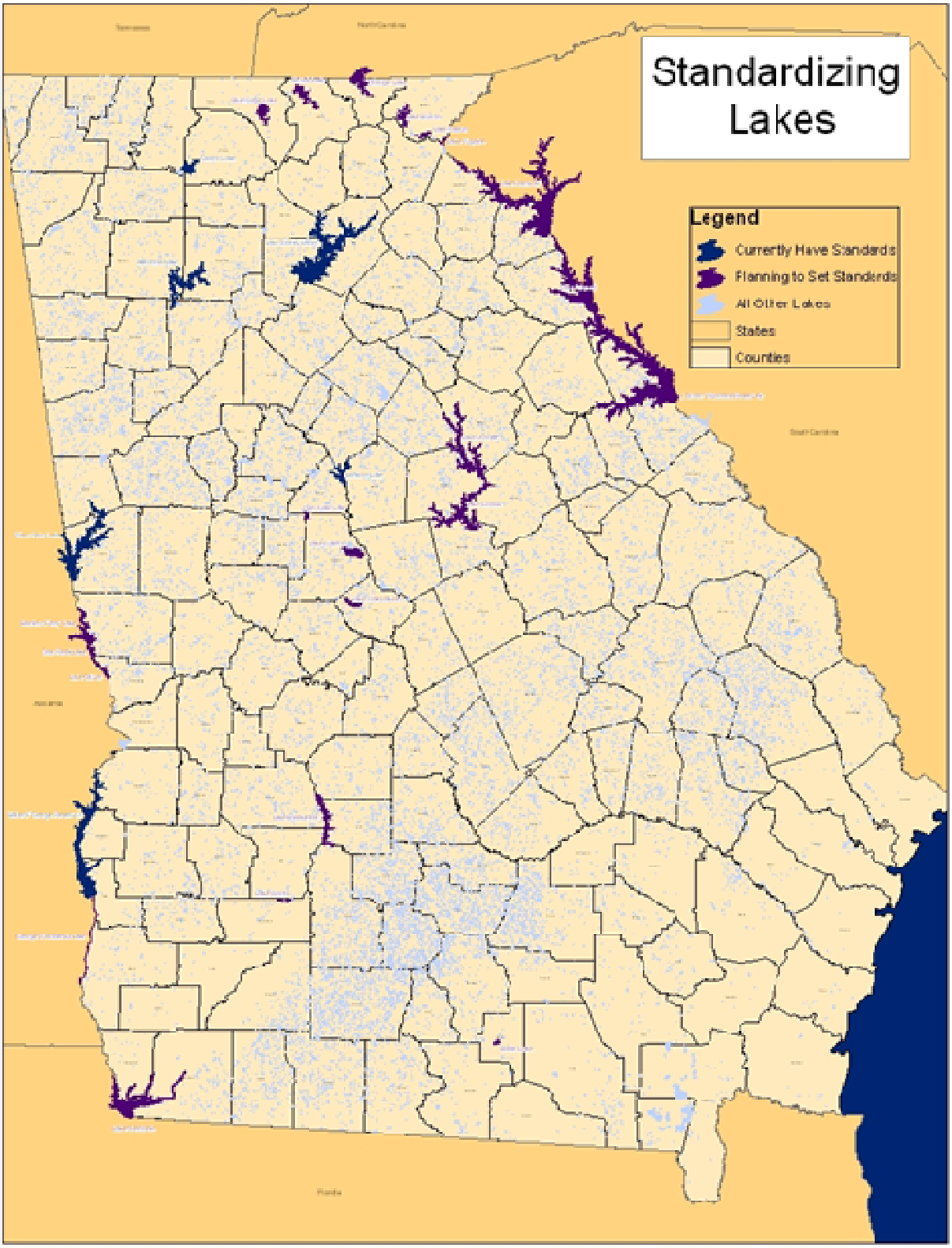
Georgia has narrative water quality standards referred to as General Criteria for all Waters in the *Georgia Rules and Regulations for Water Quality Control* that have been used to address nutrient related water quality issues in the past. This plan now provides for the development of nutrient criteria for streams and rivers in Georgia, although once numeric criteria are established for the causal (e.g., annual loading standards for TN and TP) and response parameters (e.g., chlorophyll a, DO) in the major lakes, the State will assess the need for numeric nutrient standards for the rivers and streams within each lake's watershed. In this assessment, GAEPD will consider the impact of planning activities (e.g., wasteloads, permits, TMDLs) within the watershed that will be managed to meet the lake criteria. Streams and rivers will initially be covered under a narrative criterion.

Streams and rivers are physically, chemically, and biologically different from lakes and reservoirs. They respond differently to environmental processes that affect their water quality characteristics. These differences and others may involve different parameter selection, data collection, and criteria development. Nutrient criteria for the causal parameters (total nitrogen and total phosphorus), as well as the response parameters (macroinvertebrate communities, fish population, algal biomass (chlorophyll *a* and periphyton) will be investigated.

Since it is not likely that nutrient characteristics, conditions, and responses will be the same for all streams within an ecoregion, it will be necessary to subdivide streams and rivers into groups

Figure 3. Major Lakes the GA EPD Plans to Develop Numeric Nutrient Criteria

when assigning nutrient criteria. Therefore, the first task for developing criteria for streams and rivers will be to assess the diversity of streams and rivers within each ecoregion. Possible



strategies would be to group streams and rivers according to stream order, wadeability, or watershed size. Such grouping would have to be supported by differences in the nutrient water quality data and resulting biological conditions.

There is a great deal of chemical water quality data available for nutrients in streams and rivers that have been collected as part of GA EPD's ambient water quality monitoring program, as well as other monitoring programs. The U.S. Geological Survey (USGS) has collected additional data as a result of their projects within the State. In addition, municipalities and counties throughout Georgia are collecting nutrient data as part of GA EPD's Watershed Assessment process. However, there is minimal biological community information for correlating ambient nutrient conditions to biological integrity. Available data sources will be identified, and the available data obtained, input, and maintained in the nutrient water quality database for use in analyses. Potential data and sources include fish data from the Wildlife Resource Division of the Georgia DNR, macroinvertebrate data from Columbus State University and GA EPD, periphyton data from GA EPD, and biological assessment data from Watershed Assessment projects.

GA EPD contracted with Columbus State University to conduct macroinvertebrate bioassessments for wadeable streams across Georgia from 2000 to 2005. Streams were selected as wadeable based on Strahler stream order and stream size. Fourth order streams were chosen as an appropriate size to study. In addition, large second and third order streams with a total stream length of more than eight kilometers, and small fifth order streams with stream lengths of less than eight kilometers were also included since they had roughly the same catchment area as most fourth order streams. Streams were classified as reference (least impacted) or impaired based upon the land use of each associated watershed (catchment). Land use data was analyzed using GIS to select least impacted catchments with the lowest human disturbed land uses. Possible reference candidates from all catchments that fit within a single classification based on size and ecoregion were then selected and ranked. The best-ranked sites were chosen as possible candidate reference sites. Streams were sampled for chemical, physical, and biological (macroinvertebrate) parameters. Multi-metric indices were also developed. Fifty-nine metrics applicable in Georgia that have a documented stress response were included in the analysis. Once the multi-metric indices were developed, a ranking system was established. The numerical rating system was developed based on a percentile method. The ratings offer a system of ranking for the purpose of prioritizing management activities. These data need to be incorporated into a database so they may be further assessed. The standard operating procedure for macroinvertebrate bioassessments was last updated in May 2007.

During the Columbus State University project, Georgia experienced a sustained drought from 1999 to 2003. As a result, many identified candidate reference streams, particularly those in the Coastal Plains ecoregion and other southeastern Georgia sub-ecoregions, were dry for two years or longer. Although it has been demonstrated that macroinvertebrates can recolonize a disturbed stream in a relatively short period of time, as little as 14 to 21 days, it was difficult to ascertain if these streams had attained a stable recovered community after such an extended drought. As a result, there is some uncertainty regarding the macroinvertebrate indices determined for these ecoregions. In 2006, GA EPD attempted to resample those sites that were dry or had minimal flow to verify the indices, however, drought conditions were still evident and many streams had little to no flow.

It is evident that separate multi-metric indices should be used for tidal and non-tidal streams. GA EPD is currently working toward determining if separate indices need to be developed for sub-ecoregions containing both black and clear water. GA EPD plans to update the macroinvertebrate indices for ecoregions that contain both tidal and non-tidal streams, clear and black waters, as well as those that were affected by the drought.

GA EPD has initiated periphyton bioassessments in wadeable streams. GA EPD participated in a joint bioassessment with Region 4 States and EPA Region 4 that enabled GA EPD to gain the necessary knowledge to develop a Standard Operating Procedure for Periphyton

Bioassessments. In 2007, GA EPD began biological monitoring of periphyton and macroinvertebrate in selected rivers and streams in conjunction with nutrient monitoring. GA EPD is currently working with Georgia College and State University to determine tolerance values for various diatom species based on nutrient levels. The relationship of macroinvertebrates and periphyton responses to nutrients concentrations will help in the development of appropriate nutrient criteria.

Currently, non-wadeable streams and rivers have not been assessed for macroinvertebrates, chlorophyll *a,* or periphyton. The steps toward developing nutrient criteria for non-wadeable streams and rivers may include creating an inventory, classifying streams based on size, and developing standard operating procedures for sampling of biological (macroinvertebrates and periphyton) parameters. GA EPD will develop nutrient criteria for non-wadeable streams and rivers when more training and guidance become available.

In the summer of 2010, GA EPD installed 12 continuous water quality monitors in the mainstems of the Oconee, Ocmulgee, and Altamaha Rivers at selected bridge crossings. The purpose of this study was to determine if these Rivers had large diurnal dissolved oxygen (DO) swings as a result of algae activity. Although this response was not evident at these sites, GA EPD plans to conduct similar studies in other large non-wadeable rivers to link this response to nutrient levels.

The watershed models that have been or will be developed for the lakes can also be used to help evaluate and develop stream and river nutrient criteria. These models include nutrient concentrations and loadings outputs for rivers and streams that can be used as the basis for protecting the biological health of downstream lakes.

Georgia has over 118,000 miles of rivers and streams. Over 14% of these streams (~17,500 miles) are upstream from the lakes that currently have numeric nutrient criteria and 27.5% of these streams (~32,500 miles) are upstream from lakes that GA EPD intends to establish numeric nutrient criteria in the future. Approximately 22% of Georgia stream are upstream of the estuaries (~26,200 miles) GA EPD monitors. There are another 15,000 miles or 12.6% of streams upstream of the remaining estuaries (Savannah Harbor, Ogeechee River - Ossabaw Sound, Doboy Sound, St Simons Sound, and Jekyll Sound). The total miles of streams that flow into Florida, Alabama, and Tennessee are approximately 11,900 miles (10%), 9,500 miles (8%), and 2,300 miles (2%), respectively. The total miles of streams that flow into are approximately Table 2 lists and Figure 4 shows the stream miles upstream from each of the major lakes, estuaries, and our neighboring states.

Table 2. Stream Miles Upstream from Major Lakes, Estuaries and Neighboring States

Water Body	Stream Miles	Percent of Total River Miles
West Point Lake	4,723	4.00%
Walter F. George Lake	3,817	3.23%
Lake Jackson	3,134	2.65%
Lake Lanier	2,236	1.89%
Lake Allatoona	2,646	2.24%
Carters Lake	923	0.78%
Lake Oconee	4,349	3.68%
Lake Sinclair	2,280	1.93%
High Falls Lake	451	0.38%
Lake Juliette	72	0.06%
Lake Tobesofkee	396	0.34%
Lake Blackshear	7,536	6.38%
Lake Worth	2,727	2.31%
Harding Lake	1,081	0.92%
Goat Rock Lake	608	0.51%
Lake Oliver	281	0.24%
Lake Andrews	609	0.52%
Lake Seminole	3,052	2.58%
Lake Nottely	512	0.43%
Lake Blue Ridge	483	0.41%
Lake Chatuge	283	0.24%
Banks Lake	10	0.01%
Lake Burton	199	0.17%
Lake Rabun	61	0.05%
Lake Tugalo	432	0.37%
Lake Hartwell	637	0.54%
Lake Russell	650	0.55%
Clarks Hill Lake	5,751	4.87%
Altamaha Sound	18,647	15.79%
Cumberland Sound - St Mary's River Basin	786	0.67%
St Andrews Sound – Satilla River Basin	4,350	3.68%
St Catherine's Sound	873	0.74%
Sapelo Sound	863	0.73%
Wilmington River (Wassaw Sound)	358	0.30%
Little Ogeechee River (Ossabaw Sound)	398	0.34%
Ogeechee River (Ossabaw Sound)	8,915	7.55%
St. Simons Sound	777	0.66%
Doboy Sound	366	0.31%
Jekyll Sound	694	0.59%
Savannah Harbor	4,185	3.54%
Ochlockonee River Basin	2,846	2.41%
Suwannee River Basin	9,066	7.68%
Tennessee River Basin	2,308	1.95%
Tallapoosa River Basin	1,637	1.39%
Coosa River Basin - Lake Weiss	7,894	6.69%
Total streams in Georgia	118,084	97.31%

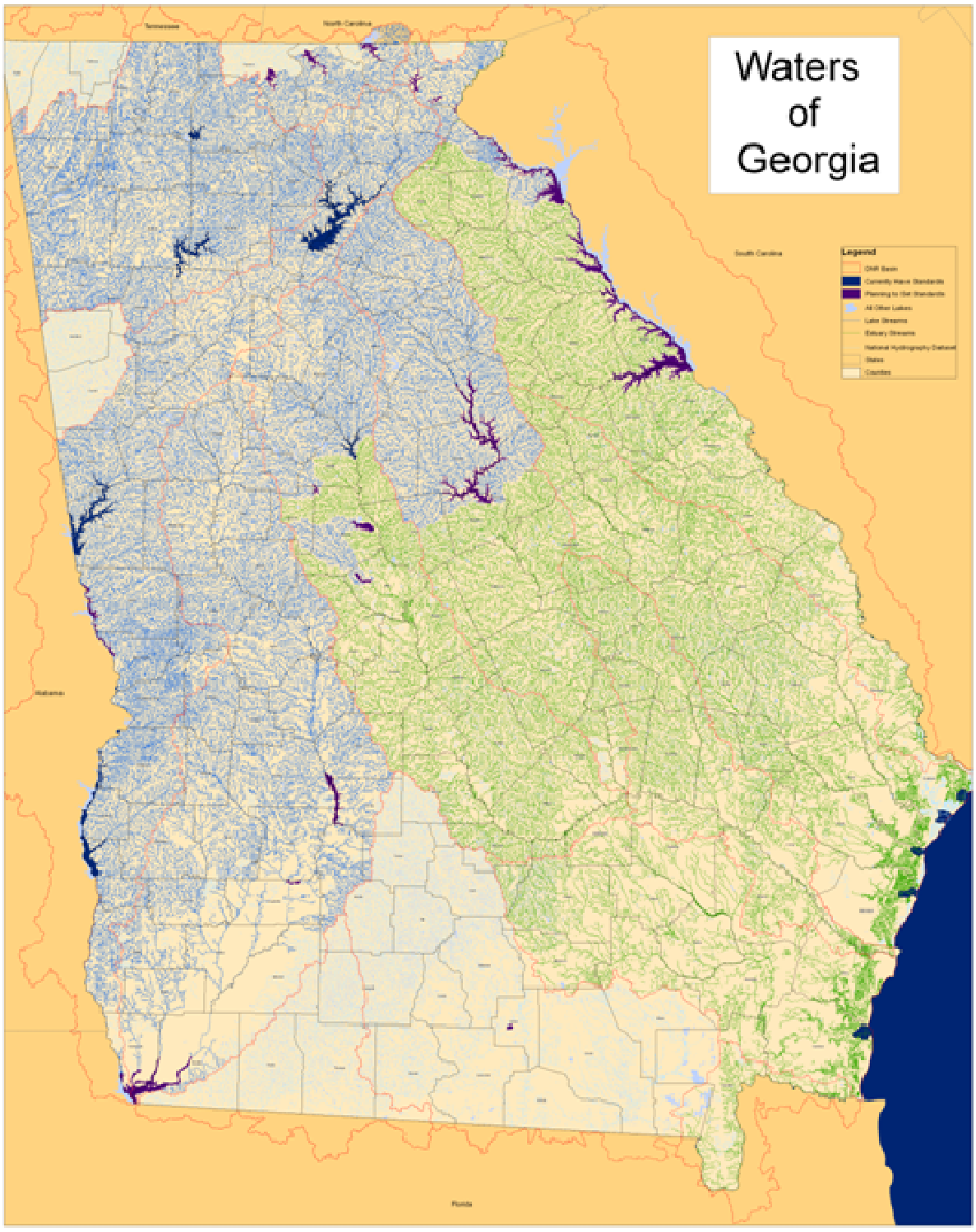


Figure 4. Georgia's River and Streams Upstream from Major Lakes, Estuaries, and Neighboring States

In 2001, Dissolved Oxygen TMDLs were established for the four river basins in south Georgia, the Ochlockonee, Suwannee, Satilla, and St Mary's. These TMDLs determined annual loads for Total Organic Carbon, Total Nitrogen and Total Phosphorus for the listed stream segments. There were 19 listed stream segments in the Ochlockonee River Basin, 48 listed stream segments in the Suwannee River Basin, 21 listed stream segments in the Satilla River Basin, and 7 listed stream segments in the St Mary's River Basin. Table 3 below provides the annual total nitrogen and total phosphorus loads that were set for the listed stream segments.

Table 3: TMDL Annual Nutrient Loads for the South Four River Basins

Listed Segments	TMDL – TN (lbs/yr)	TMDL – TP (lbs/yr)
Ochlockonee River Basin		
Aucilla River	612,245	67,419
Barnetts Creek	555,888	84,678
Big Creek - Headwaters to Little Creek near Meigs	229,107	34,129
Big Creek - Woodhaven Rd. E. of Coolidge to Ochlockonee River	183,685	22,741
Bridge Creek - Mill Creek to upstream Georgia Hwy. 111 near Moultrie	81,177	13,242
Bridge Creek - Upstream Georgia Hwy 111 near Moultrie to Ochlockonee River	129,505	20,714
E. Br. Barnetts Creek	216,253	31,724
Little Creek	53,850	8,043
Little Ochlockonee River - Slocumb Branch to downstream SR 111 near Moultrie	116,487	18,614
Little Ochlockonee River - Big Cr. to Ochlockonee River near Ochlocknee	635,270	92,785
Little Tired Creek	204,964	28,616
Lost Creek	80,315	12,322
Ochlockonee River – Headwaters, upstream Ga. Hwy 112 near Sylvester to Bay Branch, E. of Bridgeboro	49,146	6,606
Ochlockonee River - D/S Ga. Hwy. 270 to Wolf Pit Branch (d/s Giles Millpond)	136,366	18,382
Ochlockonee River - SR 37 downstream Moultrie to upstream CR222	289,035	80,786
Ochlockonee River - Bridge Cr. to Big Cr. W. of Coolidge	572,933	123,392
Olive Creek	142,903	9,447
Swamp Creek	112,552	10,124
Wards Creek	408,582	31,665
Suwannee River Basin		
Alapaha River	291,935	38,545
Bear Creek - City of Adel Lake to Withlacoochee River	1,651,316	202,625
Bear Creek - Reedy Cr. to Indian Cr. near Berlin	1,062,816	131,954
Big Creek	259,169	34,668
Cow Creek	72,266	10,118
Cane Creek	92,548	13,434
Cat Creek	93,207	5,795
Deep Creek	65,206	5,866
Double Run Creek	150,357	23,859
Fivemile Creek	99,205	11,534
Franks Creek	506,453	63,521
Giddens Mills Creek	126,552	26,132
Greasy Branch	140,125	13,182
Hardy Mill Creek	63,200	9,741
Horse Creek	134,578	18,169
Indian Creek	61,090	5,349
Little Brushy Creek	80,332	8,429
Little River - Ashburn Branch, W. of Sycamore to Warrior Cr.	93,520	12,740
Little River - Newell Branch, d/s Hwy. 32 to Ashburn Branch, W. of	200,146	29,735

Listed Segments	TMDL – TN (lbs/yr)	TMDL – TP (lbs/yr)
Sycamore		
Mill Creek	57,067	6,323
Morrison Creek	511,052	69,693
Mule Creek	53,900	14,781
Negro Branch	454,325	57,977
New River - Reedy Cr. to Gum Branch near Lenox	70,597	9,621
New River - Brushy Cr. to Withlacoochee River, E. of Sparks	925,518	223,383
New River - Westside Branch to Gum Cr. downstream Tifton	44,692	7,351
Okapilco Creek - Upstream SR S1540 to U.S. Hwy. 319, Moultrie	1,030,510	239,585
Okapilco Creek - SR 37 to Hog Cr., S. of Moultrie	107,764	12,990
Okapilco Creek - SR 76, Quitman to Withlacoochee River	146,171	19,355
Piscola River	67,545	9,017
Reedy Creek	793,837	122,708
Sand Creek	128,002	18,544
Suwannee Creek	408,412	61,408
Suwannoochee Creek - Bear Branch to Lees Bay	43,520	3,784
Suwannoochee Creek - Lees Bay to Suwannee River	549,373	37,759
Tatum Creek	708,374	50,486
Tenmile Creek	278,582	23,106
Toms Creek	73,293	8,749
Town Creek	96,914	11,684
Tributary to Withlacoocheee	48,433	4,522
Ty Ty Creek - Tucker Cr. to Warrior Cr. near Omega	407,550	19,439
Ty Ty Creek - Little Cr. near Ty Ty to Tucker Cr. near Omega	58,336	7,912
Warrior Creek - Horse Cr. to Rock Cr. near Norman Park	177,972	23,586
Warrior Creek - Rock Cr. to Ty Ty Cr. near Norman Park	213,039	28,668
West Fork Deep Creek	449,224	53,008
Willacoochee River - Turkey Branch, upstream SR90/U.S. Hwy. 319 N. of Ocilla to SR 90, S.E. of Ocilla	394,225	45,549
Willacoochee River - SR 158 to Alapaha River	199,007	24,502
Withlacoochee River	157,248	19,960
Satilla River Basin		
Big Creek	269,237	22,455
Big Satilla Creek	603,826	75,131
Boggy Creek	139,488	14,724
Broxton Creek	62,778	7,602
Buffalo Creek	380,490	29,833
Coleman's Creek	226,827	28,933
Hog Creek	485,634	53,774
Hurricane Creek	856,806	92,002
Little Hurricane Creek	430,449	56,752
Little Satilla Creek - Keene Bay Branch to Dry Branch near Odum	265,807	26,252
Little Satilla Creek - Boggy Cr. To Little Satilla River near Screven	432,732	45,985
Little Satilla River	2,125,639	254,318
Pudding Creek	149,081	20,200
Red Bluff Creek	256,318	28,131
Reedy Creek	102,703	14,983
Roses Creek	232,023	23,569
Satilla Creek	132,053	17,623
Satilla River - Satilla Cr. To Reedy Creek near Douglas	278,806	37,324
Satilla River - Pudding Cr. To Smut Br. Near Pearson	841,124	111,215
Satilla River - Rose Cr. To White Oak Cr	8,463,802	917,627
Sweetwater Creek	76,937	11,986
St Mary River Basin		
Boone Creek	57,095	3,482

Listed Segments	TMDL – TN (lbs/yr)	TMDL – TP (lbs/yr)
Corn House Creek	68,381	6,049
Horsepen Creek	22,170	1,533
St Mary's Tributary #5	35,168	1,824
North Prong St Mary's River	785,946	56,802
St Mary's River	3,564,579	263,927
Spanish Creek	338,413	25,868

In addition to these loads, river and streams that flow into Florida will have to meet Florida's numeric nutrient criteria at the stateline. Georgia EPD's recent data indicates that river and streams that enter Florida are currently meeting the numeric criteria, except for the Total Nitrogen concentration in Little Attapulgus Creek.

In 2008, the EPA prepared a Nutrient TMDL for Lake Weiss in Alabama. Lake Weiss lies in the Coosa River Basin in northeastern Alabama. The watershed has a drainage area of approximately 5,273 square miles and extends into Georgia and southern Tennessee. The Lake Weiss TMDL established an aggregate Total Phosphorus allocation for Georgia at the stateline for loads coming from the Coosa and Chattooga Rivers and required a 30% reduction in the 2005 load. The aggregate allocation for the Coosa River loads at the stateline (Q4 * 0.323, as lbs/day) is expressed as a function of flow (Q4), where Q4 represents the River flow (in terms of cubic feet per second as an annual average). The value of 0.323 represents an allowable growing season median concentration of 60 µg/L of total phosphorus multiplied by a unit's conversion factor. The aggregate allocation for the Chattooga River loads at the stateline (Q5 * 0.862, as lbs/day) is expressed as a function of flow (Q5), where Q5 represents the Chattooga River flow (in terms of cubic feet per second as an annual average). The value of 0.862 represents an allowable growing season median concentration of 160 µg/L of total phosphorus multiplied by a unit's conversion factor. Although total nitrogen loads were considered in the modeling analysis, EPA decided that reductions to the existing nitrogen loads were not necessary to address the nutrient impairment within Lake Weiss.

When, and if, Alabama establishes numeric nutrient criteria for rivers and streams, States with streams that flow into Alabama will have to meet numeric nutrient criteria at the stateline. The same is true if Tennessee were to establish numeric nutrient criteria for its rivers and streams.

Estuarine and Coastal Marine Waters

The EPA nutrient criteria technical guidance manual for estuarine and coastal marine waters defines coastal waters as those marine systems that lie between the mean high-water mark of the coastal baseline and the shelf break, or approximately 20 nautical miles offshore where the continental shelf is extensive. However, Georgia's authority for management of coastal waters extends only three miles offshore. Georgia's coast consists of a complex system of interconnected waters including sounds, tidal streams and rivers, embayments, and marshes. Nutrient dynamics are more complex in estuarine and coastal waters than anywhere else in the State. This is the result of the large nutrient loadings from major rivers, the influence of ocean tides, salinity, diverse aquatic and terrestrial environments, and complex and dynamic biological processes.

The EPA nutrient criteria technical guidance manual for estuarine and coastal marine waters states that estuarine and coastal marine waters tend to be far more unique and thus likely require development of individual waterbody-specific criteria rather than general criteria for classes of waterbodies. For instance, estuaries will likely require classification by residence time or salinity/density gradients. Consequently, the technical approach for estuarine and coastal marine waters will be developed and phased in before criteria development for these

waterbodies can proceed. The EPA Nutrient Criteria Technical Guidance Manual, Estuarine and Coastal Marine Waters will be used to assist in designing the criteria development strategy.

Various water quality monitoring programs have been conducted for Georgia's estuarine and coastal marine waters. The data from these will be identified, assembled, and maintained in the nutrient water quality database. Georgia participates in the National Coastal Assessment (NCA). The Georgia Department of Natural Resources Coastal Resources Division (GA CRD) conducts this work. Formerly known as the National Environmental Monitoring and Assessment Program (EMAP), the NCA was created in 1988 by the EPA in cooperation with other federal agencies to provide basic answers relating to environmental problems impacting the Nation's coastal ecological resources. Similar to the freshwater EMAP sampling protocol, Coastal EMAP applies a probability-based study design on regional scales to address many coastal resource related issues.

The NCA is designed to be a five-year effort of data collection and compilation to be done in July and August. The NCA's probabilistic sampling design focuses on characterizing broad spatial differences in selected indicators. To ensure that sample locations are selected in an unbiased manner, a hexagonal grid is used to define sampling areas in the NCA program. Georgia's 50 annual sites are randomly selected from both a large and small hexagonal grid overlay covering all of the major sound/river systems and their associated tidal watersheds. A total of 250 randomly selected sites will be sampled over five years. Annually there will be a 15% overlap in sites, resulting in 210 unique sites and 40 trend-like sites.

Nutrient monitoring in Georgia's coastal rivers, sounds, and estuaries is funded by the State of Georgia to assess the nutrient loads in our sounds and estuaries. Nutrient monitoring began on March 1, 2000 and is a continuous monitoring program designed to establish trends for nitrate nitrogen, nitrite nitrogen, ammonia nitrogen, total dissolved phosphorus, orthophosphate, and silicate. Sample collection for nutrients occurs monthly at 89 stations on the coast. In 2010, funding was cut reducing of the number of sampling stations monitored each year to 35. The General Assembly annually funds river nutrient monitoring, and monthly monitoring occurs year-round on the Ogeechee, Altamaha, and St. Mary's Rivers. On each of these rivers, six sample sites have been chosen using the collective knowledge of resource managers, commercial fishermen, and scientists. Water samples from each of these sites are collected by GA CRD and analyzed by the University of Georgia for a suite of nutrients including nitrates, nitrites, ammonia, total dissolved phosphorus, orthophosphates, and silicates. The purpose of this monitoring effort is to establish scientifically sound data for nutrient loads in Georgia's coastal rivers, estuaries, and sound systems. The baseline data are a tool for resource managers to use in making management decisions based on both historical and current water quality conditions.

GA EPD began monitoring for nutrients, chlorophyll *a*, and zooplankton along with routine water quality in the Altamaha Sound in 2009. In 2010, monitoring began in Cumberland and St. Andrews Sounds. Monitoring started in Sapelo and St. Catherine Sounds in 2011 and the Wilmington River (Wassaw Sound) and Little Ogeechee River (Ossabaw Sound) in 2012. These samples are collected monthly during the growing season. These data will be analyzed to determine if there is a biological response in estuarine waters to nutrient concentrations, and aid in nutrient criteria development. Once numeric criteria are established for the causal (e.g., annual loading standards for TN and TP) and response parameters (e.g., chlorophyll a, DO) in the major estuaries, the State will assess the need for numeric nutrient standards for the rivers and streams within each estuary's watershed. In this assessment, GAEPD will consider the impact of planning activities (e.g., wasteloads, permits, TMDLs) within the watershed that will be managed to meet the estuary criteria. Streams and rivers will initially be covered under a narrative criterion.

Watershed and estuary models that have been developed as part of the State Water Plan include the Brunswick Harbor, Savannah Harbor, and the St. Mary's estuary. These models can be used in the development of estuary nutrient criteria. For example, model outputs include nutrient concentrations and loadings for rivers and streams that can be used as the basis for protecting the biological health of downstream estuaries.

Wetlands

EPD has authority to regulate waters of the State, defined to explicitly include wetlands, and to develop water quality standards for such waters in order to protect their physical, chemical and biological integrity. EPD also has the authority to regulate the discharge of pollutants into waters of the State. EPD issues Clean Water Act ("CWA") Section 401 water quality certifications as a means of protecting the State's wetlands and to ensure the consistency of CWA Section 404-permitted activities with the State's water quality standards.

GA EPD has received several EPA Wetlands Program Development Grants to lay the groundwork for the eventual establishment of assessment protocols, monitoring, and water quality criteria development for wetlands. EPD established a Wetlands Management Unit in April 2011. EPD's wetlands program is focused on specific goals and activities relating to the four core elements of an effective wetlands program:

- Monitoring and Assessment
- Regulatory Activities
- Voluntary Restoration and Protection
- Water Quality Standards for Wetlands

GA EPD has initiated efforts that focus on the eventual establishment of assessment protocols, and ultimately, nutrient criteria for wetland ecosystems. The GA EPD has secured and reviewed the EPA's Guidance document released in 2008 for wetlands criteria development. GA EPD will have to accomplish the following tasks regarding the development of wetland monitoring and assessment procedures and protocols before criteria can be developed and proposed:

1. TRAINING: The first component of the project development is the acquisition of the necessary training and equipment to conduct accurate and defensible field surveys and assessments. The intention is to learn as many different approaches to wetland monitoring as possible; for example GA EPD staff plan to participate in in-depth classes studying Ohio's rapid assessment method, North Carolina's Wetland Assessment Method, the EPA's training for the National Wetlands Condition Assessment, and Army Corps of Engineers approved wetland delineation training courses. The Watershed Planning and Monitoring Program (WPMP) staff of GA EPD will then establish a preliminary monitoring and assessment protocol based on those established by these and other state and federal organizations. GA EPD staff attended these various classes in 2010 and 2011. In addition, GA EPD will convene a Wetland Monitoring Protocol Advisory Panel to provide guidance and oversight during the initiation of GA EPD Watershed Protection Branch's pilot wetland assessment efforts. The group's work will include, but will not be limited to, review of protocols, participation in field assessments, and providing advice regarding the Branch's planned wetland assessment efforts (e.g. which wetland types are most critical to survey, establishing classification schemes, coordination with the State Wildlife Action Plan, etc.).

2. FIELD SURVEYS: GA EPD and GA CRD staff will jointly assess 52 wetland sites selected randomly by the EPA as part of a broader effort to characterize the general health of the nation's wetlands. This work is being conducted as part of EPA's National

Wetlands Condition Assessment. This project was executed during April-October 2011. The protocol used for this project is identical to the methodology selected for the regional intensification pilot studies. As such, all data collected through this effort can be utilized in conjunction with data collected via the ecoregion pilot studies. In August-September 2011, GA EPD delineated, classified, and assessed the condition of 15 randomly selected wetlands sites of the dominant type within the Piedmont (45) eco-region in order to determine metrics that adequately discriminate reference from impaired condition. The Piedmont pilot project was conducted in concert with similar projects in North Carolina, South Carolina, and Alabama utilizing the same site selection process and methodology. In 2012, GA EPD plans to conduct a similar pilot project in the Southeastern Plain (65) eco-region wetlands. In 2013, GA EPD plans to conduct field surveys in the Southern Coastal Plain (75) and the Ridge and Valley (67) eco-regions wetlands, and in 2014 GA EPD will conduct field surveys in the Blue Ridge (66) eco-region wetlands. GA EPD will utilize and ground truth the GIS wetland coverage tools developed by the University of Georgia. GA EPD will combine these tools with a probabilistic model to select fifteen sites from wetlands of each eco-region to delineate and assess. Once an initial assessment of the dominant type of wetland type in each eco-region has been completed, GA EPD will assess less dominant types until all major wetland types have been suitably characterized. GA EPD can use the experience gained in the field to adjust the methodology, as necessary, to accommodate the nuances present within each wetland ecosystem subtype. The number of sites sampled annually as part of this effort will be contingent on budget and personnel constraints.

3. MONITORING: Chemical, soil, floristic, and biological analyses will be conducted on those sites selected for delineation. This initial sample collection will be as robust as possible and occur over the course of several years. GA EPD will also conduct surveys during this time to determine the source water for each wetland under study. Much like the field surveys and delineation component, GA EPD will use the experience gained from each site visit to further refine the monitoring and assessment methodology.

4. DATA ASSESSMENT: Once the field staff has completed the monitoring and assessment phase of the program development plan, all data collected will be compiled into a database for analysis. Once the data has been verified, they will be used to generate preliminary metrics for each wetland subtype. Reference conditions will be established for each wetland subtype and used to analyze future wetlands under study. These reference conditions will also be used for assessing the effectiveness of wetland mitigation conducted throughout the state.

In order to bolster the accuracy of the methodology and metrics and ease the staff and financial burden of such a project, GA EPD is spearheading the establishment of a Region 4 wetland monitoring workgroup. This is a joint effort among all states in Region 4 with the support of the EPA's National Office of Wetlands, Oceans, and Watersheds. The goal of the workgroup is to promote interstate collaboration in establishing and refining wetland monitoring protocols and data assessment. We also expect the workgroup to provide a mechanism by which states may share assessment data with one another, allowing GA EPD staff to further build the dataset for each wetland ecosystem subtype, and thus bolstering the statistical validity of the scoring metrics. As a result, these data collection efforts and studies will enhance the chemical, physical, and biological data in wetlands and will provide the GA EPD with an increased number of data points and relationships to have a sound scientific evaluation for nutrient response in this water body type.

EPD relies on CWA Section 401 to regulate the State's wetlands, issuing 401 water quality certifications for activities permitted under the federal CWA Section 404 permitting program administered by the U.S. Army Corps of Engineers (Corps). The issuance of Section 401 water

quality certifications is a critical tool in the protection of Georgia's water quality standards. EPD also participates in the Interagency Review Team ("IRT"), which reviews and evaluates Section 404 permitted activities (including required stream and wetland mitigation measures) and oversees the implementation of the EPA and Corps' compensatory mitigation requirements for Section 404-permitted activities. Conditions incorporated in 401 water quality certifications are designed to prevent impacts that would violate water quality standards or other water quality-specific requirements.

Nonpoint Source Nutrient Reduction Strategies

Element 4 and 5 of the Stoner Memo focuses on addressing nutrient reductions from agricultural and septic sources, respectively, at the state/local level. GA EPD's Nonpoint Source Management Program supports nutrient reduction efforts through the use of Section 319(h) Grant funds. To be proactive in addressing nutrients, GAEPD gives additional priority to Section 319(h) Grant applications that include elements to address potential nutrient impairments. This provides an incentive for local governments and other organizations to consider nutrients as part of their projects. Table 4 reflects those projects since 2000 that have specifically addressed or discussed nutrient management as a component of the project.

Table 4. Section 319(h) Grant Funded Nutrient Related Projects

	Number of Projects	Federal Dollars	Total Project Cost
Agriculture Only	32	$13,109,614	$22,375,369
Septic Only	11	$2,325,906	$3,947,427
Agriculture & Septic Combined	10	$3,124,211	$5,200,351
Other (Urban, Trading, etc.)	8	$881,129	$1,490572
Total	**61**	**$19,440,860**	**$33,013,719**

Through the Section 319(h) Grant program, GA EPD commits funds to its partners to address nutrients from agricultural run-off and other sources through the provision of technical assistance. These projects include implementing BMPs such as constructed wetlands, agricultural filter strips, live-stock fencing, and nutrient trading. Figure 5 below depicts those watersheds where agricultural BMPs have been implemented, along with successful delisting of streams in those watersheds (Element 4).

Through the Section 319(h) Grant program, funds have also been dedicated to projects addressing stormwater run-off from septic sources. These projects include implementing BMPs such as septic tank repairs, septic tank relocation, and mapping the location of septic tanks throughout the county or region. Figure 6 below depicts those watersheds where BMPs have been implemented, along with successful delisting of streams in those watersheds (Element 5).

One example of a successful EPD grant enabled local governments to locate failing septic tanks through an online tool. The South Georgia Regional Commission (SGRC) has partnered with the Georgia Department of Public Health (DPH) South Health District (SHD) to implement the *Well and Septic Tank Referencing and Online Mapping* (WellSTROM) System. The intent of the project was to develop a tool that would assist with the identification and mapping of both new private wells and septic systems. Because of the completion and continuance of this project by local staff, information is being accrued that helps better assess sources of pollution, such as fecal coliform and nutrients. In 2009, the UGA Marine Extension (MAREX) partnered with EPD to capture data and locations of septic system in four northern counties on the coast (Bryan, Effingham, Liberty, and Long). SGRC was a spectator in this project as UGA already had a plan

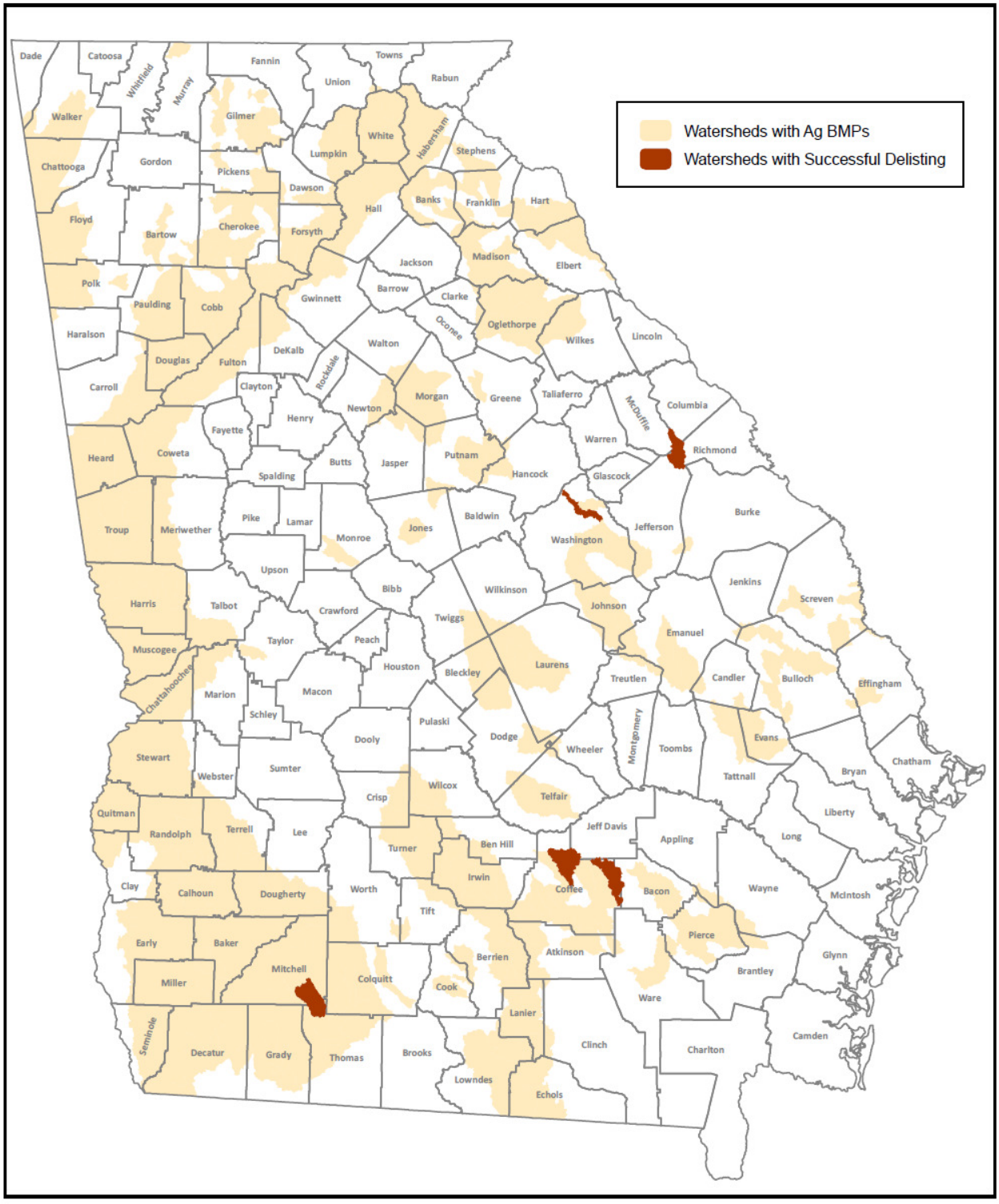


Figure 5. Map of Georgia Watersheds with Agricultural BMPs Implemented and Successful Delisting Watersheds

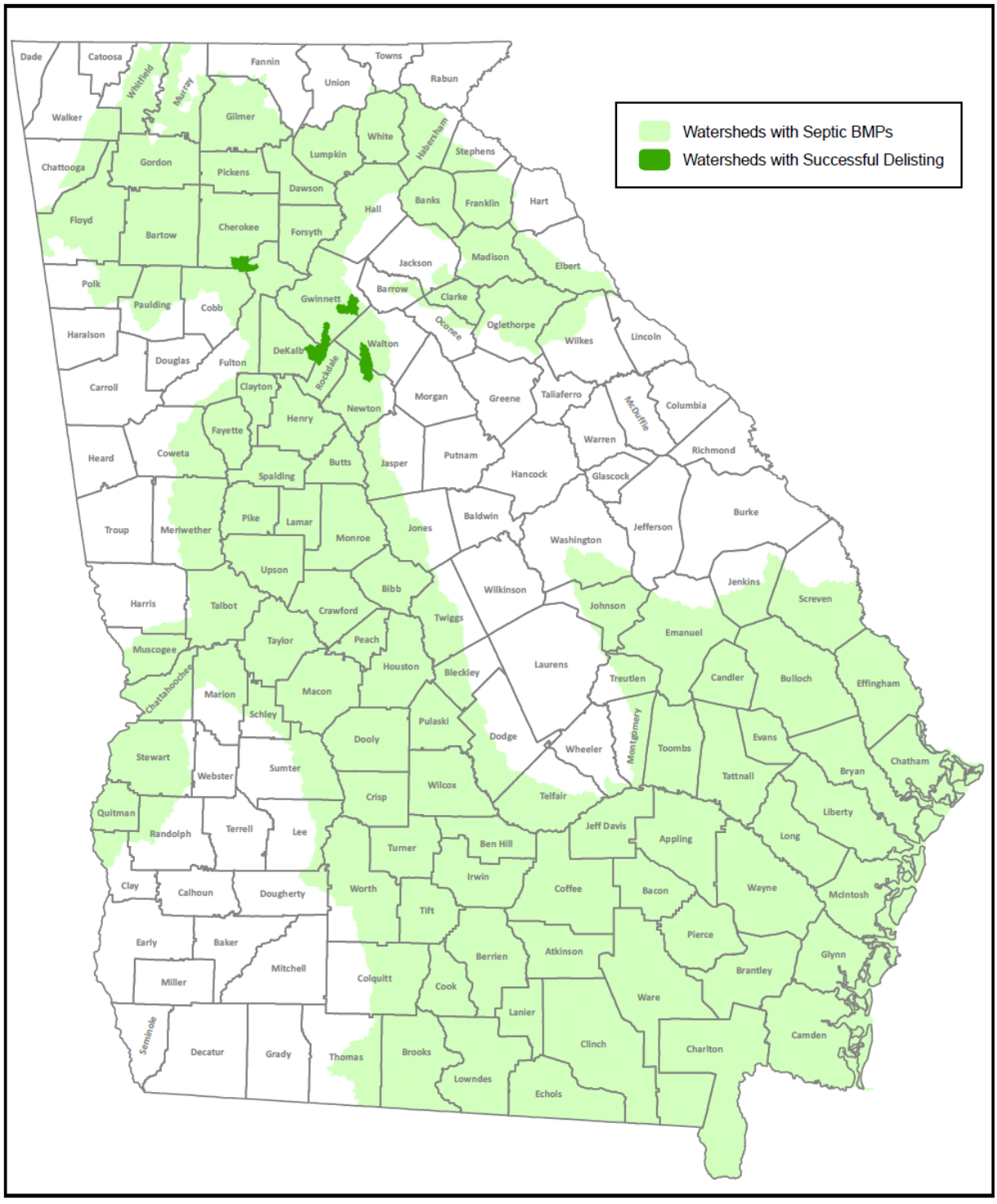


Figure 6. Map of Georgia Watersheds with Septic BMPs Implemented and Successful Delisting Watersheds

for mapping. However, SGRC offered WellSTROM as a resource for mapping data collection progress and by the project's end, all data collected was integrated into the WellSTROM mapping application. In 2010-11, SGRC became EPD/ MAREX project partners for the second phase of septic mapping in the coastal region, which covered Camden, Chatham, Glynn, and McIntosh counties. Meanwhile, Garrison (the Georgia Department of Public Health (DPH) database) was coming online. SGRC made contact with DPH about acquiring Garrison data and mapping it in WellSTROM. This provided Garrison a solid mapping component that it may otherwise not have had. The initial investment of $76,000 has resulted in a state-wide tool that is being adopted by DPH and being used by nearly every health district in Georgia. Access to this information will help in the planning and implementation of non-point source (NPS) pollution management and augment Georgia's proactive approach to nutrient and other NPS management. The benefit of this project will allow local governments and health departments to identify priority areas to focus resources in addressing potentially failing septic tanks.

Another nonpoint source reduction project has focused on a feasibility study for nutrient trading in the Coosa River Basin. In order to meet the phosphorus load reduction goal in the Lake Weiss TMDL, the GAEPD has proposed phosphorus limitations on all the NPDES point source dischargers in the basin. The TMDL acknowledges that non-point sources are major contributors to the phosphorus loading as well. There may be alternative solutions to meet the phosphorus (P) load reduction goals that are more cost effective (lower life cycle cost per mass of P removed) and environmentally beneficial than simple point source reductions. For example, by implementing non-point source best management practices (BMPs), the point source dischargers may be able to meet their permit requirements more cost effectively. The Nutrient Trading Framework is being led by the Northwest Georgia Regional Commission under the direction of the Northwest Georgia Water Resources Partnership (Partnership). The project scope includes: problem identification; technical review of existing phosphorus loads and reduction goals; possible trading procedures; identification of potential non-point source BMPs including size and possible locations; regulatory requirements; financial obligations of entities involved in the trade; operations and maintenance, and review of key legal issues. The scope also includes a concept plan for the BMP(s) to be developed, and will provide locations for possible BMPs. The project location will be chosen based on proximity to the headwaters of Lake Weiss and high nutrient correlations between available water quality monitoring data from previous studies including the Coosa River Study by GAEPD, and Watershed Hydrology and Water Quality Modeling Report for Coosa Watershed prepared as part of the State-wide Water Plan. This project will provide an alternative approach to meet the Lake Weiss TMDL Implementation Plan requirements and will use existing information provided in the Coosa River Basin Modeling Study (GAEPD) and the Watershed Assessment currently being conducted by the Partnership. This project will also provide a Nutrient Trading Framework which may be applied to other areas in the state to cost effectively meet pollutant load reduction requirements.

Element 6 of the Stoner Memo focuses on accountability and verification measures to ensure best management practices are in place to document load reductions. All Section 319(h) Grant funded projects that implement BMPs, structural and non-structural, must report their progress towards implementation in order to maintain funding. Projects are required by OMB rules to maintain BMPs for 5-10 years or the functional life of the BMP, which is included in all grant contracts. Information regarding implementation is tracked by GA EPD project managers and reported to the EPA on either a quarterly or a semi-annual basis. This information is uploaded and housed within the EPA's Grants Reporting & Tracking System (GRTS). GA EPD project managers also conduct site visits throughout the life of the project to ensure implementation. For agriculture projects, representatives from collaborating state and/or federal agricultural agencies are required to sign-off on the installation of management practices.

The Settingdown Creek watershed and the Altamaha River Basin project included: 1) revising, updating and/or developing agricultural nutrient management plans (NMPs); 2) providing record keeping tools for these producers to better manage their farms; 3) providing technical assistance in identifying areas in need of improvement on their farming operation; and 4) helping guide producers towards financial opportunities to complete these tasks for non-CAFO producers. As part of this project, Georgia Soil & Water Conservation Commission (GSWCC) partnered with University of Georgia - Cooperative Extension Service (UGA-CES) to provide one-on-one technical assistance to farmers in this process. GSWCC contributed to the revision of nutrient management planning training software, which is used statewide by NMP planners. UGA-CES, the Georgia Department of Agriculture, and GSWCC leveraged funds to update the software, which is freely available. GSWCC and the UGA-CES also conducted several field days around the state offering litter spreader calibration, a nutrient management planning refresher course, and a refresher course for certified nutrient management planners. GSWCC also targeted landowners in the 11-county Coastal Nonpoint Source Program area offering the same nutrient management assistance. Once this project was complete, GSWCC took steps to roll this program out statewide, starting in areas of the state where GSWCC is currently working. Upon project completion, GSWCC plans to incorporate this program into its existing Nonpoint Source Control Program as an ongoing initiative to improve the utilization of nutrient planning to protect Georgia's natural resources.

Element 7 of the Stoner Memo addresses the reporting on implementation activities, such as load reductions. Projects funded using Section 319(h) Grant funds or conducted under the auspices of the Georgia Nonpoint Source Management Program are reported through Georgia's NPS Program annual report. This captures many of the program's activities and progress in addressing NPS pollution, including nutrients. As Georgia updates its NPS Management Program Plan, new goals and metrics will be included and reported annually. Many of these goals and metrics will address nutrients, reflecting Georgia's proactive approach. Furthermore, Section 319(h) Grant funded projects are required to report load reductions of nitrogen, phosphorus, and sediment where applicable. This includes any and all projects that install structural best management practices. This data is mandated to be put into the EPA's Grant Reporting and Tracking System (GRTS) annually.

Nutrient Criteria Adoption Schedule

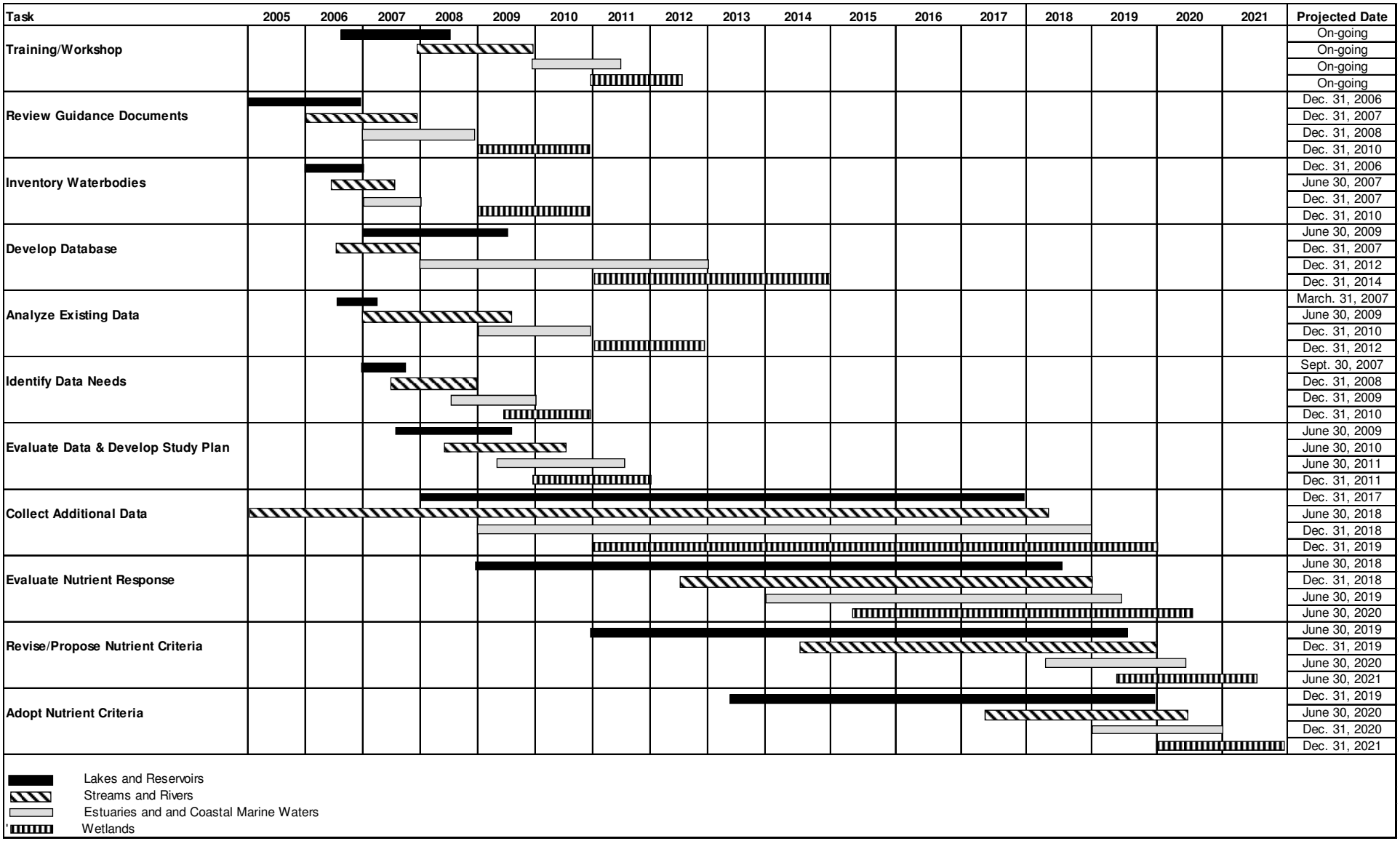
As scientifically defensible numerical nutrient criteria are developed, they will be proposed for adoption. Consequently, the proposed standards will be subject to the public review, comment, and hearing process before being submitted to the Board of the Georgia Department of Natural Resources for adoption. Because of the impact that nutrient standards will have on water quality management and affected entities, it is anticipated that there will be input from the public, regulated community, and environmental groups that could significantly affect the standards adoption process and schedule.

Before any narrative or numeric nutrient criteria are adopted, consideration of implementation with other water quality programs is needed. If the numeric nutrient criteria contain some form of biological confirmation, there needs to be a discussion of the role of the biological endpoint. Some important qualities for choosing the appropriate biological endpoint are making sure this response variable is sensitive to anthropogenic nutrient sources. There should be well-defined and documented empirical evidence that the biological response is ecologically relevant and covers the major pathways for nutrients to manifest any adverse effects, taking into account downstream protection. The biological endpoint chosen should also be representative and provide protection for the correct tier of aquatic life. For example, GA EPD designates streams as fishing; however, those that are identified as trout streams may require different nutrient protection than those designated as warmwater fisheries.

If GA EPD chooses to proceed with numeric nutrient standards that contain biological confirmation, the standard needs to be clear as to what is considered an impairment and should be consistent with GA EPD's listing assessment methodology. The standard should contain an appropriate duration and frequency, along with minimum data requirements needed to assess the standard. An experienced monitoring staff with adequate resources would be needed to discern nutrient caused biological effects. The GA EPD will need to increase its biological monitoring staff if GA EPD pursues a nutrient standard with biological confirmation.

The development and adoption of nutrient criteria for all of Georgia's waters will require some time to complete and will be dependent on the resources available to perform the work necessary for all aspects of the process. This work was initiated in 2004 with the inclusion of nutrient monitoring in the ambient water quality monitoring plan for 2005. The schedule outlined in Figure 7 begins in January 2005. It is based on the assumption that resources will be available for all aspects of the process. If staff and funding are not fully available, the plan will be adjusted to optimize available resources. This schedule may require subsequent revision in future plan updates. Some tasks (i.e. evaluate nutrient response) could be an ongoing effort, as new information is made available. When resource shortages can be reasonably anticipated, GA EPD will develop contingencies (e.g., consideration of less staff-intensive reference approaches, ground-truthing remotely sensed trophic data, or prioritizing criteria adoption in certain ecoregions) to minimize the impact on nutrient criteria development. Therefore, this schedule is dynamic and may be subject to changes, but ultimately the desired end point of nutrient criteria shall be reached.

Figure 7. Nutrient Criteria Adoption Schedule



Appendix A
Strategy for Addressing Phosphorus in NPDES Permitting

Georgia Department of Natural Resources
Environmental Protection Division, Watershed Protection Branch
4220 International Parkway, Suite 101, Atlanta, Georgia 30354
Linda MacGregor, P.E., Branch Chief
404/675-6232
FAX: 404/675-6247

November 11, 2011

MEMORANDUM

TO: Linda MacGregor

FROM: Elizabeth A. Booth, PE, PhD

RE: Strategy for Addressing Phosphorus in NPDES Permitting

Clean water is important to Georgia's environmental and economic vitality. Our citizens, our industries (including the tourism industry), and our aquatic life depend on clean water. Controlling nutrients, particularly phosphorus is a critical part of protecting our water resources.

Phosphorus is the primary pollutant associated with the eutrophication of Georgia's surface waters. Excess phosphorus can cause nuisance algal blooms and reduced transparency which may make waters unsuitable for swimming or other recreational activities. Algal blooms can also cause taste and odor problems in drinking water. Excess algae can also affect the dissolved oxygen resources in a waterbody and impair biology.

Phosphorus comes from both point and nonpoint sources. Point sources consist mainly of municipal and industrial wastewater treatment plant discharges. Nonpoint sources include runoff from agricultural fields, feedlots, urban areas, urban construction sites and on-site sewage treatment systems. With respect to non-point phosphorus loads entering State waters, EPD will work with the Georgia Department of Agriculture, the Cooperative Extension Service, the Urban Agriculture Council and the Georgia Soil and Water Conservation Commission to develop ideas for managing phosphorus from agricultural lands and urban landscapes and with the Georgia Forestry Commission to develop ideas to manage phosphorus from forested areas.

Since 2005 the Watershed Protection Branch has been implementing an unofficial strategy for addressing phosphorus loadings in State Waters. We believe that this strategy is within our permitting authority and a proactive step causing cost-effective wastewater treatment plant expansions rather than costly retrofits. Georgia EPD has committed to adopt nutrient standards as outlined in "Georgia's Plan for the Adoption of Water Quality Standards for Nutrients."

The strategy has two key elements – 1) monitoring of effluent phosphorus at all facilities upon permit renewal or issuance, and 2) effluent phosphorus limits for facilities that are new or expanding (indicating that a capital investment is being made). Most permittees have understood the upcoming changes and have appreciated the advance notice to prepare for these changes. In advance of adopted nutrient standards, permit applicants can opt out of the permit limit recognizing that they will be

expected to meet eventual nutrient limits very quickly, and should not expect to be placed on an extended schedule to come into compliance.

This strategy is intended to define a framework for permitted point sources by outlining permit limits and monitoring requirements. Be advised that once nutrient standards are adopted by the GA DNR Board, then even facilities opting out initially will be subject to nutrient limits. It is important to apply many decisions to new or expanding wastewater treatment plant situations, as it is usually more economical to include phosphorus control in the design of new facilities rather than retrofitting.

The implementation of this strategy will be associated with the permitting cycle and with basin/watershed management approaches. With respect to the permitting cycle, decisions on phosphorus limits, phosphorus management planning, monitoring, etc. will be made as permittees request new or expanded treatment plant discharges, and for those not expanding, decisions will be made when permits come up for reissuance. Another major decision point for applying phosphorus treatment requirements will occur following the identification of a nutrient problem in a specific waterbody or watershed. In this case monitoring and/or limits may be established for discharges contributing to the problem prior to permit reissuance or future planned expansions.

The strategy includes the following:

- General Strategy for All Waters
- Strategy for Discharges to Waters in Close Proximity to Lakes and/or Estuaries
- Strategy for Tributaries to Waters Entering Lakes with Specific Water Quality Standards
- Strategy for Waters on the Georgia 303(d) List

EPD will issue wasteload allocations including a phosphorus limit in accordance with this strategy and with an explanation of the following flexibility. The flexibility will be repeated in the cover letter that transmits the wasteload allocation to the permit applicant.

"The nutrient permit limits in this wasteload allocation are in accordance with EPD's proactive Strategy for Addressing Phosphorus in NPDES Permitting. In advance of adopted nutrient standards, permit applicants can opt out of the permit limit recognizing that they will be expected to meet eventual nutrient limits very quickly, and should not expect to be placed on an extended schedule to come into compliance. In order to opt out and not be subject to the phosphorus limit, the permit applicant must advise EPD of this decision prior to or concurrent with submitting the Design Development Report to EPD."

General Strategy for All Waters

- Industrial and major municipal NPDES wastewater dischargers will provide phosphorus data or design information as a part of the routine permit reissuance process. EPD may assign or increase monitoring requirements for phosphorus upon reissuance of a permit to evaluate phosphorus loadings if a reasonable potential for phosphorus in the discharge is present.
- All new or expanding NPDES treated wastewater discharges upstream from reservoirs, lakes, impoundments, and/or estuaries may be given monitoring requirements for ortho phosphate if a reasonable potential for the presence of phosphorus in the discharge is present.
- New or expanding major municipal (greater than or equal to 1 MGD) and industrial NPDES treated wastewater dischargers will be permitted at 1.0 mg/L total phosphorus or less to protect downstream waters if a reasonable potential for the presence of phosphorus in the discharge is present.
- New or expanding minor municipal (less than 1 MGD) and industrial NPDES treated wastewater dischargers will be permitted at 8.34 lbs/day total phosphorus or less to protect downstream waters if a reasonable potential for the presence of phosphorus in the discharge is present.
- Watershed Assessment and Protection Plans should include an analysis and discussion of potential non-point source phosphorus in the watershed.
- Special consideration will be given to waters designated as Outstanding Natural Resource Waters (ONRW), Wild River, Scenic River, trout stream, waters generally supporting shellfishing and other nutrient sensitive waters.

Strategy for Discharges to Waters in Close Proximity to Lakes and/or Estuaries

- All new or expanding NPDES industrial and municipal wastewater treatment plants discharging to or in close proximity to reservoirs, lakes, impoundments, and/or estuaries will be permitted at 0.5 mg/L total phosphorus or less to protect these waters providing a reasonable potential for the presence of phosphorus in the discharge is present.

Strategy for Tributaries to Waters Entering Lakes with Specific Water Quality Standards

Six lakes, West Point, Walter F. Georgia, Jackson, Lanier, Allatoona, and Carter's, have site-specific nutrient criteria. Each lake has site-specific criteria for nutrients including a total phosphorus lake loading given in pounds per acre-foot volume per year. Major lake tributaries have annual total phosphorus loadings that were established to maintain the phosphorus loads into each lake. This strategy, in part, is intended to ensure these loads are not exceeded and the water quality is protected.

The total permitted phosphorus loading from wastewater treatment facilities upstream from a major lake tributary compliance point shall not exceed the total phosphorus

loading allocated to point sources in the watershed used in developing the total phosphorus loading criteria for the major lake tributaries in order to help ensure

- compliance with the annual total phosphorus loading provided for in the Georgia Rules and Regulations for Water Quality Control.
- The total permitted phosphorus loading from wastewater treatment facilities discharging directly to the lakes shall not exceed the total phosphorus loading allocated to point sources directly to the lake used in developing the annual total phosphorus lake loading in order to help ensure compliance with the total phosphorus lake loading provided for in the Georgia Rules and Regulations for Water Quality Control.
- EPD will carefully evaluate requests for new discharges where the phosphorus load is small on a case-by-case basis in order to minimize the proliferation of septic systems.
- Treated wastewater discharge expansion will be considered on the basis of maintaining or reducing total permitted phosphorus loading.

Strategy for Waters on the Georgia 303(d) List

- For waters on the Georgia 303(d) list for parameters associated with nutrients, TMDLs will be developed, point and nonpoint source allocations will be calculated and reductions implemented as appropriate through TMDL implementation plans.
- Until TMDLs are developed, treated wastewater discharge expansions will be considered on the basis of maintaining or reducing total permitted phosphorus loading.
- EPD will carefully evaluate requests for new discharges where the phosphorus load is small on a case-by-case basis in order to minimize the proliferation of septic systems.
- Local governments in these watersheds are expected, as a part of their Watershed Assessments, to assess waters on the Georgia 303(d) List, develop Protection Plans and implement best management practices to minimize nonpoint source pollution in existing urban areas and in newly developing areas.

This strategy is subject to update over time. Information and knowledge about nutrient management issues and nutrient criteria is expected to change over time and this strategy will be updated as appropriate.

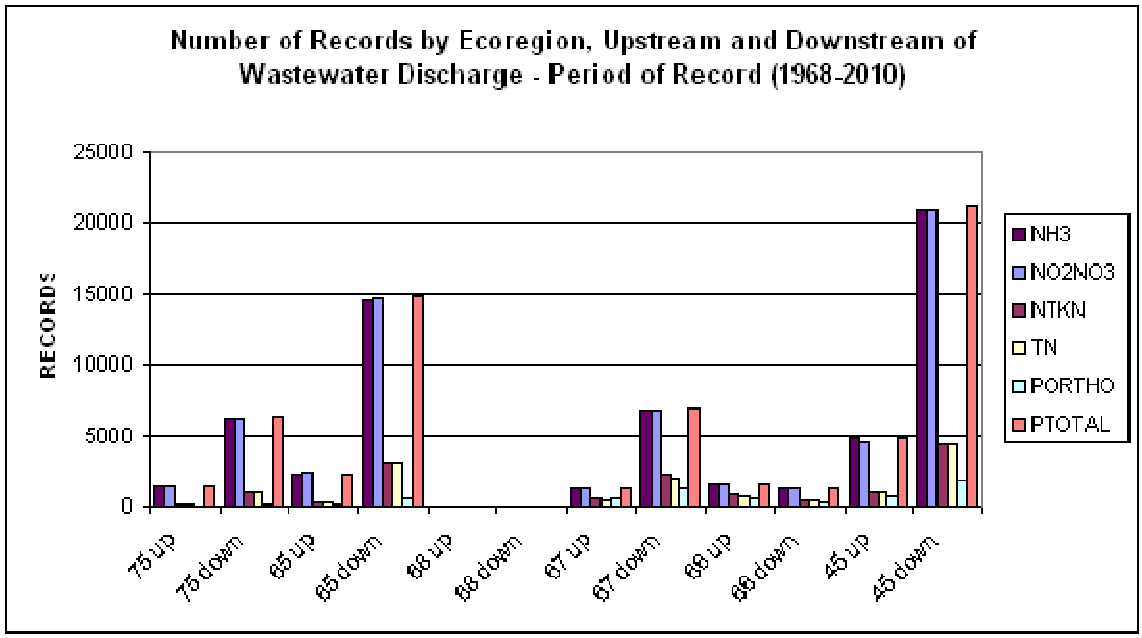
Strategy for Addressing Phosphorus in NPDES Permitting
Page 5

Table 1 ***Strategy for Addressing Phosphorus in NPDES Permitting***	
Point Source Situation	**Strategy**
Routine permit reissuance without expansion or other situation listed below	Phosphorus monitoring
New or expanding discharges upstream from reservoirs, lakes, impoundments, and/or estuaries	Monitoring requirements for ortho phosphate
New or expanding major (greater than or equal to 1 MGD) discharges	Permitted at 1.0 mg/L total phosphorus or less to protect downstream waters
New or expanding minor (less than 1 MGD) discharges	Permitted at 8.34 lbs/day total phosphorus or less
All new or expanding plants discharging to or in close proximity to reservoirs, lakes, impoundments, and/or estuaries	Permitted at 0.5 mg/L total phosphorus or less
Tributaries to Lakes with Specific Water Quality Standards (West Point, Walter F. George, Jackson, Lanier, Allatoona, and Carter's)	The total permitted phosphorus loading from wastewater treatment facilities upstream from a major lake tributary compliance point shall not exceed the total phosphorus loading allocated to point sources in the watershed used in developing the annual total phosphorus loading criteria for the major lake tributaries
Discharges directly to Lakes with Specific Water Quality Standards (West Point, Walter F. George, Jackson, Lanier, Allatoona, and Carter's)	The total permitted phosphorus loading from wastewater treatment facilities discharging directly to the lakes shall not exceed the total phosphorus loading allocated to point source directly to the lake used in developing the annual total phosphorus lake.
New discharges to Lakes (directly or to tributaries) with Specific Water Quality Standards (West Point, Walter F. Georgia, Jackson, Lanier, Allatoona, and Carter's)	EPD will carefully evaluate requests for new discharges where the phosphorus load is small on a case-by-case basis in order to minimize the proliferation of septic systems
Expansion of discharges to Lakes (directly or to tributaries) with Specific Water Quality Standards (West Point, Walter F. Georgia, Jackson, Lanier, Allatoona, and Carter's)	Considered on the basis of maintaining or reducing total permitted phosphorus loading.
For waters on the Georgia 303(d) list for parameters associated with nutrients	TMDLs will be developed, point and nonpoint source allocations will be calculated and reductions implemented as appropriate through TMDL implementation plans.
For expansions of discharges to waters on the Georgia 303(d) list for parameters associated with nutrients, prior to TMDLs being developed	Considered on the basis of maintaining or reducing total permitted phosphorus loading.
New discharges to waters on the Georgia 303(d) list for parameters associated with nutrients, prior to TMDLs being developed	EPD will carefully evaluate requests for new discharges where the phosphorus load is small on a case-by-case basis in order to minimize the proliferation of septic systems.

Appendix B
Trends in Georgia Stream Nutrient Water Quality Parameters

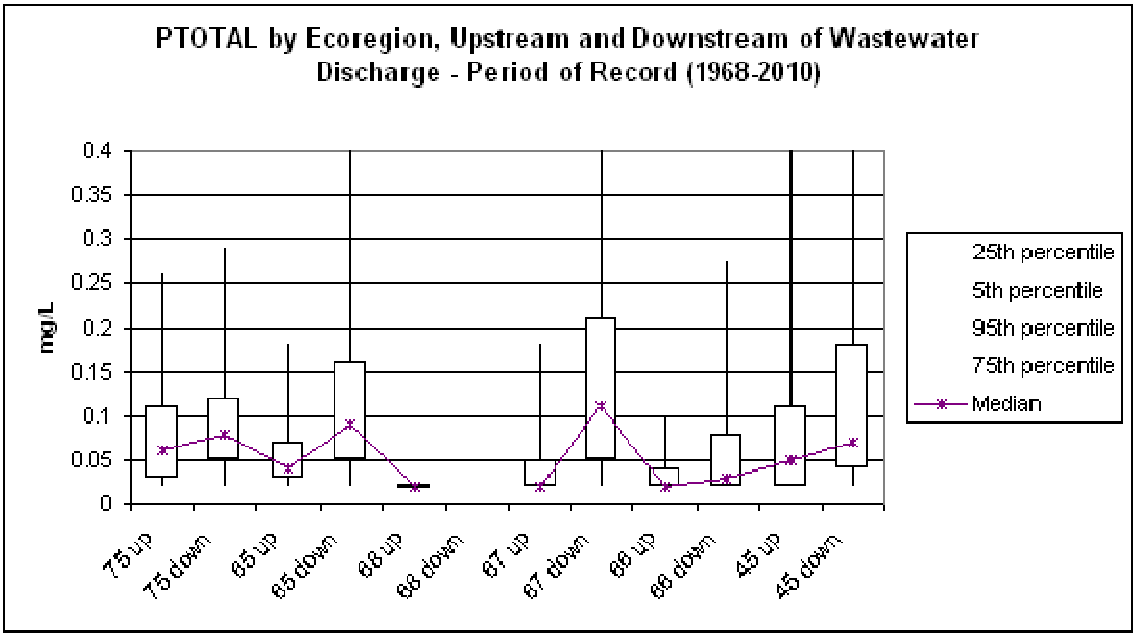
Trends in Georgia Stream Nutrient Water Quality Parameters
March 15, 2011

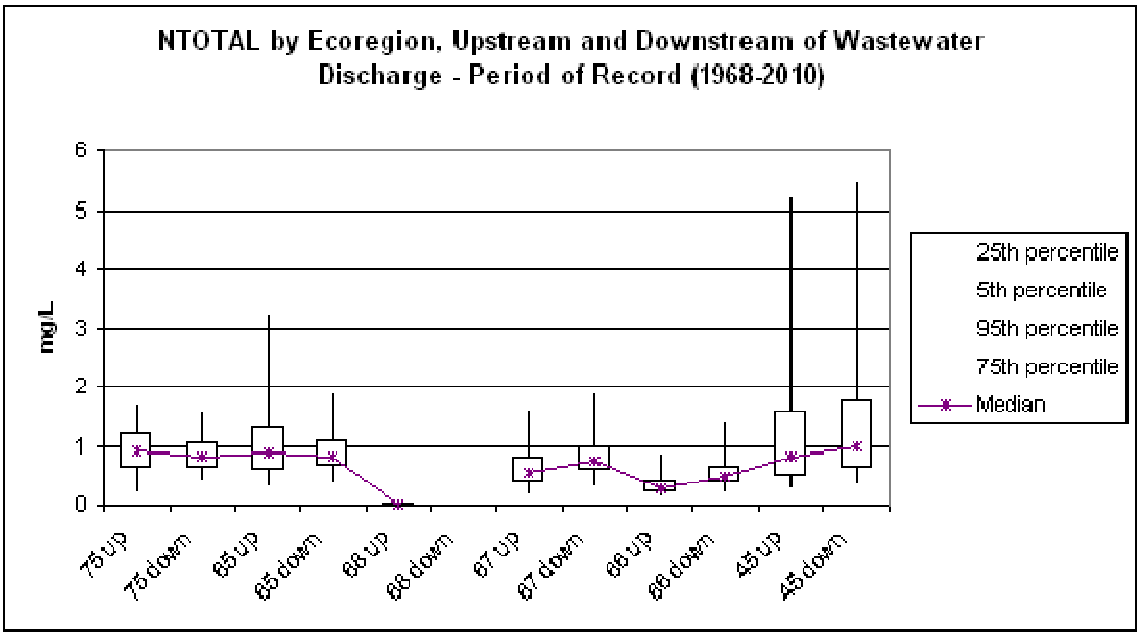
- Over 71,400 water quality samples of Georgia Streams were analyzed over the time period from 1968 to 2010. Distribution of samples over Georgia Ecoregions is shown below.
- Sampling Sites were analyzed using GIS to determine if they were upstream or downstream of NPDES or LAS facilities.



75 – Southern Coastal Plain	67 – Ridge and Valley
65 – Southeastern Plains	66 – Blue Ridge
68 – Southern Appalachians (insufficient data)	45 – Piedmont

Box plots comparing instream water quality for each ecoregion split between upstream and downstream sites for the period of record.





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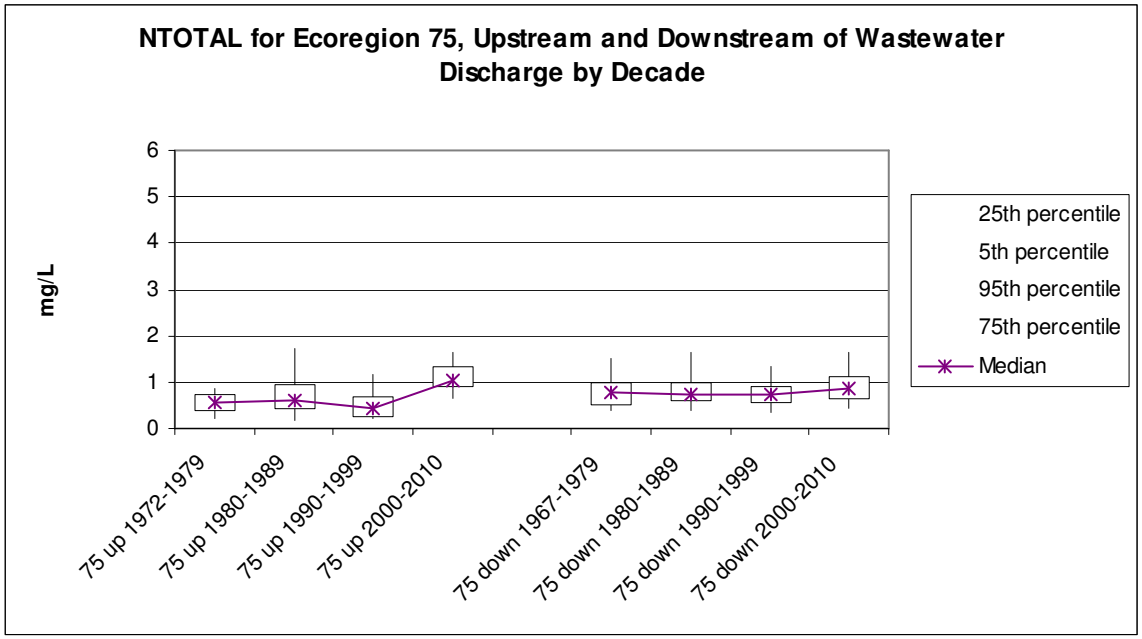
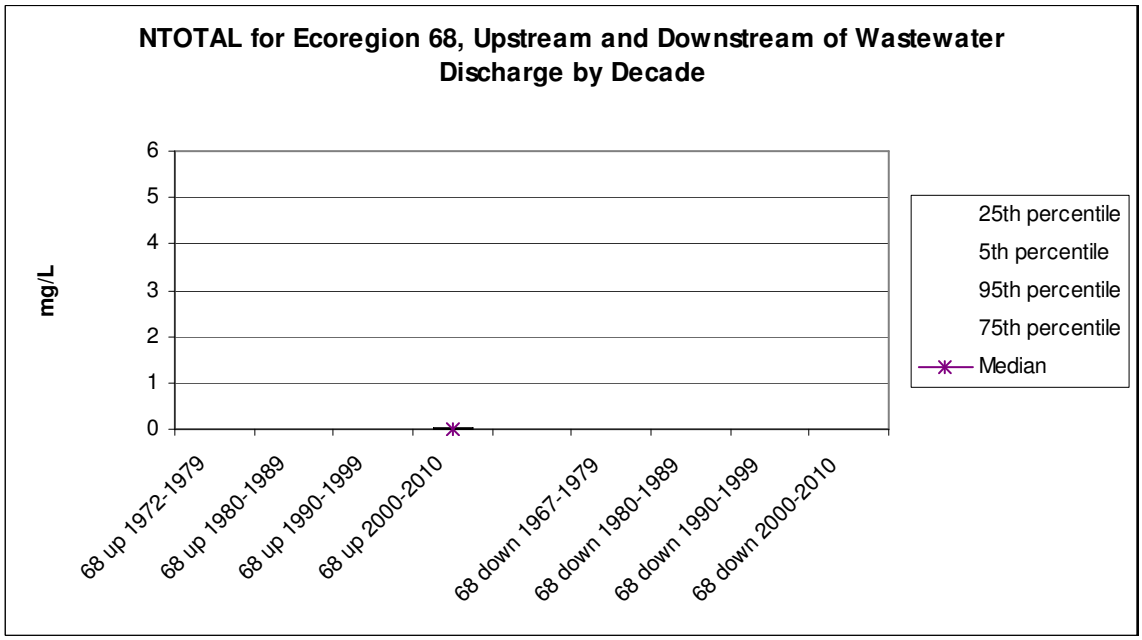
Decadal Trends of Total Nitrogen and Total Phosphorus in each ecoregion split between upstream and downstream sites.





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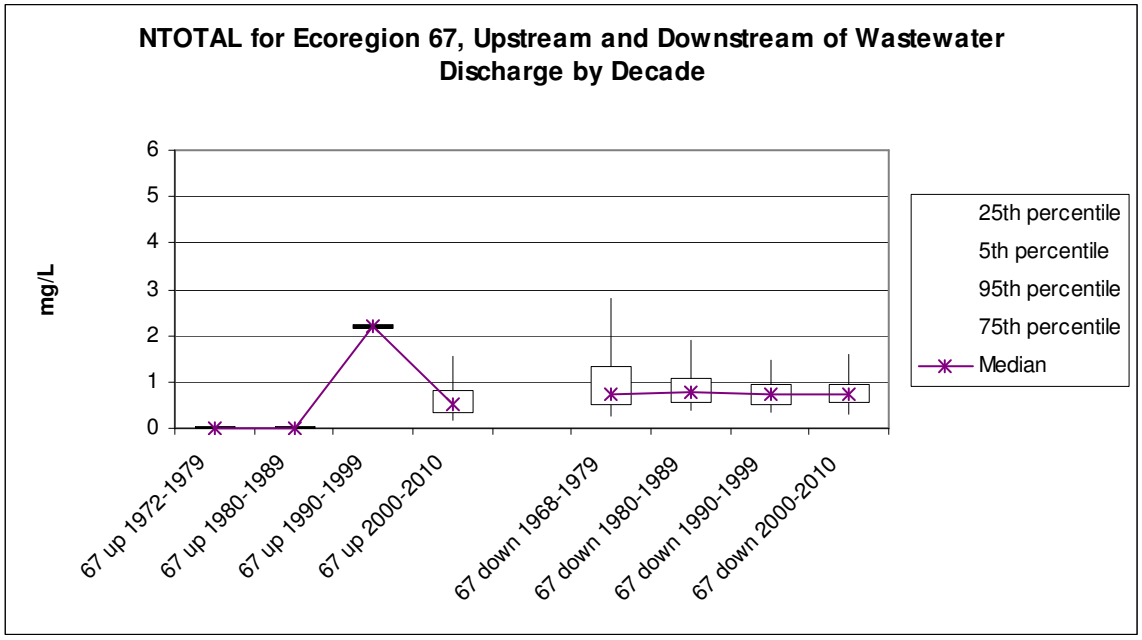

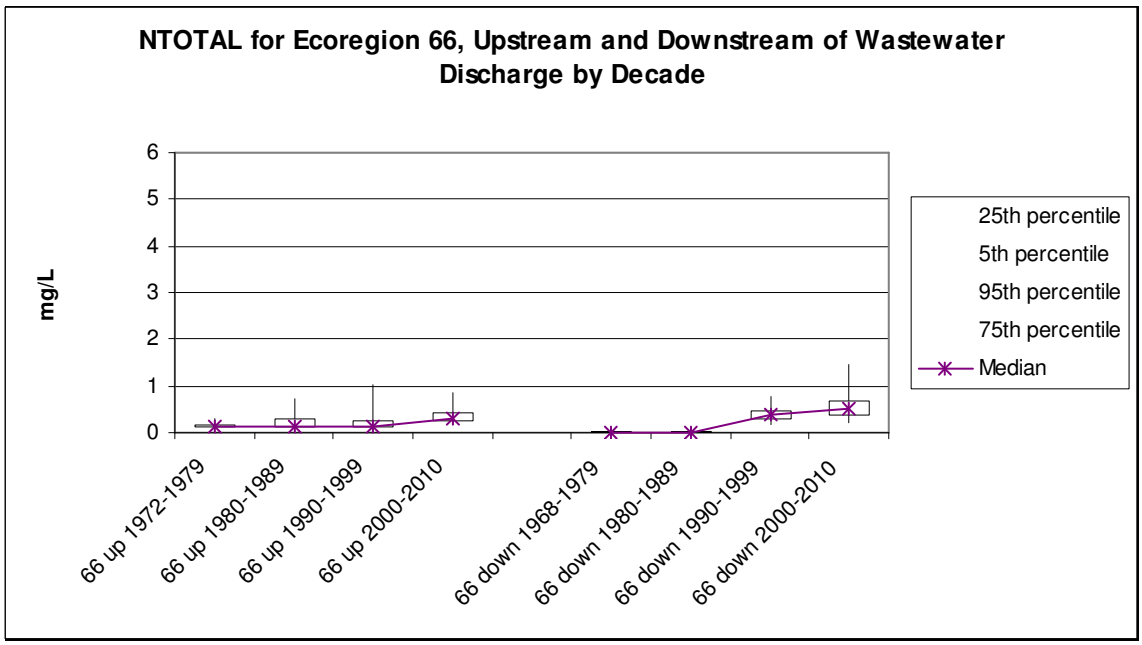

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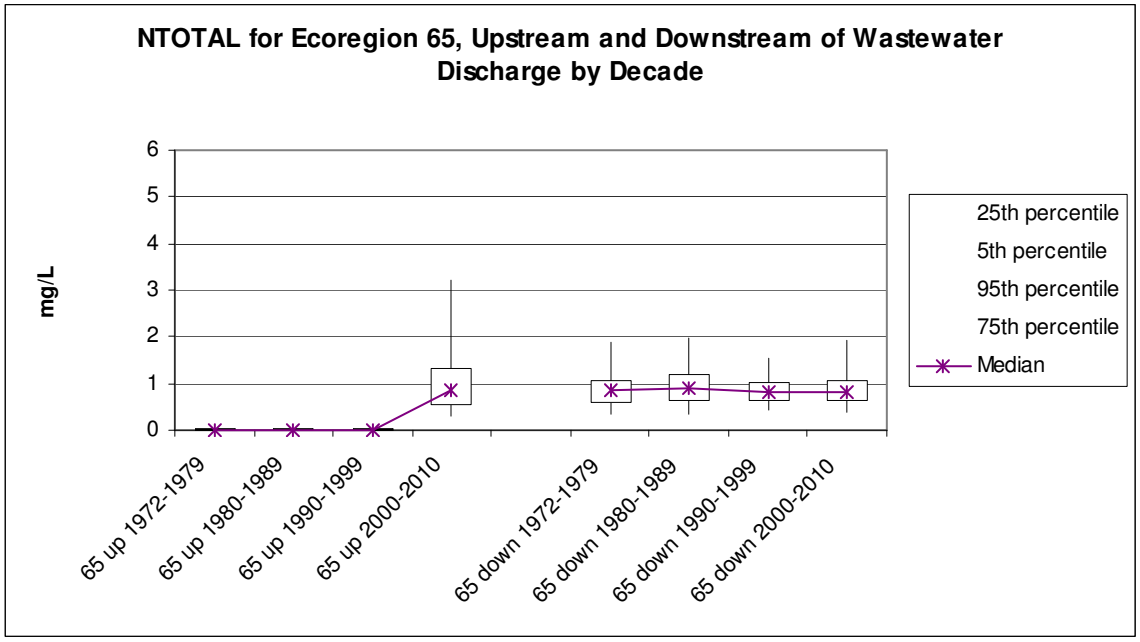
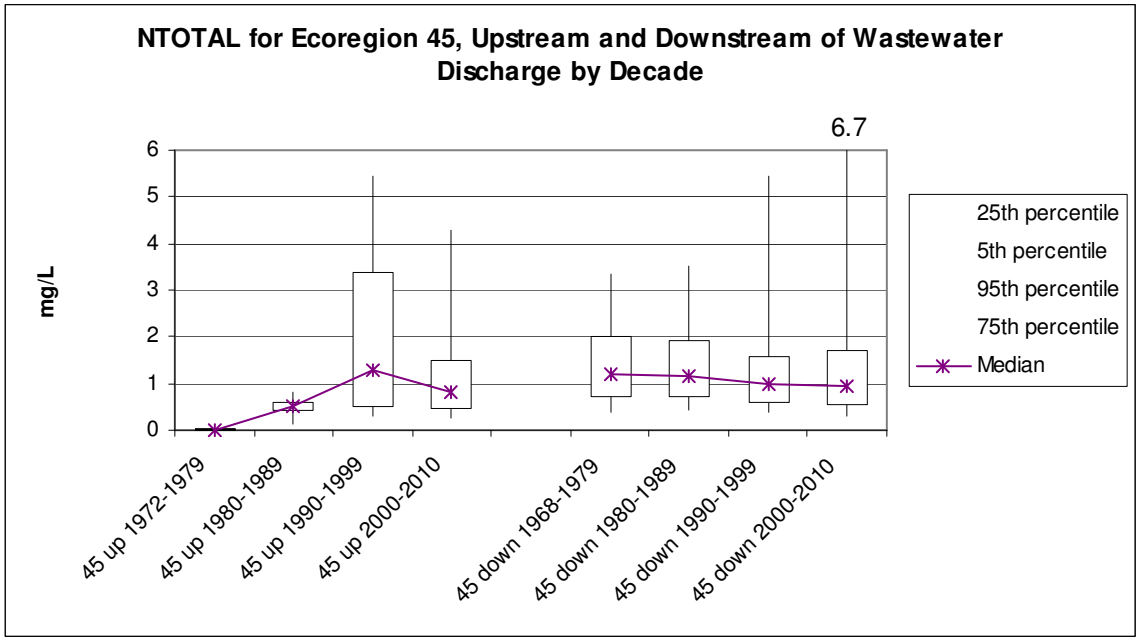
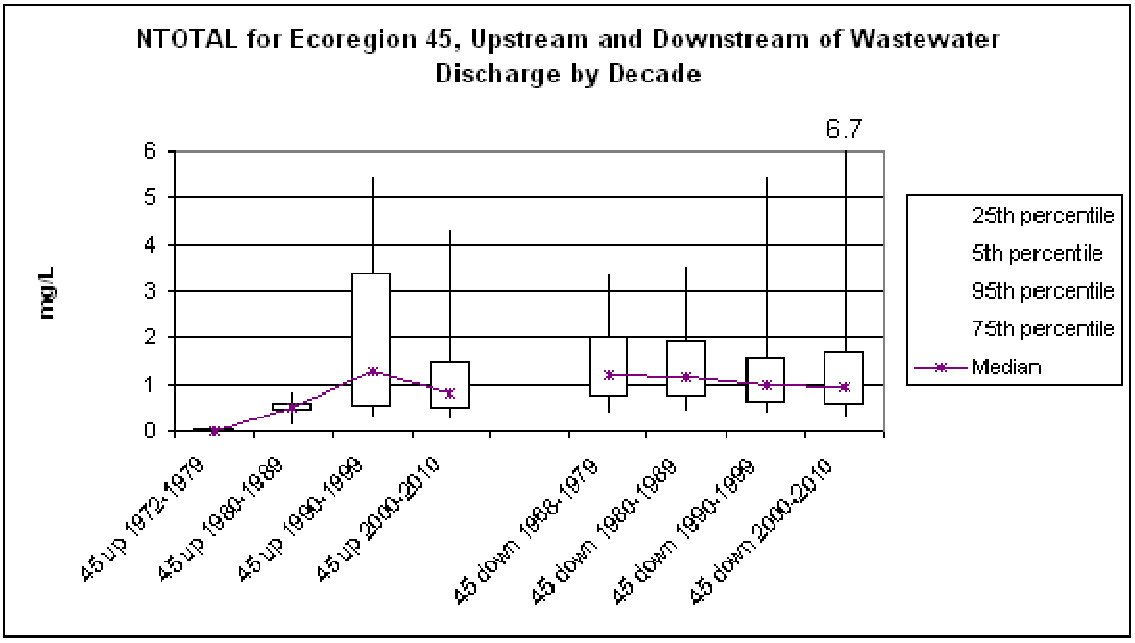
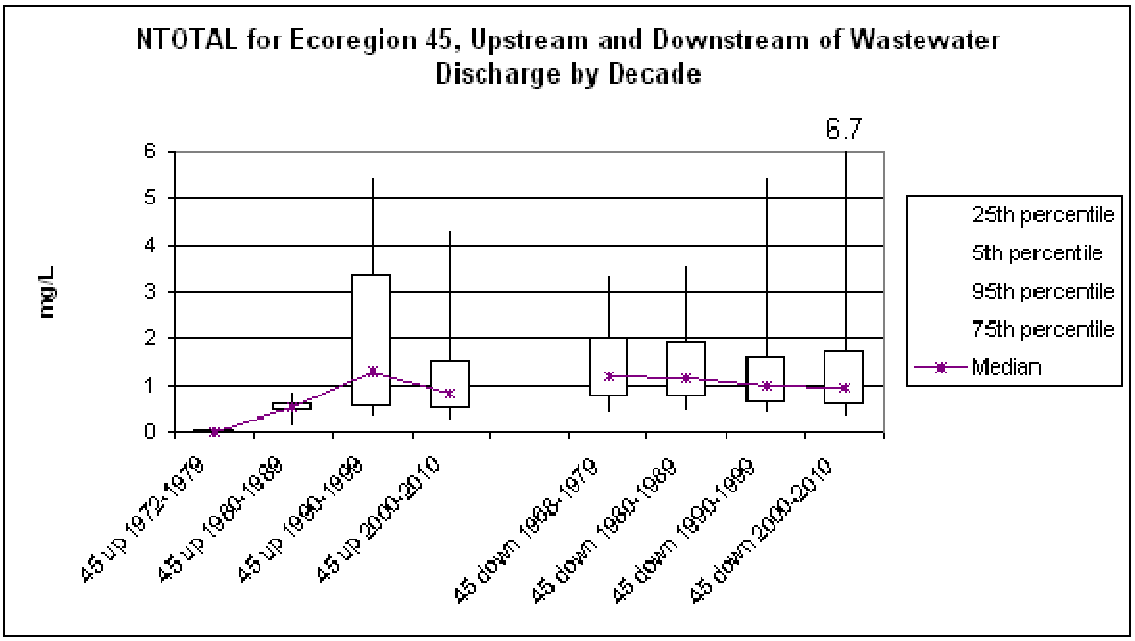
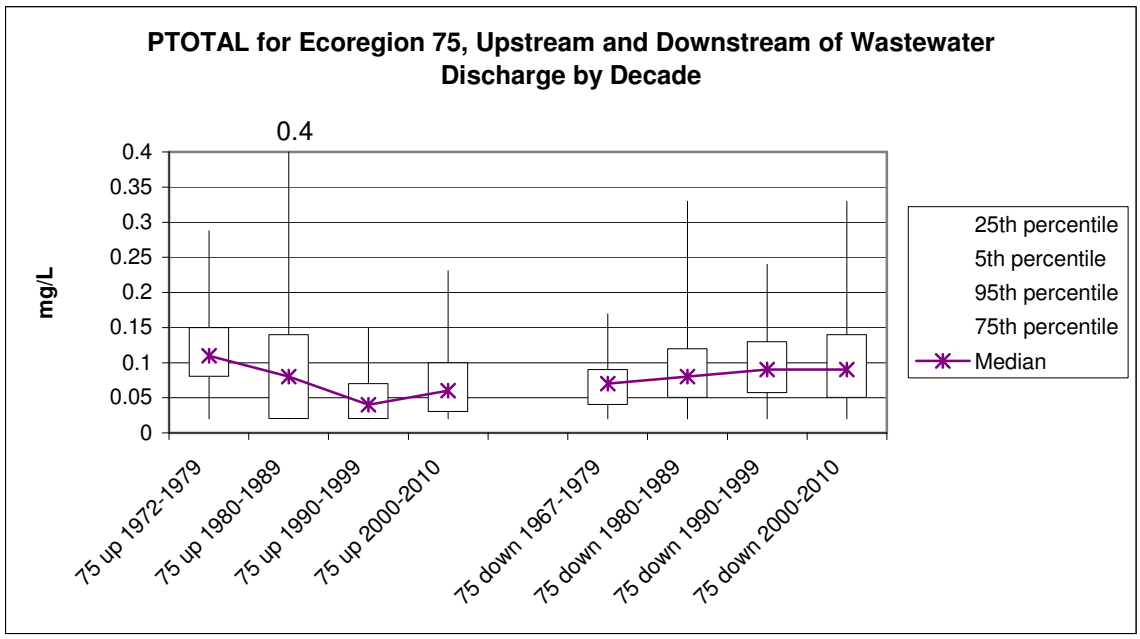
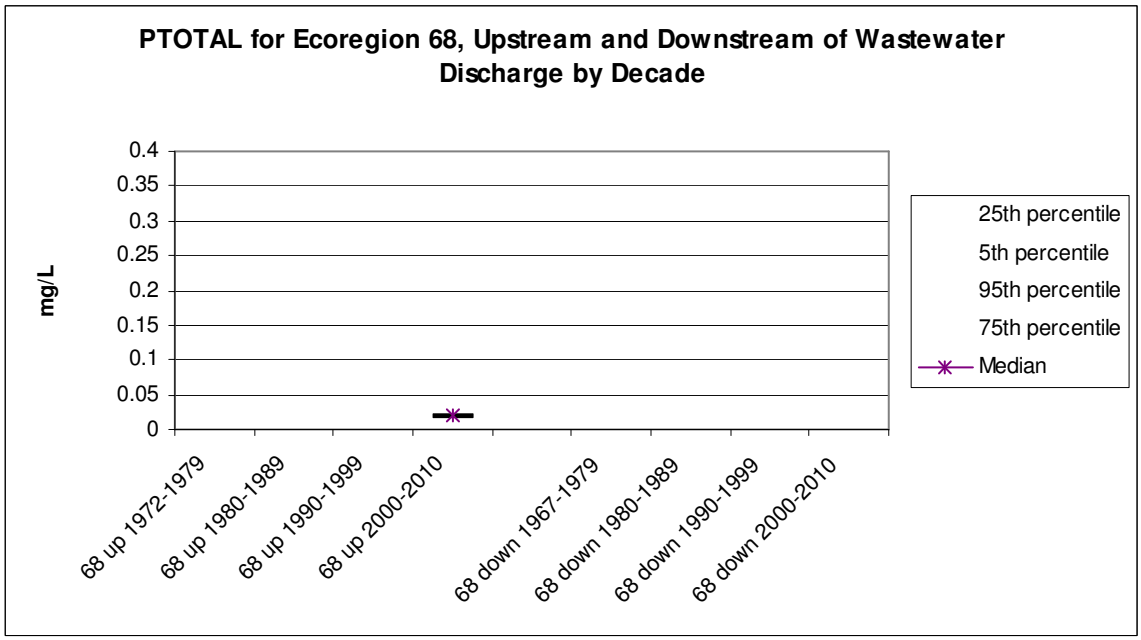

NTOTAL for Ecoregion 65, Upstream and Downstream of Wastewater Discharge by Decade
mg/L
6
5
4
3
2
1
0
65 up 1972-1979
65 up 1980-1989
65 up 1990-1999
65 up 2000-2010
65 down 1972-1979
65 down 1980-1989
65 down 1990-1999
65 down 2000-2010
25th percentile
5th percentile
95th percentile
75th percentile
Median


NTOTAL for Ecoregion 45, Upstream and Downstream of Wastewater Discharge by Decade
6.7
mg/L
0
1
2
3
4
5
6
45 up 1972-1979
45 up 1980-1989
45 up 1990-1999
45 up 2000-2010
45 down 1968-1979
45 down 1980-1989
45 down 1990-1999
45 down 2000-2010
25th percentile
5th percentile
95th percentile
75th percentile
Median


NTOTAL for Ecoregion 45, Upstream and Downstream of Wastewater Discharge by Decade
6.7
mg/L
0
1
2
3
4
5
6
45 up 1972-1979
45 up 1980-1989
45 up 1990-1999
45 up 2000-2010
45 down 1968-1979
45 down 1980-1989
45 down 1990-1999
45 down 2000-2010
25th percentile
5th percentile
95th percentile
75th percentile
Median


NTOTAL for Ecoregion 45, Upstream and Downstream of Wastewater Discharge by Decade
6.7
mg/L
0
1
2
3
4
5
6
45 up 1972-1979
45 up 1980-1989
45 up 1990-1999
45 up 2000-2010
45 down 1968-1979
45 down 1980-1989
45 down 1990-1999
45 down 2000-2010
25th percentile
5th percentile
95th percentile
75th percentile
Median





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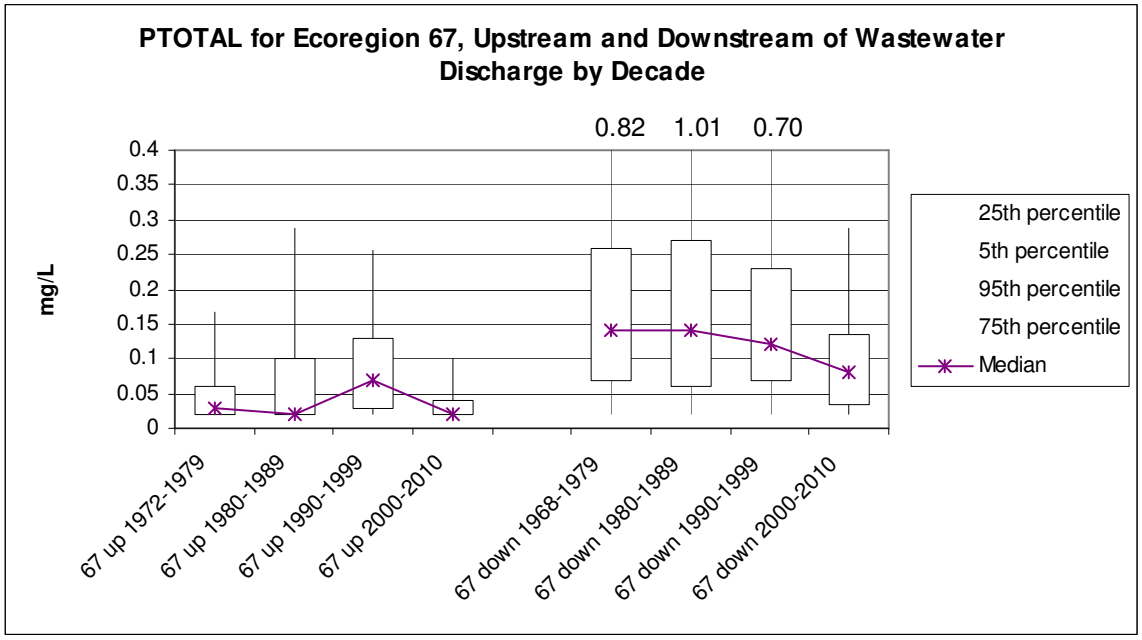

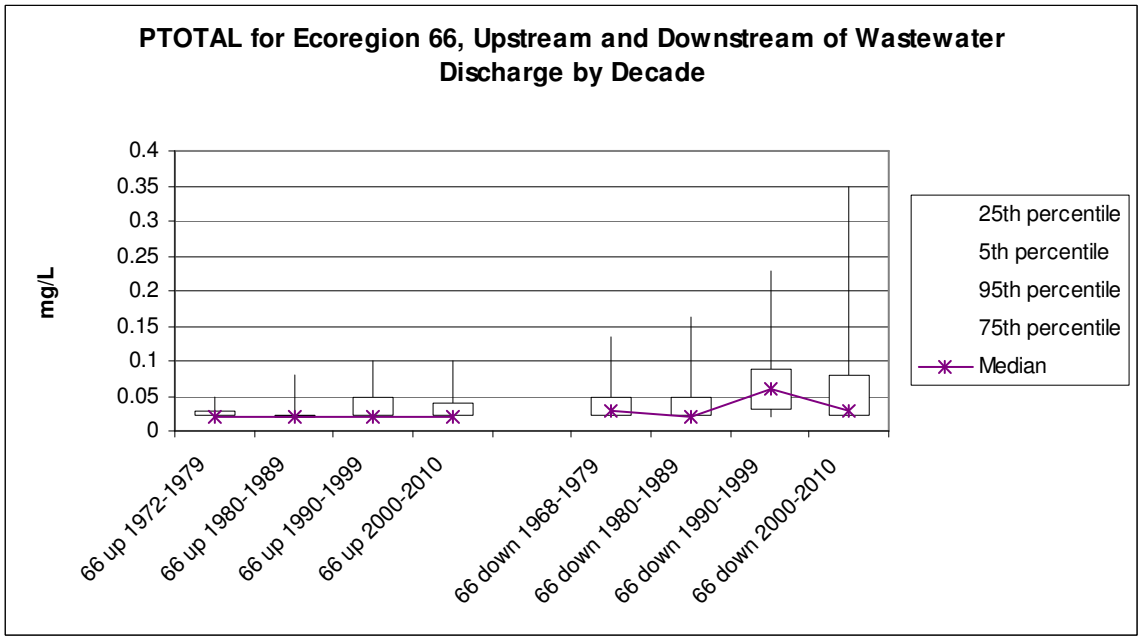

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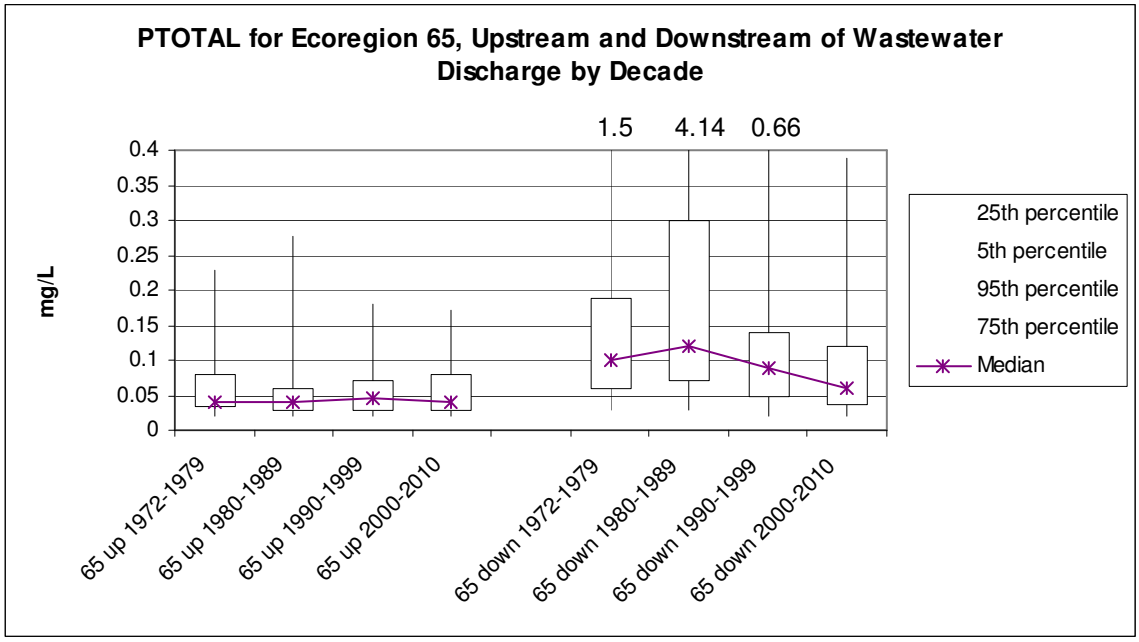

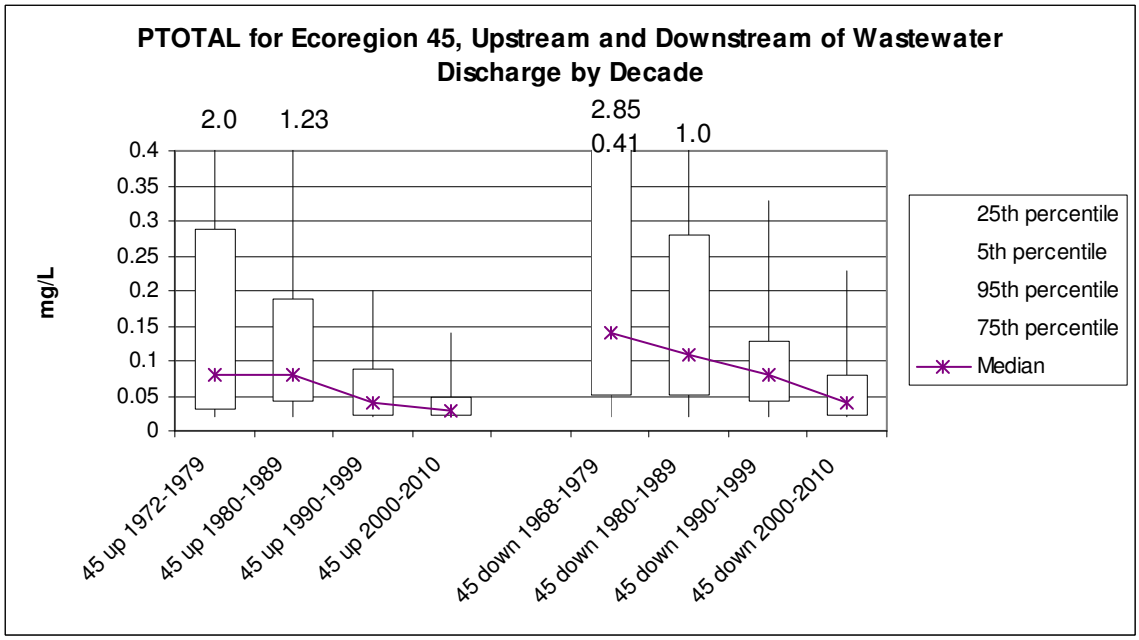

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Appendix C
Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution

From Nancy K. Stoner Nutrient Memo
EPA Acting Assistant Administrator
March 16, 2011

Working in Partnership with States to Address Phosphorus and Nitrogen Pollution through Use of a Framework for State Nutrient Reductions

Recommended Elements of a State Framework for Managing Nitrogen and Phosphorus Pollution

1. Prioritize watersheds on a statewide basis for nitrogen and phosphorus loading reductions. A. Use best available information to estimate Nitrogen (N) & Phosphorus (P) loadings delivered to rivers, streams, lakes, reservoirs, etc. in all major watersheds across the state on a Hydrologic Unit Code (HUC) 8 watershed scale or smaller watershed (or a comparable basis.) B. Identify major watersheds that individually or collectively account for a substantial portion of loads (e.g. 80 percent) delivered from urban and/or agriculture sources to waters in a state or directly delivered to multi-jurisdictional waters. C. Within each major watershed that has been identified as accounting for the substantial portion of the load, identify targeted/priority sub-watersheds on a HUC 12 or similar scale to implement targeted N & P load reduction activities. Prioritization of sub-watersheds should reflect an evaluation of receiving water problems, public and private drinking water supply impacts, N & P loadings, opportunity to address high-risk N & P problems, or other related factors.

2. Set watershed load reduction goals based upon best available information. Establish numeric goals for loading reductions for each targeted/priority sub-watershed (HUC 12 or similar scale) that will collectively reduce the majority of N & P loads from the HUC 8 major watersheds. Goals should be based upon best available physical, chemical, biological, and treatment/control information from local, state, and federal monitoring, guidance, and assistance activities including implementation of agriculture conservation practices, source water assessment evaluations, watershed planning activities, water quality assessment activities, Total Maximum Daily Loads (TMDL) implementation, and National Pollutant Discharge Elimination System (NPDES) permitting reviews.

3. Ensure effectiveness of point source permits in targeted/priority sub-watersheds. A. Identify Municipal and Industrial Wastewater Treatment Facilities that contribute to significant measurable N & P loadings; B. All Concentrated Animal Feeding Operations (CAFOs) that discharge or propose to discharge; and/or C. Urban Stormwater sources that discharge into N & P-impaired waters or are otherwise identified as a significant source.

4. Agricultural Areas. In partnership with Federal and State Agricultural partners, NGOs, private sector partners, landowners, and other stakeholders, develop watershed-scale plans that target the most effective practices where they are needed most. Look for opportunities to include innovative approaches, such as targeted stewardship incentives, certainty agreements, and N & P markets, to accelerate adoption of agricultural conservation practices. Also, incorporate lessons learned from other successful agricultural initiatives in other parts of the country.

5. Storm water and Septic systems. Identify how the State will use state, county and local government tools to assure N and P reductions from developed communities not covered by the Municipal Separate Storm Sewer Systems (MS4) program, including an evaluation of minimum criteria for septic systems, use of low impact development/ green infrastructure approaches, and/or limits on phosphorus in detergents and lawn fertilizers.

6. Accountability and verification measures. A. Identify where and how each of the tools identified in sections 3, 4 and 5will be used within targeted/priority sub-watersheds to assure reductions will occur. B. Verify that load reduction practices are in place. C. To assess/demonstrate progress in implementing and maintaining management activities and achieving load reductions goals: establish a baseline of existing N & P loads and current Best Management Practices (BMP) implementation in each targeted/priority sub-watershed, conduct ongoing sampling and analysis to provide regular seasonal measurements of N & P loads leaving the watershed, and provide a description and confirmation of the degree of additional BMP implementation and maintenance activities.

7. Annual public reporting of implementation activities and biannual reporting of load reductions and environmental impacts associated with each management activity in targeted watersheds. A. Establish a process to annually report for each targeted/priority sub-watershed: status, challenges, and progress toward meeting N & P loading reduction goals, as well as specific activities the state has implemented to reduce N & P loads such as: reducing identified practices that result in excess N & P runoff and documenting and verifying implementation and maintenance of source-specific best management practices. B. Share annual report publically on the state's website with request for comments and feedback for an adaptive management approach to improve implementation, strengthen collaborative local, county, state, and federal partnerships, and identify additional opportunities for accelerating cost effective N & P load reductions.

8. Develop work plan and schedule for numeric criteria development. Establish a work plan and phased schedule for N and P criteria development for classes of waters (e.g., lakes and reservoirs, or rivers and streams). The work plan and schedule should contain interim milestones including but not limited to data collection, data analysis, criteria proposal, and criteria adoption consistent with the Clean Water Act. A reasonable timetable would include developing numeric N and P criteria for at least one class of waters within the state (e.g., lakes and reservoirs, or rivers and streams) within 3-5 years (reflecting water quality and permit review cycles), and completion of criteria development in accordance with a robust, state-specific workplan and phased schedule.