

NUTRIENT CRITERIA DEVELOPMENT PLAN

FOR THE COMMONWEALTH OF VIRGINIA

MARCH 24, 2004

All 2006 & 2008 Updates Provided in Italics

With 2010 Updates

All 2010 Updates Provided in Underlined Italics

DEPARTMENT OF ENVIRONMENTAL QUALITY

WATER DIVISION

OFFICE OF WATER QUALITY PROGRAMS

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PURPOSE

This plan is intended to provide a framework for developing nutrient water quality standards for the Commonwealth of Virginia. The document has been prepared by the Department of Environmental Quality (DEQ) in response to guidance issued by the United States Environmental Protection Agency (EPA). Although this state nutrient criteria development plan is optional, EPA encouraged the States to submit a plan by October 31, 2002 in order to assure EPA of the State's intent to develop nutrient criteria.

In this plan DEQ explains its intent to develop state specific criteria rather than adopt the EPA published national 304(a) nutrient criteria and outlines the work to be performed, status of data analysis, options for criteria development, and time schedule for developing and adopting nutrient criteria into the Virginia water quality standards regulation.

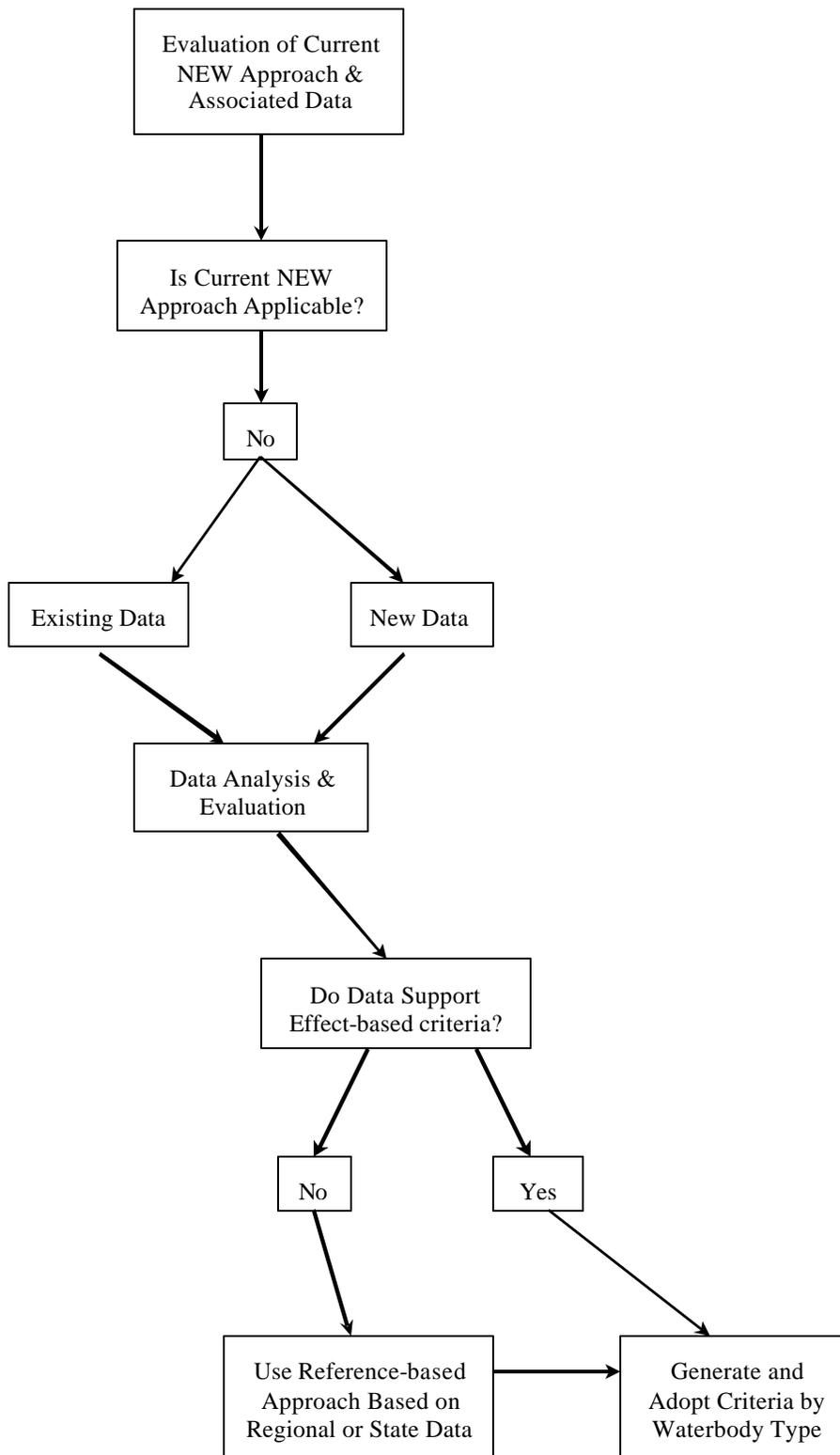
The information in this plan is preliminary and will be subject to revision as the DEQ, EPA, stakeholders and the general public review the Commonwealth's criteria development. EPA Region III will review the initial plan submission and advise the state if changes are needed. Once a mutually acceptable version of the plan is completed, EPA will public notice the State plan in the Federal Register. EPA will then use the plan to track the State's progress in nutrient criteria development. If the State keeps to the schedule contained in the Plan EPA should not have to promulgate nutrient criteria for the State.

Update 2006: The most recent plan was approved in March 2004. This March 2006 submission represents an update to that plan since the VA DEQ has completed many of the milestones; therefore an update is necessary to reflect those accomplishments.

Update 2008: The March 2006 update to the plan was accepted by EPA in September 2006. This 2008 submission represents an update to that plan since EPA approved lake nutrient criteria are now in effect in Virginia and the timelines for nutrient criteria development for rivers and streams have been updated to reflect the EPA funded opportunity for Virginia to pilot a nutrient screening protocol.

Update 2010: The 2008 update to the plan was accepted by EPA in August 2008. This 2010 submission represents an update to that plan because the timelines for nutrient criteria development for rivers and streams have been revised to reflect past and ongoing activities related to investigations in Virginia to develop a nutrient screening protocol for wadeable and non-wadeable streams and rivers.

General Schematic of Virginia Proposed Plan:



APPROACH

Preferred: Effect-based criteria will be considered as well as other options, including the development of nutrient criteria that reflect localized conditions and protect specific designated uses utilizing processes outlined in the EPA Technical Guidance Manuals (USEPA 2000 - 2001) or other scientifically defensible methods and appropriate water quality data (such as the current collaborative effort to develop nutrient criteria for the Chesapeake Bay).

This effort will also involve an evaluation of the applicability of Virginia's current regulatory program (Nutrient Enriched Waters) for controlling nutrients in state surface waters by water body type (estuaries, lakes and reservoirs, rivers and streams). Appendices A through E describe Virginia's regulatory designations of these Nutrient Enriched Waters. Designations are based upon an evaluation of local water quality data for one or more indicators of nutrient enrichment (chlorophyll a, total phosphorus and dissolved oxygen fluctuations); the waters are protected from further enrichment by a companion regulation for control of total phosphorus from point sources. This evaluation will consider expansion of the existing State approach to include designations of additional waters experiencing nutrient enriched problems and to address such issues as total nitrogen, watersheds and non-point sources.

If the concept of Nutrient Enriched Waters is not incorporated into the final approach selected by the State, a plan will have to be developed to transition from the existing regulatory Nutrient Enriched Waters listings to the new regulatory approach by sequentially deleting currently designated Nutrient Enriched Waters as the Commonwealth adopts nutrient criteria for those waters.

Fall-back: Reference condition-based criteria refined for Virginia from either the EPA Region III regional database or Virginia STORET database at ecoregion Level IV supplemented with new 2000-2002 Virginia CEDS monitoring data. Virginia may consider the choice of a percentile other than those suggested in 304(a) criteria documents and technical guidance manuals.

FORM

Instead of using the default 304(a) criteria for nutrients (either as numeric criteria or as a translator for narrative criteria) for rivers and lakes which were based on broad national aggregate ecoregion level 3 data, the State prefers to develop wherever possible, nutrient criteria that reflect localized conditions and protect specific designated uses utilizing processes outlined in the technical guidance manuals or other scientifically defensible methods and appropriate water quality data. Virginia and other States in EPA Region III are finding the 304(a) nutrient criteria to be too "broad brushed" to be applicable to these water body types in the individual states and think subregionalization or subclassification below the board ecoregion Level 3 is needed because of these heterogeneity issues. Therefore, Virginia and other EPA Region III states within the EPA Region III Regional Technical Assistance Group (RTAG) are working with EPA staff and their contractors on the development of a region specific database for rivers and lakes. However, before Virginia proceeds with using the EPA or State database for refining reference condition based criteria for lakes and rivers in Virginia, we would like to have the

benefit of the peer review comments on the 304(a) nutrient criteria and EPA's response to these comments. Virginia is also participating with other Chesapeake Bay states and EPA in the effort described below to develop Chesapeake Bay-specific nutrient criteria.

The parameters for which Virginia will set criteria will be water body type specific and in situations where the Commonwealth shares waters with another state, consideration will be given to consistency in parameter choice with the neighboring state.

Estuaries. Virginia is involved in the States/EPA collaborative effort (See Appendix F) to develop Chesapeake Bay-specific designated uses and associated numeric water quality criteria for dissolved oxygen, water clarity and chlorophyll *a* (response variables). Once EPA publishes the criteria (expected in April 2003), the State will consider the criteria and other scientific and technical support information before initiating the rulemaking to adopt appropriate uses and criteria for the Chesapeake Bay and its tidal tributaries.

*Update 2006: These EPA criteria were published in 2003 with Addendums in 2004. These criteria have been adopted by Virginia and approved by EPA in June 2005. Virginia has two state-specific issues related to the Chesapeake Bay that were adopted by the Virginia Water Control Board which became effective in January 2006. These 2006 revisions included site-specific criteria for numerical chlorophyll *a* criteria in the James River and dissolved oxygen criteria for the Mattaponi and Pamunkey Rivers. This completes the Bay related nutrient criteria process.*

Update 2010: Dialogue has begun between VA, MD, and EPA regarding nutrient criteria development for Chincoteague Bay, an Eastern Shore oceanside estuary shared with Maryland. Discussion has centered on the availability and extent of VA nutrient-related data for the water body as well as past and ongoing nutrient investigations by MD Dept. of Natural Resources Coastal Bay Program.

Evaluation of Historical Approach. Prior to proceeding with development of quantitative criteria for causal (nitrogen and phosphorus) and response (chlorophyll *a* and water clarity -Secchi depth or turbidity) variables for water body types in Virginia other than the Chesapeake Bay estuary, the State will first evaluate the applicability of its current Nutrient Enriched Waters approach. This approach to the control of nutrient enrichment (Appendix E) is based on recommendations from a Technical Advisory Committee (TAC). The TAC was composed of 19 national and regional experts and formed in 1987 to advise the State staff on how to best deal in a regulatory framework with nutrient enrichment in VA waters including the Chesapeake Bay. The experts advised staff that criteria values for total phosphorus and total nitrogen were not appropriate criteria for all waters and regions of the state. Rather, the experts recommended that Virginia use response variables (25 ug/l chlorophyll *a* and dissolved oxygen fluctuations) and total phosphorus for specific water body types and recommended that the state not use total nitrogen as an indicator of nutrient enrichment.

Update 2006: In implementing this plan, the agency will continue to evaluate this Nutrient Enriched Waters historical approach to control nutrient enrichment as each water body type's nutrient criteria progressed through the rulemaking process. This evaluation resulted in

the decision to eliminate Nutrient Enriched Waters designations for the Bay and its tidal tributary waters. This deletion is effective for the tidal waters; however the lakes nutrient enriched waters deletions are only proposed and still subject to agency and public evaluation.

Update 2008: Although the four lakes (Smith Mountain Lake, Lake Chesdin, South Fork Rivanna Reservoir, and Claytor Lake) listed as nutrient enriched waters were initially proposed for deletion as part of the lake and reservoir nutrient criteria rulemaking process, in the final adopted version of the amendments, these four lakes were retained in response to a recommendation received during the public comment period to retain the Nutrient Enriched Waters designations for these four lakes because of the historical protection from nutrient enrichment that the companion Nutrient Policy has provided by requiring a monthly average total phosphorus effluent limit of 2 mg/L for point source discharges over a certain flow. Therefore, the proposed deletion of the Nutrient Enriched Waters designation for the four lakes was removed from the final proposal that was adopted and became effective in August, 2007. Subsequent to this rulemaking, the lakes in the Chesapeake Bay drainage (Lake Chesdin and South Fork Rivanna Reservoir) have been proposed for deletion in the triennial review amendments to the water quality standards regulation; this rulemaking is scheduled to become effective in 2009.

Update 2010: Triennial Review amendments regarding the above-mentioned Nutrient Enriched Waters (NEW) standards were approved by the VA State Water Control Board and sent to EPA in April 2009. EPA approval of deleting Lake Chesdin and South Fork Rivanna Reservoir from the NEW section was received on January 5, 2010.

Demonstrate Where Criteria Not Needed. The State also intends to direct some effort toward generating the data needed to support a decision to not adopt one or more of the criteria (such as total nitrogen in phosphorus limited lakes and other waters). This will be accomplished by the development from the state CEDS database TN/TP ratios for representative lakes, streams and rivers in each river basin as well as evaluation of several published reports on limiting nutrients in Virginia waters. The reports utilized will include – but not be limited to - USGS publications, bulletins from the Virginia Water Resources Research Center (Sherrard and Hoyle, 1977; Beaty and Parker, circa 1993), and algal growth potential bioassay data for selected lakes summarized in a 1982 report on EPA Clean Lakes Program funded monitoring and research in publicly accessible lakes and reservoirs in Virginia (SWCB, 1982). The Commonwealth will also evaluate existing monitoring data and consider as an option the establishment of criteria at ambient total nitrogen concentrations in freshwater rivers and streams if it can be demonstrated that these levels do not interfere with designated uses and do not contribute to an exceedence of a downstream criterion. The Commonwealth will start with criteria development in the estuary and work its way upstream so appropriate criteria will have already been established downstream.

Lakes and Reservoirs: The state will initially consider response variables such as chlorophyll "a," and a measure of water clarity (e.g. Secchi depth or photometer) for lakes and reservoirs as well as causal variables (total phosphorus but probably not total nitrogen). In lake waters that experience dissolved oxygen deficiency, dissolved oxygen may be added as a response variable. As part of this standards setting effort, the state will attempt to demonstrate via use attainability studies that in deepwater reservoirs and lakes some phosphorus enrichment

may be consistent with a particular game fishery designated use. Use attainability analyses will likely also be useful for lakes that are unable to meet water quality standards due to flushing rate, depth stratification, internal nutrient recycling, or high watershed-area-to-lake-volume ratios. A model may be utilized to determine whether total phosphorus and dissolved oxygen parameters adequately protect a deep reservoir or lake's designated uses and chlorophyll a or secchi disk depth is not required as an independent criterion. VA DEQ plans to consider in the data evaluation phase seasonality and uses, especially for chlorophyll, as well as narrative regulatory translators expressed as percentages or other statistical factors or ratios. The State will calculate Carlson (1977) trophic state indices for the various parameters (total phosphorus, chlorophyll a and Secchi depth) at reference condition lakes and determine if there are redundant measures that can be eliminated for certain lake types or conditions or seasons.

Update 2006: All of the above has been completed and the state has proposed chlorophyll a and total phosphorus criteria for lakes and reservoirs. The Notice of Public Comment and Hearing for these amendments was published in January 2006.

Update 2008: These criteria were adopted in 2006 and effective in August 2007. See Appendix N (2010 update: revised and renamed Appendix M).

Rivers and streams: The state will initially consider response variables such as chlorophyll a and turbidity for rivers and streams and causal variables (nitrogen and phosphorus) but also possibly consider a combined index for those variables appropriate at the ecoregion level. For plankton as well as periphyton (diatoms and other attached algae) dominated streams, an attempt will be made – if the Commonwealth identifies a source of funding for conducting the work in-house or obtains ecosystem specific data from nearby states – to construct quantitative relationships among nutrient criteria parameters such as total nitrogen and total phosphorus and parameters that are more directly related to or descriptive of the particular designated uses (possibly multivariate regression analysis to determine the threshold level of phosphorus and other parameters - such as sediment and flow - and an index of biological integrity developed from algal community survey data). As part of the effort to select appropriate criteria, the agency will also consider the percentage of wetted stream perimeter coverage of macrophytes as a potential criterion of nutrient enrichment.

Update 2006: The state has received the December 2005 draft AAC report which considers the use of downstream loading impacts and localized effects in wadeable and non wadeable streams. DEQ staff will continue to work with the AAC in the coming months to finalize the technical approach that will be used to develop the nutrient criteria for streams and rivers and determine whether the basis for the criteria will require additional data collection in or whether the criteria can be based on the scientific literature and studies completed in other areas of the country. Depending upon the technical approach used, the final adoption date for the criteria could range from 2008 to later in 2009 (See Appendix M; Update 2010: timeline revised and renamed Appendices N1 & N2). These issues are addressed in the Fiscal Year 2006 Work Plan of the Academic Advisory Committee for freshwater nutrient criteria and the December 2005 Draft Report of the VA Academic Advisory to the VA Department of Environmental Quality: Freshwater Nutrient Criteria for Rivers and Streams (Appendix O and P; replaced with FY 2010 Work Plan & FY 2009 Final Report).

Update 2010: DEQ staff has continued to work with the AAC; Appendix 0 has been updated to contain the current Fiscal Year 2010 Work Plan of the Academic Advisory Committee for freshwater nutrient criteria. The DEQ website at (<http://www.deq.virginia.gov/wqs/rule.html#NUT2>) contains several reports from 2004 – 2009 providing AAC analysis and recommendations for development of nutrient criteria for both wadeable and non-wadeable freshwater streams and rivers. The fiscal year 2009 year-end AAC reports provide analysis and recommendations for wadeable and non-wadeable nutrient criteria development (Appendix P).

Wadeable Streams

The AAC recommended that nutrient criteria for freshwater wadeable streams be defined using a unique approach, termed the “screening value approach” (AAC 2006). This approach employs a series of monitoring procedures to determine whether the amount of nutrients in a water body allows it to support the aquatic-life use. The first stage of the screening-value approach to water-quality assessment for nutrient effects, as recommended by the AAC (2006), would employ two sets of thresholds for nitrogen (N) and phosphorus (P):

- Screening Value(s): Streams with nutrient concentrations below the screening value(s) are assessed as “not impaired by nutrients.”
- Critical Value(s): Streams with nutrient concentrations above the critical value(s) are assessed as “impaired.”

Streams that cannot be assessed using the screening or critical values would be visually assessed. If a stream’s nutrient concentrations do not allow assessment using the screening or critical values, and if the visual assessment is inconclusive, a benthic-macroinvertebrate assessment would be employed to assess the stream.

Working within the context described above, the Virginia DEQ and the AAC conducted a trial run (Pilot Program) of a screening-value approach for nutrient criteria in wadeable, freshwater streams of Virginia’s Mountain and Piedmont regions (located within EPA’s Aggregate Nutrient Ecoregions XI and IX, respectively). The initial sample schedule for the Pilot Program called for DEQ biologists to begin sampling in Fall 2007 and concluding after the Spring 2008 sample season. However, administrative procedures associated with an EPA grant application had not yet been completed by that date so the initial sampling was delayed until Spring 2008. Sampling for the Pilot Program was concluded in November 2008. The grant was necessary to fund sample analysis. The project described in this document was supported by Grant/Cooperative Agreement Number 08HQGR0004 from the USGS; the funding originated from U.S. EPA Region 3. John Schefter and Kimberly Dove of the USGS facilitated the interagency transfer of funding.

The trial run and subsequent data analysis attempted to determine critical and screening values that discriminate impairment status with high levels of statistical confidence.

- Critical Value-TN and/or TP concentration above which the probability of impairment by nutrients is high
- Screening Value-TN and/or TP concentration below which the probability of impairment by nutrients is low

Pilot Program results did not suggest screening values. In addition, the critical values suggested by the program results would be sufficient to assess only a very small number of monitoring sites because they are at the extreme upper end of the distribution of nutrient concentrations that occur in Virginia streams. The AAC submitted a report in June 2009 titled “A Screening Value Approach to Nutrient Criteria Development for Wadeable Streams in the Mountains and Piedmont of Virginia: July 2008-June 2009 Activities (Appendix P). Analysis of 2008 Pilot Program data was inconclusive regarding determination of TN & TP screening & critical values.

The 2001-2006 probabilistic-monitoring data were used for an exploratory analysis, and its results were considered for illustrative purposes only. The results of the analysis indicate that the technique employed shows promise as a potential mechanism for deriving screening values. However, as with the pilot program, the critical values suggested would be sufficient to assess only a very small number of sites because they are at the extreme upper end of the distribution of nutrient concentrations found in Virginia streams.

The focus in FY 2010 for wadeable streams and rivers is to further develop the nutrient criteria screening value including the definition of screening and critical values and an analysis of potential effects of nutrient criteria implementation on DEQ water monitoring resources if the Screening Value approach is to be used. Visual assessment field sheets for regularly scheduled 2009 fall season benthic monitoring sites have been submitted to the AAC for inclusion in their analysis. Use of visual assessment sheets will continue for the spring 2010 season but corresponding benthic data will not be available for analysis until late 2010. This project should be completed in fiscal year 2011 and, if the end product successfully identifies potential criteria thresholds that are scientifically and legally defensible for establishing nutrient criteria for wadeable streams, DEQ could expect to start the regulatory process for wadeable streams towards the end of 2011. The regulatory process to adopt amendments to the water quality standards regulation takes 18 – 24 months; the updated timeline for wadeable streams in Appendix N1 shows a completion date of 2014.

Non-Wadeable Streams & Rivers

The AAC reasoned that fish community structure may be a useful diagnostic of nutrient-related effects in larger non-wadeable rivers, which are typically too large for standard benthic macroinvertebrate sampling protocols. A preliminary analysis was proposed, using existing data, to determine whether statistically significant relationship(s) exist among a limited suite of variables representing nutrient conditions and fish community structure, and at broad geospatial scales. If such a relationship can be demonstrated, based on analyses with archival data alone, additional future analyses and targeted database development may support the establishment and validation of ecologically-based, and scientifically defensible, numeric nutrient criteria for larger (i.e., non-wadeable) lotic ecosystems.

A report from the AAC was submitted May 21, 2009 titled “Development of Freshwater Nutrient Criteria for Non-Wadeable Streams in Virginia: Fish Community Assessment, Phase II” (Appendix P). This report identified statistically significant relationships among TN,

chlorophyll-a, and to a lesser degree TP, and fish community-based stream health metrics using an expanded database (n=35,000 records, DEQ ambient monitoring) of all Chesapeake basin watersheds (6th order HUCs) in Virginia. Some of these relationships were relatively strong predictors of both healthy and degraded stream assemblages and might reasonably serve as the basis for establishing biologically valid nutrient criteria. Specifically, fish community metrics were strongly and negatively correlated with TN and Chl-a concentrations in 77 acknowledged non-wadeable streams. Differences did exist between responses of coastal versus non-coastal stream fish assemblages to nutrient and trophic status, but the geographic differentiation may not warrant separate nutrient criteria for streams. The study identified the potential for conservative criteria thresholds for the protection of high quality non-wadeable streams/ rivers as follows: TN < 2.0 mg/L and Chl-a < 0.88 µg/L. At this time, criteria based on TP may not be warranted.

The focus of work in FY 2010 for non-wadeable freshwater streams and rivers is to:

- a) explore documented differences between responses of coastal versus non-coastal stream fish assemblages to nutrient and trophic status to evaluate whether or not the geographic differentiation warrants separate nutrient criteria for coastal versus non-coastal streams and rivers;
- b) expand the limited, existing paired database for non-wadeable streams and rivers through additional data mining and GIS analysis and attempt to refine proposed nutrient criteria for TN and Chl-a based on this expanded coverage, and;
- c) assist with the development of a formal proposal to EPA Region III for funding that could leverage ongoing fieldwork (e.g DEQ's ProbMon Program) and develop a separate and synoptic database of nutrient and fish community metrics for validating proposed nutrient criteria for non-wadeable streams in Virginia.

It is expected that the above activities, in addition to others identified during the above outlined process, may continue through fiscal year 2011. If these further investigations provide scientific and legally defensible basis for nutrient criteria for non-wadeable streams, DEQ could expect to start the regulatory process for non-wadeable streams in 2012. The regulatory process to adopt amendments to the water quality standards regulation takes 18 – 24 months; the updated timeline for non-wadeable freshwater streams and rivers in Appendix N2 shows a completion date in 2014.

PROCESS

State Staffing and Resource Needs. Considerable multi-state and federal resources as well as in-house DEQ Chesapeake Bay Program staff were utilized over a two year period in the development of Chesapeake Bay specific nutrient criteria, but similar resources are unavailable for nutrient criteria development for other water body types within the Commonwealth. DEQ technical staff resources (2.5 full time equivalents) within the water quality standards program are insufficient to concurrently handle the Chesapeake Bay rulemakings as well as the technical criteria development and rulemakings for lakes and rivers and triennial review and exceptional state waters (ONRW) rulemakings. There is no state or identified federal sources of funding available to hire additional full time or temporary wage employees to assist in this effort. Therefore, criteria development in Virginia out of necessity will be a phased two step process for

each water body type as described in the section on prioritization and coverage so as to accomplish these tasks with existing staff resources. Although the Commonwealth has experienced significant budget reductions brought on by declining revenues, the Water Quality Standards and Biological Monitoring unit within the Office of Water Quality Programs (which has the responsibility for developing these criteria) has sought an alternative state source of funding for analysis of a portion of their fish tissue and sediment samples so that they can divert \$19,000 of their contractual skilled support services this fiscal year and \$22,000 next fiscal year to fund the work of a State Code mandated Academic Advisory Committee (AAC). Virginia DEQ is seeking sources of funding for data collection and analysis. Staff – in consultation with other EPA Region III states – has identified the need for monitoring data to explore an effects based approach for developing appropriate nutrient criteria for periphyton dominated streams (USEPA, 1999). If Maryland is successful in obtaining funding for such a proposed Region wide study, DEQ will utilize regional or central office staff to collect the required samples in Virginia. A biological monitoring program coordinator position was recently created within the standards and biological monitoring unit and it is anticipated that this individual plus some time freed for an existing position by transferring the biomonitoring coordination function to this new position will provide some additional staff resources to assist in this effort. If this Maryland project does not materialize, Virginia DEQ will have to either rely on data from the states of West Virginia and Kentucky for shared ecoregions or literature values. An in-house project team consisting of representatives from the standards and water permitting staff will be formed to ensure that, concurrent with the rulemakings, implementation guidance is developed for consistent application of the nutrient criteria to VPDES permitted facilities.

Update 2010: The Water Quality Standards and Biological Monitoring unit is now the Water Quality Standards unit as oversight of biological monitoring has been assimilated into Water Quality Monitoring & Assessments. DEQ technical staff resources within the water quality standards program has diminished from 2.5 full time equivalents to two. There are still no state or identified federal sources of funding available to hire additional full time or temporary wage employees to assist in technical criteria development and rulemakings for nutrient criteria or other unrelated, concurrent water quality standards issues (cadmium and lead criteria updates, public water supply designations, and exceptional state waters designation petitions).

Administrative Procedures Necessary for Plan Implementation. Once the technical development phase of the nutrient criteria setting process is completed in Virginia, DEQ staff must initiate a rulemaking process with concurrent implementation guidance development. Any amendments which the DEQ makes to the Virginia water quality standards regulation must conform to the agency Public Participation Guidelines (Appendix G) and the State Administrative Process Act (Appendix H). Included in this process is an economic analysis conducted by the Department of Planning and Budget; the economic impact on permittees would be part of this evaluation. The State rulemaking administrative process normally takes two years from the agency drafting of a notice of intended regulatory action (NOIRA). A generic rulemaking timeline is provided in Appendix I.

Involvement of Critical Decision-Makers. Recommendations based on input from an academic advisory committee, in-house DEQ technical staff and management, and a stakeholder

workgroup – as well as public comment and staff response to that comment – will be provided to the State Water Control Board (Board). This seven-member citizen member board appointed by the Governor has the statutory authority to adopt and modify regulations, including the water quality standards. Board members will also run the public hearings for the various water body specific nutrient criteria rulemakings.

Public Participation and Stakeholder Involvement. Prior to submission of this plan to EPA, DEQ presented the plan for comment and review at a public noticed stakeholders meeting held in Richmond at the DEQ central office on October 22, 2002. DEQ also filed a notice in the Virginia Register for November 4, 2002 publication to provide for a 30 day public comment period on the plan posted on the DEQ Web site at <http://www.deq.virginia.gov/wqs/rule.html#NUT2>. DEQ intends to submit a revised plan to EPA fifteen days after the close of the comment period to include appropriate changes based on public comment.

During the criteria development phase, the State will rely on technical advice/expert opinion from in-house technical staff and an Academic Advisory Committee (with the addition of fishery scientists) which was formed by the Virginia Water Resources Research Center to provide advice on water monitoring and assessment issues as mandated by amendments to the State Code. A separate general stakeholders group composed of environmentalists, industrial, municipal wastewater and other interested parties will meet with DEQ staff at periodic (semiannual or quarterly) meetings to be advised of the efforts of the AAC and agency staff and to be consulted on these efforts. This group will assist in issues related to implementation of the criteria recommended by the technical workgroup. During the rulemaking process for adoption of water body specific nutrient criteria, the general public will have opportunities to comment in writing and in person during the NOIRA comment period/public meetings and later during the public comment period and hearings on the proposed criteria. These comments will be summarized with staff responses for the Board. In addition, as part of the public participatory approach, an ad hoc advisory committee will be formed to advise staff on development of the regulatory text for the amendments.

Outside Expertise for Data Analysis and Peer Review. The VA DEQ will initially utilize a technical workgroup (consisting of a core of AAC scientists) to aid staff in nutrient criteria development. This technical workgroup will consist of a small group of individuals knowledgeable in the response of aquatic systems to nutrients. This workgroup will consider options for developing nutrient criteria, offer suggestions for data needs, provide guidance on options for data evaluation, and provide input on the final product/proposed regulatory language. Technical questions that will be posed to the AAC are included in Appendix J. The VA DEQ will evaluate their comments and suggestions to further define the development of nutrient criteria and to update the workplan.

REGIONALIZATION

Plan Integration With Adjacent States Sharing Waters. Virginia has six neighboring states (MD, NC, WVA, DC, TN, and KY) in two EPA regions (III and IV) where there may be potential downstream effects. There will be several opportunities for integration of the Virginia

Plan with these adjacent states where waters are shared. This integration already exists for the Chesapeake Bay estuary via the ongoing EPA/States collaboration on development of nutrient criteria for the Bay; Maryland, the District of Columbia and West Virginia are the three adjacent Region III states involved in this effort. Virginia will also periodically consult – primarily via conference calls - with neighboring states, including Maryland, West Virginia and Kentucky, that share an interest in monitoring and nutrient criteria development for periphyton dominated streams. In addition, Virginia has since the early 1970s collaborated with the state of North Carolina on activities to reduce nutrient input from Virginia waters into the Chowan drainage including – upon petition from North Carolina – designating portions of the Chowan drainage within Virginia as Nutrient Enriched Waters. There is an existing agreement between Virginia and North Carolina that would apply in this situation. Virginia intends to address potential downstream effects on North Carolina waters as part of the rivers and stream nutrient criteria rulemaking. Virginia also routinely exchanges information with the Tennessee Valley Authority states and will consider downstream effects on these waters as part of the lakes and reservoirs nutrient criteria rulemaking.

Coordination of Efforts with Regional Technical Assistance Group: Virginia DEQ staff participates in the EPA Region III Regional Technical Assistance Group (RTAG) which has focused primarily on development of a regional freshwater data base for use in nutrient criteria development for rivers and streams and lakes and reservoirs. There are representatives to RTAG from the above named three neighboring states also located in EPA Region III.

CLASSIFICATION

For purposes of criteria development, state surface waters will first be classified by water body types: estuaries, lakes and reservoirs, and rivers and streams (plus wetlands once technical guidance is available) and then further subclassified.

Estuaries: As described in Appendix F, VA DEQ will divide the Chesapeake Bay drainage into regulatory designated use zones for different segments of the Bay based on depth, hydrology, and aquatic community where different water quality nutrient criteria will apply depending on the aquatic life found in that zone.

Update 2006: Virginia has adopted and EPA approved water quality standards to protect designated uses from the impacts on nutrients and suspended sediments in the Chesapeake Bay and its tidal tributaries.

Lakes and Reservoirs: The state - with the advice of the technical and stakeholder workgroups - will consider various classification schemes for lakes and reservoirs based on physical characteristics (depth, hydraulic residence time, and ratio of lake size to watershed size), natural trophic conditions, and designated uses. One of the size issues that will be considered are setting regulatory size thresholds (such as those less than 10 acres or with water residence time of less than 14 days) for lakes and reservoirs that would eliminate small lakes from the population. Consideration will also be given to whether or not criteria should be established for lakes and reservoirs without public access. VA DEQ will also consider pursuing "use attainability" studies to refine uses, especially for lakes with multiple uses, such as promoting a

game fishery (Ney, 2001) while maintaining water clarity that promotes recreational swimming. The state will consider conducting a literature search of user perception surveys (Heiskary and Walker 1988 and 1995) of multipurpose lakes and reservoirs in determining appropriate criteria in lakes and reservoirs. If necessary, user perception surveys may also be conducted. The agency will also consider determining the appropriate, possibly more stringent criteria for a lake or reservoir that has a public water supply designated use. The relationship of waterbody depth and specific dissolved oxygen criteria be considered

Update 2006: All of the above have been completed and the state has proposed chlorophyll a and total phosphorus criteria for lakes and reservoirs. See Appendix M.

Update 2008: These criteria were adopted in 2006 and effective in August 2007. See Appendix M.

Rivers and Streams: VA DEQ will - in consultation with the technical and stakeholder workgroups - consider specific classification schemes for rivers and streams (stream order, flow rates, and plankton vs. periphyton dominated streams) before deciding on the best approach. If resources continue to be limited, the state will consider literature values or the use of criteria developed for periphyton dominated streams in adjoining states.

Update 2006: DEQ staff will continue to work with the AAC in the coming months to finalize the technical approach that will be used to develop the nutrient criteria and determine whether the basis for the criteria will require additional data collection in Virginia streams and rivers or whether the criteria can be based on the scientific literature and studies completed in other areas of the country. Depending upon the technical approach used, the final adoption date for the criteria could range from 2008 to later in 2009. See Appendix M for timeline and Appendix P for the December 2005 draft AAC Report (Update 2010: timeline revised and renamed Appendices N1 & N2).

Update 2008: DEQ staff has continued to work with the AAC; Appendix 0 has been updated to contain the current Fiscal Year 2009 Work Plan of the Academic Advisory Committee for freshwater nutrient criteria.) The DEQ website at (<http://www.deq.virginia.gov/wqs/rule.html#NUT2>) contains several reports from 2004 – 2008 providing AAC analysis and recommendations for development of nutrient criteria for both wadeable and nonwadeable freshwater streams and rivers. The current focus for wadeable streams and rivers is a joint VA Tech/DEQ pilot program – with EPA funding for this project from EPA – for a screening value approach to nutrient criteria development for freshwater wadeable streams. This project will be completed in calendar year 2009 and DEQ expects to start the regulatory process for wadeable streams in the second half of 2009. The regulatory process to adopt amendments to the water quality standards regulation takes 18 – 24 months; the updated timeline for wadeable streams in Appendix M shows a completion date of 2011. The current focus of the AAC work for non-wadeable streams and rivers is on using fish community metrics and selected measures of nutrient concentration and trophic status to develop nutrient criteria for non-wadeable streams and rivers; the updated timeline for non-wadeable streams in Appendix M shows a completion date of 2012.

Update 2010: DEQ staff continues to work with the AAC; Appendix O has been updated to contain the Fiscal Year 2010 Work Plan for the AAC for freshwater nutrient criteria development and Appendix P updated to the FY 2009 Final Reports for wadeable and non-wadeable streams and rivers. The DEQ website at (<http://www.deq.virginia.gov/wqs/rule.html#NUT>) contains the AAC Final Report for FY 2009 and the FY 2010 Work Plan. The classification scheme for rivers and streams remains the same. The focus continues to further develop the nutrient criteria screening value approach for wadeable streams and on using fish community metrics and selected measures of nutrient concentration and trophic status to develop nutrient criteria for non-wadeable streams and rivers.

PRIORITIZATION & COVERAGE

Staff resource constraints, the need (contingent upon availability of resources) to collect additional data for streams and rivers, and the time needed to complete the technical criteria development process for each waterbody type will necessitate a sequential approach to nutrient criteria development in Virginia.

This sequential approach will allow criteria development and adoption of estuaries, followed by lakes and reservoirs and then streams and rivers so that the downstream effects can be predicted and addressed at each step in the process.

The State's approach can be described as a two step process – technical development of nutrient criteria and administrative adoption of the criteria – for each water body type. Prioritization of waters for criteria development and adoption will be based on availability of data to proceed with a rulemaking. Therefore, the first rulemaking will be for the Chesapeake Bay estuary because criteria for those waters are expected to be available by the spring of 2003 (see Appendix F). The technical criteria development process for lakes and reservoirs and collection of additional monitoring data for streams and rivers will run currently with the Bay rulemaking. Because a need has been identified for periphyton data for technical evaluations of streams and rivers, we will collect that information before the workgroup convenes on streams and rivers. By the time the Bay rulemaking is completed, nutrient criteria for lakes and reservoirs should be available to initiate a rulemaking to adopt criteria for those waters. Once the lakes rulemaking is underway, the technical development of criteria for rivers and streams will be initiated.

Update 2010: Nutrient criteria development for coastal streams not named in the Chesapeake Bay rulemaking, the ocean side of the Eastern Shore of Virginia, and waters in the Virginia portion of the Chowan basin will be revisited after Virginia has viable criteria for rivers & streams available to enter the rulemaking process. Preliminary collaboration with Maryland regarding available nutrient data for the shared waters of Chincoteague Bay on the Eastern Shore has begun.

During and beyond the nutrient criteria rulemaking process, the Commonwealth will continue to involve several complementary strategies in its approach to the assessment and control of nutrient enrichment in surface waters. Virginia's current practice of assessing benthic

impairments and low dissolved oxygen levels in lakes due to nutrient stresses as part of the 305(b) process can already lead to 303(d) listings and TMDL development of control measures.

Each of the three waterbody type specific rulemakings will include a proposal to rescind the listing for that particular waterbody type from the Nutrient Enriched Waters listing in Section 9 VAC 25-260-350.A of the Water Quality Standards regulation. By leaving these in place until the waterbody type specific nutrient criterion is effective, Virginia can continue to maintain the current level of protection for these waters. Concurrent with the post public hearing 150-day time period for each rulemaking - as previously discussed in the resources section - agency project teams will be tasked with development of implementation plans for applying the new criteria to VPDES permitted facilities, including those previously protected by the total phosphorus effluent control policy that is a companion regulation to the nutrient enriched waters designations.

In addition to this regulatory approach, there are statutory approaches to managing nutrients in Virginia waters, including a ban - effective January 1 1988 - on the sale, manufacture or distribution for use of any cleaning agent containing more than 0.5 percent phosphorus by weight. More recently, the Virginia Legislature enacted the Water Quality Improvement Act, which became effective July 1, 1997, and provides monetary incentives for point source and non-point source control of nitrogen and phosphorus. The state code also mandates the development of tributary plans for restoration of the water quality and living resources of the Chesapeake Bay.

INVENTORY OF EXISTING DATA

Existing Data. A summary is provided of existing estuary, lakes and rivers data for Virginia in the attached Table 1 from the legacy 1990-2000 STORET database supplemented by the more recent DEQ CEDS database through September 2002. Although saltwater/estuarine data for the Commonwealth are included in the table, the collaborative EPA/States effort to develop nutrient criteria for the Chesapeake Bay is nearing completion (spring of 2003) and would supersede any effort by Virginia to develop Bay specific criteria. Virginia will also consider for inclusion in the final database the 1990 –2000 STORET data from all Region III states that is being compiled at ecoregion level IV for Rivers and Streams and eventually for Lakes and Reservoirs if it will strengthen the available database of water quality information. However, the National database will not be utilized for state criteria development because of heterogeneity issues. Existing data from Region IV states that share Virginia's physiographic regions (*e.g.*, North Carolina and Kentucky) may also be useful.

Data Analysis. As part of the State criteria development process for inland/fresh waters, DEQ will inventory existing data for Virginia from STORET/CEDS and address (if have not already done so) QA/QC aspects of the existing data. The state will also address for various water types the duration (how long) and frequency (how often) in addition to magnitude (how much), explore seasonal or annual averaging period (based on monthly measurements – weekly not available), and possibly consider exceptions for extraordinary events such as a 100-year flood. Virginia may consider the choice of a percentile other than those suggested in 304(a) criteria documents and technical guidance manuals. For example, the currently listed Nutrient Enriched Waters in Virginia will be separated by water body type and reference curves will be developed for the various criteria to determine what percentile of the reference distribution could

be a starting point for the criteria for these waters. In addition, the reference condition approach will be applied to waters with similar physical characteristics as described in an earlier section. Paired nutrient and effects data from waters with similar physical characteristics will also be plotted to determine an effects threshold that could help refine the criterion value. For example, Carlson's Trophic State Indices will be developed for the lakes and reservoirs for Secchi disk, total phosphorus and chlorophyll a data and compared to ranges of user perceived impairment in aesthetic qualities and recreation potential developed by Heiskary and Walker (1988) and others.

Planned Data Collection: No algal identifications and counts or chlorophyll data exist for stream periphyton during the 1990 to present time period. As part of the criteria development process for freshwater rivers and streams, Virginia will consider the collection of new data as required (possibly stream and river periphyton and plankton). Due to the time lag involved in collection and assessment of these new data and the need for the analyzed data before serious consideration can be given to chlorophyll or indice criteria delineations based on plankton versus periphyton dominated streams as well as staff resource limitations, the State will likely schedule technical development of nutrient criteria for streams and rivers when these data are available rather than address both lakes and rivers in the same rulemaking. Use attainability studies may be needed to refine stream or lake uses, especially where seasonality or depth may be an issue in application of the criteria. Other situations where use attainability studies might prove useful would be where recreational/aesthetic uses might be impaired by the growth of periphyton at levels that are less than those that would impair benthic macroinvertebrates or other aquatic life uses. Similarly, the filamentous green algae that might be considered "nuisance" growth might be found to occur even under very low background nutrient concentrations during warm periods of stable flow. In these cases, it may be beneficial to refine the specific uses designated for a particular waterbody (e.g., full body contact uses vs. aquatic life uses). If existing studies on correlations between lake trophic indices and perceived nuisance conditions prove inappropriate, there may be a need to conduct state specific studies or to seek expert opinion on appropriate regional or state specific ratings.

DATA NEEDS

If periphyton monitoring proves infeasible either due to time or resource constraints, consideration will be given to a literature search of data on this effort and consultations with states located within the same ecoregions as Virginia that have collected and analyzed stream periphyton data. Literature searches may also be needed on characterization of waterbodies with similar physical characteristics.

ASSESSING PROGRESS

Timelines and schematic process diagrams which describe major milestones and the schedule for completion of the criteria setting process are provided in the text of this plan. In addition, Appendices K, L, and M provide color coded timelines for each of the three rulemakings (Chesapeake Bay, lakes/reservoirs and streams/rivers, respectively) with descriptions of each step of the rulemaking process from the pre-Notice of Intended Regulatory Action to the final publication in the Virginia Registrar and effective date of each amendment after EPA review and approval. The details provided in these timelines allow EPA and other

stakeholders to track the Commonwealth's progress through the rulemaking process for each water body type. These timelines and diagrams are supplemented by an overall narrative description of the process in the Prioritization & Coverage and Process sections and additional detailed information incorporated into this plan as Appendices G, H, and I.

PLAN REVISIONS

This plan is provided to the EPA as an indication of the Virginia DEQ staff's efforts to develop and adopt nutrient criteria into the State water quality standards regulation. The Virginia DEQ will provide drafts of criteria for EPA review throughout the process and invite EPA staff to participate in the workgroups. From time to time peer review comments from the technical workgroup or the public participation process may necessitate revisions to the plan. Notification of revisions will be provided via letter to the EPA regional administrator and concurrently to the EPA Region III nutrient criteria coordinator and the water quality standards coordinator for Virginia. Virginia DEQ anticipates the 106 agreements will reflect adjustments to the plan.

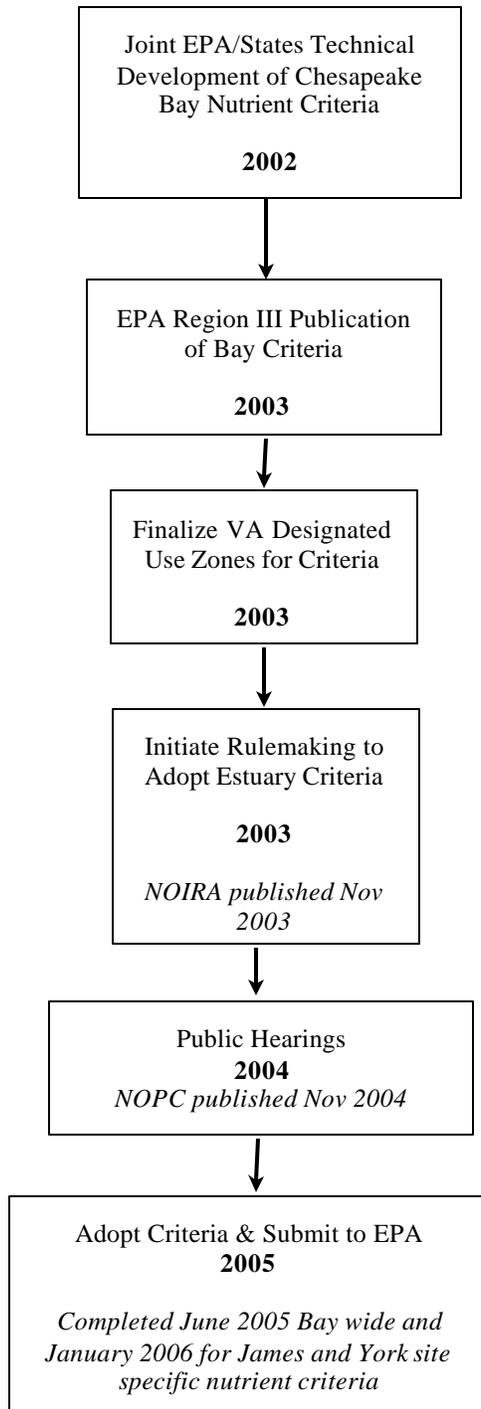
Table 1. Data Assessment.

	DO PROBE	DO WINKLER	TURBIDITY JTU	TURBIDITY FTU	SECCHI	TOTAL PHOSPHORUS	CHLOROPHYL L A CORRECTED	AMMONIA	NITRITE	NITRATE	TKN
	00299	00300	00070	00076	00078	00665	32211	00610	00615	00620	00625
ESTUARY	25317	1070	486	9523	4612	7608	2596	4927	4987	4992	7606
LAKE AND RESERVOIR	9159	400	47	2778	1370	3603	1411	3651	3589	3950	3575
RIVER AND STREAM	73812	8200	7244	48741	3704	65457	7291	62830	62869	62868	65192

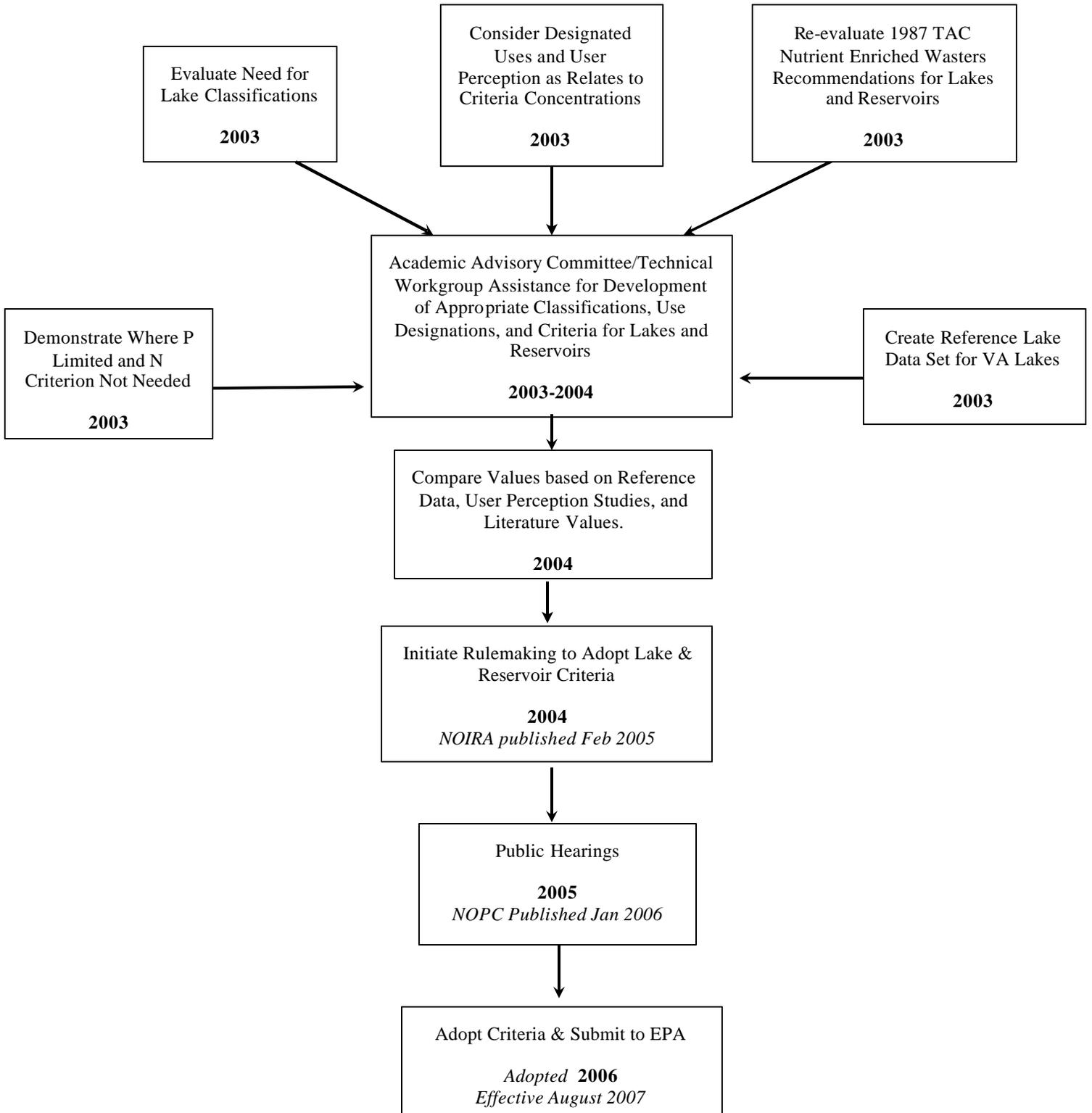
Appendix B

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WATER QUALITY STANDARDS FOR THE 21st CENTURY, 1989: 55-57

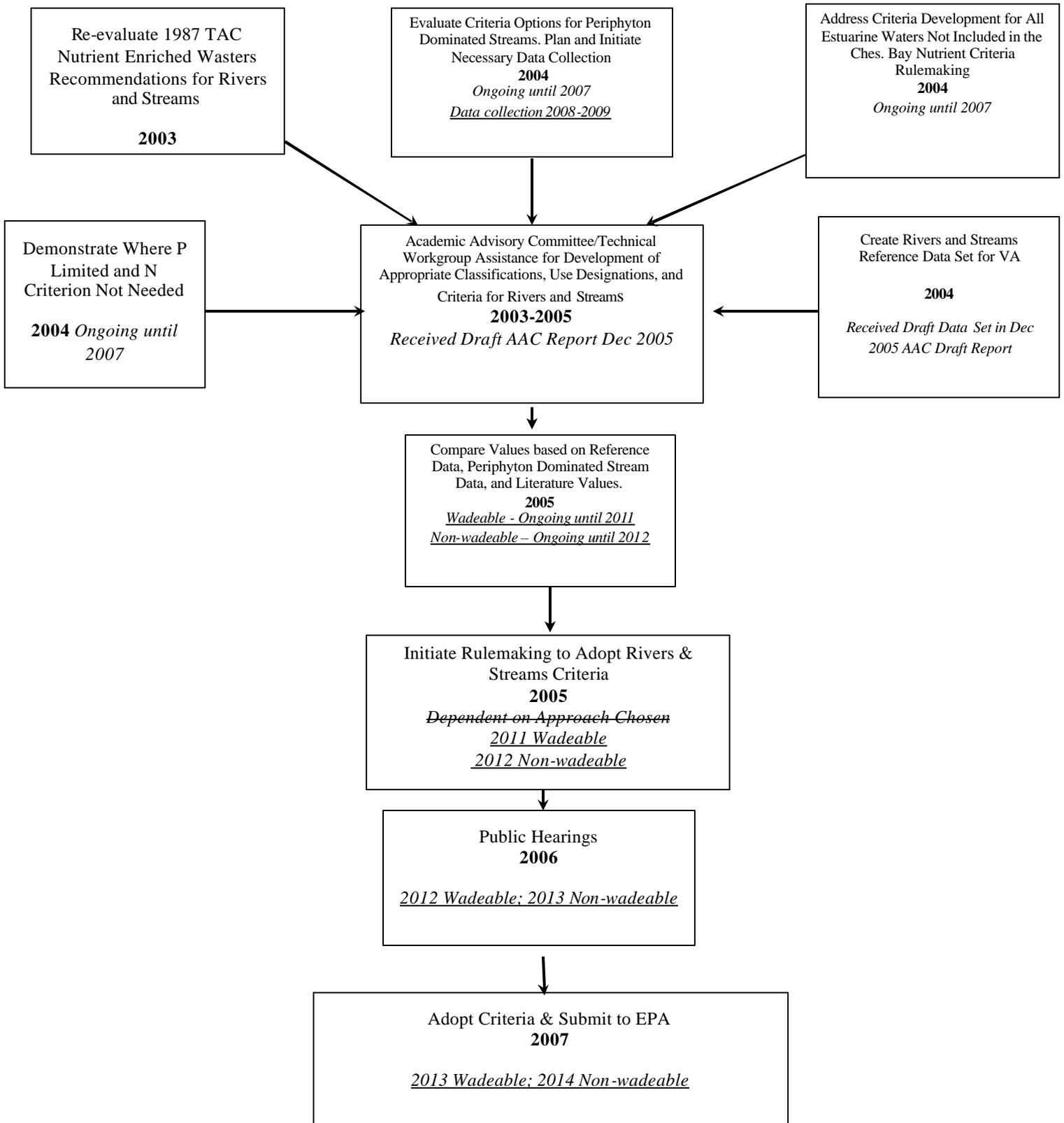
Schematic for Estuaries:



Schematic for Lakes and Reservoirs: Updates 2006 and 2008



Schematic for Rivers and Streams Updates ~~2006~~ & ~~2008~~ 2010:



Estuaries:

Activities and milestones for development of nutrient criteria for estuaries:

Year	Activities
2002	Joint EPA/States technical development of Chesapeake Bay nutrient criteria for dissolved oxygen, water clarity and chlorophyll <u>a</u> .
2003	EPA Region III publication of Bay criteria. Virginia DEQ determines boundaries for designated uses and matches to appropriate environmental endpoint for different segments of the Bay. Virginia issues NOIRA to initiate rulemaking to adopt nutrient criteria for the Virginia portion of the Chesapeake Bay. <i>NOIRA published Nov 2003.</i>
2004	Public hearings. <i>NOPC published Nov 2004.</i>
2005	Complete state rulemaking within 24 months after NOIRA published in <u>Virginia Register</u> and submit to EPA. <i>Completed June 2005 with Site Specific Numerical Chlorophyll for James and DO for York Completed in Jan 2006.</i>

Update 2010: Dialogue has begun between VA, MD, and EPA regarding nutrient criteria development for Chincoteague Bay, an Eastern Shore oceanside estuary shared with Maryland. Discussion has centered on the availability and extent of VA nutrient-related data for the water body as well as past and ongoing nutrient investigations by MD Dept. of Natural Resources Coastal Bay Program.

Lakes and Reservoirs:

Activities and milestones for development of nutrient criteria for lakes and reservoirs:

Year	Activities
2003	<p>Form technical (initially WQMIRA required Academic Advisory Committee) and stakeholder workgroups and as part of this effort re-evaluate 1987 TAC nutrient enriched waters recommendations.</p> <p>Evaluate the need for subdividing lakes into different classes, including classification issues of size, depth, retention time, run of the river impounded reservoirs vs. man made lakes vs. natural lakes, and public access vs. private ownership.</p> <p>Consider designated uses and user perception as it relates to criteria concentrations. Include issues about fishery and turbidity and nutrient levels. Design and implement user perception study or research suitable literature studies.</p> <p>Demonstrate where P limited and where N criterion is not needed.</p> <p>Evaluate feasibility of refining EPA's reference condition by creating a reference lake data set of least impacted lakes Virginia in and deriving values based on the nutrient levels found in these lakes.</p>
2004	<p>Compare values based on reference lake data, user perception studies, and literature values. Use expert opinion from AAC/technical workgroup for assistance with development of appropriate classifications, use designations and criteria for VA lakes and reservoirs.</p> <p>Issue NOIRA to initiate rulemaking to adopt nutrient criteria for lakes and reservoirs. <i>NOIRA published Feb 2005.</i></p>
2005	<p>Public hearings. <i>NOPC published January 2006.</i></p>
2006	<p>Complete state rulemaking within 24 months after NOIRA published in <u>Virginia Register</u> and submit to EPA. <i>Adopted June 2006 and effective August 2007.</i></p>

Rivers and Streams:

Activities and milestones for development of nutrient criteria for rivers and streams :

Year	Activities
2003	Form technical (initially WQMIRA required Academic Advisory Committee) and stakeholder workgroups and as part of this effort re-evaluate 1987 TAC nutrient enriched waters recommendations for rivers and streams.
2004	Use expert opinion from AAC/technical workgroup for assistance with periphyton vs. plankton dominated streams. Plan and initiate necessary data collection (monitoring and/or literature searches) and/or use of data from neighboring states in same sub-ecoregion. Demonstrate where P limited and where N criterion is not needed. Address criteria development for all estuarine waters not included in the Chesapeake Bay nutrient criteria rulemaking including the coastal streams not named in the Chesapeake Bay criteria rulemaking, the ocean side of the Eastern Shore of Virginia and eastern shore ocean side and downstream effects on the North Carolina estuary from waters in the Virginia portion of the Chowan basin. Evaluate feasibility of refining EPA's reference condition by creating a reference river and streams data set of least impacted Virginia freshwater rivers and streams and deriving values based on the nutrient levels found in these waters. <i>Ongoing until 2007.</i>
2005	Compare values based on reference rivers and streams data, periphyton dominated stream data, ambient levels, and literature values. Use expert opinion from AAC/technical workgroup for assistance with development of appropriate classifications, use designations and criteria for Virginia rivers and streams. <i>Draft AAC Report received Dec 2005. <u>Ongoing through 2009 2010.</u></i> Issue NOIRA to initiate rulemaking to adopt nutrient criteria for rivers and streams. <i>See dual timelines in update 2006 below.</i>
2012/2013	Public hearings. <u>Update 2010: 2012 for wadeable; 2013 for non-wadeable.</u>
2013/2014	Complete state rulemaking within 24 months after NOIRA published in <u>Virginia Register</u> and submit to EPA. <u>Update 2010: 2013 for Wadeable and 2014 for non-wadeable.</u>

Wetlands:

It is not possible to predict a time schedule at this point for wetlands because the development of nutrient criteria for wetlands will be deferred until there is an EPA technical guidance document available for evaluation. However, Virginia will consider - as part of the technical development of nutrient criteria for lakes and reservoirs – site specific nutrient criteria for Lake Drummond, which is a natural dystrophic lake located within the Great Dismal Swamp.

Update 2008: Site specific nutrient criteria were developed as a special standard for Lake Drummond during the rulemaking for nutrient criteria for lakes and reservoirs which had an effective date of August 2007.

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Appendix A

Nutrient Criteria—Lakes and Reservoirs B-9

5. The Virginia Nutrient Enriched Waters Designation

by Jean Gregory, Virginia Department of Environmental Quality

The quality of Virginia's surface waters, particularly those in the Chesapeake Bay drainage area, is affected by the presence of nutrient enrichment. In recognition of this, the State Water Control Board (SWCB), now the Department of Environmental Quality, has developed a strategy to protect the surface waters of the Commonwealth of Virginia from the effects of nutrient enrichment.

In the mid-1980's, the State's General Assembly formed a joint legislative subcommittee to study these problems in the Chesapeake Bay. One of the recommendations in their final report was to direct the SWCB to develop water quality standards by July 1, 1988, to protect Chesapeake Bay and its tributaries from nutrient enrichment. The SWCB decided to expand this standards-setting activity statewide to include other river basins and lakes where there were known nutrient enrichment problems. A second legislative mandate to develop implementation strategies for carrying out these water quality standards was made jointly to the SWCB, which has jurisdiction for point sources, and the Division of Soil and Water, which is responsible for nonpoint source controls. As a result, SWCB developed two regulations that became effective on May 25, 1988. The first established a water quality standard that designated as "nutrient enriched waters" those waters of the Commonwealth that show evidence of degradation due to the presence of excessive nutrients. A companion policy regulation was created to control certain point source nutrient discharges affecting State waters designated as "nutrient enriched waters."

To assist them in developing the water quality standard, the SWCB formed a Technical Advisory Committee (TAC) composed of 19 scientists from east coast universities and the Federal government. There were specific issues the Board was seeking advice on prior to developing these standards, including such issues as whether narrative or numerical standards were needed, appropriate parameters and numerical levels, and the appropriate monitoring, sampling, and evaluation methods.

The SWCB used a variety of policy analysis techniques to obtain recommendations from the committee for the best indicators of nutrient enrichment. First, SWCB mailed a series of three delphi questionnaires to the 19 TAC scientists asking them to identify major issues and thereby reach some consensus on topics to focus on. Responses were anonymous so that the scientists would not bias each other. SWCB followed this process with a two-day spring (May 14-15, 1987) workshop held in Williamsburg by the University of Virginia's Institute of Environmental Negotiation. A summary report was compiled.

The Technical Advisory Committee recommended four parameters that could be

used as in-stream indicators of nutrient enrichment. Listed in descending order of importance they are chlorophyll a, dissolved oxygen (D.O.) fluctuations, total phosphorus, and total nitrogen. Note that the first two parameters are symptoms of nutrient enrichment rather than direct measurements of nutrients.

Each of these four parameters was considered to develop a recommendation for fresh water lakes.

Chlorophyll a

Most TAC members favored use of a chlorophyll a criterion for lakes. A numerical level of 25 :g/l as a monthly average with a maximum one-time exceedence level of 50 :g/l was proposed. These values received general support from the group. There was a discussion about whether the chlorophyll criterion should be based on planktonic chlorophyll only or whether some consideration should be given to macrophytic chlorophyll as well. It was determined that a planktonic measure would be easier to sample and would accurately reflect the eutrophic condition of the lake.

It was suggested that monitoring samples be taken at one-half the Secchi depth as long as that depth was greater than 1 foot. An alternative proposal was to use an integrated mixed layer sample which, according to some members, would yield more reliable results. The use of Secchi depth is, however, a well-recognized and reliable method and it was favored for its simplicity.

TAC members thought the numerical chlorophyll criterion for lakes should be combined with a narrative element that would deal with the problems caused by high chlorophyll levels—taste, odor, and clogged filters at water treatment plants.

Dissolved Oxygen

It was the consensus of the TAC group that due to wide variation in D.O. at different depths and the difficulty this creates in setting standards and sampling techniques, and the fact that D.O. problems are symptoms that would be reflected in other standards, no lake criterion for D.O. should be recommended. The group did agree that a narrative component addressing the conditions associated with D.O. problems should be drafted.

Total Phosphorus

The TAC group suggested two possible lake criteria for total phosphorus in lake waters: a level of 50 :g/l as a weighted mean based on the water mass, or a level of 25 :g/l as a mixed layer mean. These levels were judged to be of equal validity as a measure of total P. (It was noted that if chlorophyll were sampled on a mixed layer basis this might be the preferred approach because the two samples could be taken at the same time.)

Total Nitrogen

The TAC group discussed the possibility of linking the criterion for total nitrogen to the criterion for phosphorus. It was suggested that some N to P ratio could be used or that the nitrogen criterion could be set at ten times the phosphorus criterion. After discussion, the group agreed that no nitrogen criterion should be set. Phosphorus is almost always the limiting factor in the eutrophication of Virginia's warm water lakes, and the group thought a nitrogen criterion would be unnecessary.

Recommendations of the TAC

In freshwater lakes the state should consider setting a chlorophyll *a* criterion of 25 :g/l as a monthly average, with a one-time exceedence level of 50 :g/l with both measured at one-half the Secchi depth (if > 1 foot). This should be combined with a total phosphorus criterion of 50 :g/l as a weighted mean or 25 :g/l as a mixed layer mean. A narrative component should be developed as well to address more general chlorophyll *a* and D.O. problems in lakes.

Taking into consideration the recommendation of the committee, the SWCB decided to base its designations for lakes and all other surface waters on the first three parameters. A reference to these parameters was included in the introduction to the water quality standard regulation for designating nutrient enriched waters. SWCB was intentionally silent on the numerical limits because unacceptable amounts of these parameters could vary depending on the type of water body, whether it were a lake, free-flowing river, or tidal estuary. Because every designation would require an amendment to Virginia's water quality standards, and full public participation is required by the agency and State rules for adopting regulations, SWCB felt that the public would be properly notified in every case of the appropriate scientific and numeric basis for these designations.

Average seasonal concentrations of chlorophyll *a* exceeding 25 mg/l, dissolved oxygen fluctuations, and high water column concentrations of total phosphorus have been the indicators used to date to evaluate the historical data and to identify those waters affected by excessive nutrients. Chlorophyll *a*, a pigment found in all plants, was used as the primary indicator because it indicates the quantity of plant growth.

Based on a review of historical water quality records, the SWCB designated as "nutrient enriched waters" three lakes, one tributary to a lake, nine embayments or tributaries to the Potomac River, the Virginia portion of the Chesapeake Bay, and a large portion of the Bay's tributaries. Since this initial round of designations, SWCB has amended the standard to designate the tidal freshwater portion of the Chowan River Basin in Virginia. SWCB intends to continue to review these designations and, during each triennial review of water quality standards, will consider additions and deletions to the list. For example, Lake Chesdin is proposed for designation during the current triennial review of the water quality standards regulation.

As SWCB has authority to issue National Pollution Discharge Elimination System (NPDES) permits, and thereby control point source discharges of nutrients, a policy for controlling certain point sources of nutrients to those waters designated as "nutrient enriched" was established. (Another agency, the Division of Soil and Water, developed strategies for managing nonpoint sources of nutrients to "nutrient enriched waters.") The policy requires certain municipal and industrial organizations that discharge effluents containing phosphorus to maintain a monthly average total phosphorus concentration of 2 mg/L or less. The 2 mg/L limit was based on the following criteria:

- Limits that are readily achievable by chemical addition processes, as demonstrated by

experiences in other parts of the country

- Suggested achievable limits for biological phosphorus removal contained in several reports as well as in State pilot plant studies.

SWCB has found that this level of phosphorus removal would result in meeting the 40 percent reduction goal of total phosphorus for point source discharges from Virginia entering into the Chesapeake Bay.

Municipal and industrial dischargers that release phosphorus in concentrations above 2 mg/l to these “nutrient-enriched waters” are subject to this policy if they have a design flow of 1.0 MGD or greater and a permit issued on or before July 1, 1988. These dischargers were required to meet the 2 mg/l effluent limitation as quickly as possible and, in any event, within three years following modification of the NPDES permit. If the discharger voluntarily accepted a permit that required nitrogen removal to meet a monthly average total nitrogen effluent limitation of 10 mg/l for April through October, the discharger was allowed an additional year to meet the phosphorus effluent limitation.

All new source dischargers with a permit issued after July 1, 1988, and a design flow greater than or equal to 0.05 MGD that propose to discharge to “nutrient-enriched waters” are also required to meet a monthly average total phosphorus effluent limitation of 2 mg/l. All dischargers to “nutrient-enriched waters” that, at the time of that designation, were subject to effluent limitations more stringent than the 2 mg/l monthly average total phosphorus are required to continue to meet the more stringent phosphorus limitation.

The policy regulation also contains language that allows SWCB to require monitoring of discharges when the permittee has the potential for discharging monthly average total phosphorus greater than 2 mg/l and also allows adjoining States to petition the Board to consider rulemakings to control nutrients entering tributaries to their nutrient-enriched waters.

The policy regulation states that after the point source controls are implemented and the effects of this policy and the nonpoint source control programs are evaluated, the SWCB recognizes that it may be necessary to impose further limitations on dischargers for additional nutrient control to prevent undesirable growths of aquatic plants. This policy can thus be viewed as the first phase of a strategy to protect Virginia’s waters from the effects of excessive nutrients.

Appendix B

J. W. GREGORY

WATER QUALITY STANDARDS FOR THE 21st CENTURY, 1989: 55-57

A Strategy for Nutrient-Enriched Waters in Virginia

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The quality of Virginia's surface waters, particularly those in the Chesapeake Bay drainage area, is being affected by the presence of excessive quantities of nutrients. In recognition of this, the Virginia Water Control Board has developed a strategy to protect the surface waters of the Commonwealth of Virginia from the effects of nutrient enrichment.

In the mid-1980s, the State's General Assembly formed a joint legislative subcommittee to study these problems in Chesapeake Bay. One of the recommendations in their final report was to direct the Virginia Water Control Board (VWCB) to develop water quality standards by July 1, 1988, to protect Chesapeake Bay and its tributaries from nutrient enrichment. The VWCB decided to expand this standards-setting activity statewide to include other river basins and lakes where there were known nutrient enrichment problems. A second legislative mandate to develop implementation strategies for carrying out these water quality standards was made jointly to the VWCB, which is responsible for point sources, and the Division of Soil and Water, which is responsible for nonpoint source controls. As a result, VWCB developed two regulations that became effective on May 25, 1988. The first established a water quality standard that designated as "nutrient-enriched waters" those waters of the Commonwealth that show evidence of degradation attributable to the presence of excessive nutrients. A companion policy regulation was created to control certain point source discharges of nutrients affecting State waters designated as "nutrient-enriched waters."

When developing the water quality standard, the VWCB was fortunate to have as background information not only joint State/EPA Chesapeake Bay Program studies but also a review prepared by the Washington Council of Governments on the types of water quality standards that other States were using to control nutrients. VWCB was also aware of the classification system for nutrient-sensitive waters that our neighboring State, North Carolina, had developed. As VWCB reviewed regulatory approaches to controlling nutrients, its lack of technical expertise on nutrient-related issues soon became apparent. To fill this need, they put together a Technical Advisory Committee comprised of 19 scientists from east coast universities and the Federal Government.

The VWCB used a variety of policy analysis techniques to obtain recommendations from the

committee for the best indicators of nutrient enrichment. First, VWCB mailed a series of three delphi questionnaires to the scientists, asking them to identify major issues and reach some consensus on topics to focus on. The questionnaire responses were made anonymously to allow the scientists an opportunity to change their minds and not be biased by another Individual on the committee. VWCB followed this process with a two-day spring workshop run in Williamsburg by the University of Virginia's Institute of Environmental Negotiation, which compiled a summary report.

The Technical Advisory Committee recommended four parameters that could be used as in-stream indicators of nutrient enrichment. Listed in descending order of importance they are: chlorophyll a, dissolved oxygen fluctuations, total phosphorus, and total nitrogen. Note that the first two parameters are symptoms of over-enrichment rather than direct measurements of nutrients.

Taking into consideration the recommendation of the committee, VWCB decided to base its designations on the first three parameters. A reference to these parameters was included in the introduction to the water quality standard regulation for designating nutrient enriched waters. VWCB was intentionally silent on the numeric limits, as the committee had advised, because unacceptable amounts of these parameters could vary depending on the type of waterbody, whether it were a lake, free-flowing river, or tidal estuary. Since every designation would involve an amendment to Virginia's water quality standards, and since full public participation is required by the agency and State rules for adopting regulations, VWCB felt that the public would be properly notified in every case of the appropriate scientific and numeric basis for these designations.

Average seasonal concentrations of chlorophyll a exceeding 25 :g/L, dissolved oxygen fluctuations, and high water column concentrations of total phosphorus were the indicators used to evaluate the historical data and to identify those waters affected by excessive nutrients. Chlorophyll a, a pigment found in all plants, was used as the primary indicator because it indicates the quantity of plant growth. With the exception of the mainstem of the Chesapeake Bay, the waterbodies designated as "nutrient enriched" had a historical record of chlorophyll a measurements in the visible range-sufficient to discolor the water. The Virginia portion of the Chesapeake Bay mainstem was included because slight to moderate enrichment was becoming evident and because it is part of the whole Chesapeake Bay, which is a nutrient-enriched system. Management programs are needed to prevent further degradation of this valuable resource.

Based on a review of historical water quality records, the board designated as "nutrient enriched waters" three lakes, one tributary to a lake, nine embayments or tributaries to the Potomac River, the Virginia portion of the Chesapeake Bay, and a large portion of the Bay's tributaries. Since this initial round of designations, VWCB has amended the standard once to designate the tidal freshwater portion of the Chowan River Basin in Virginia. VWCB intends to continue to review these designations and, during the triennial review of water quality standards, will consider additions and deletions to the list. Presently VWCB is initiating field studies of a freshwater river and a lake that may be designated "nutrient enriched" during the 1990 triennial review.

Since VWCB has authority to issue National Pollution Discharge Elimination System (NPDES) permits and thereby control point source discharges of nutrients a policy for controlling certain point sources of nutrients to those waters designated as "nutrient enriched" was established. (Another agency, the Division of Soil and Water, has developed strategies for managing nonpoint sources of nutrients to "nutrient enriched waters.") The policy requires certain municipal and industrial organizations that discharge effluents containing phosphorus to maintain a monthly average total phosphorus concentration of 2 mg/L or less. The 2 mg/L limit proposed is based upon the following criteria: limits that are readily achievable by chemical addition processes as demonstrated by

experiences in other parts of the country and suggested achievable limits for biological phosphorus removal contained in several reports as well as in State pilot plant studies. VWCB has found that this level of phosphorus removal allows it to meet the 40 percent reduction goal for point source total phosphorus for Virginia's portion of Chesapeake Bay.

Municipal and industrial dischargers that release phosphorus in concentrations above 2 mg/L to these "nutrient-enriched waters" are subject to this policy if they have a design flow of 1.0 MGD or greater and a permit issued on or before July 1, 1988. These dischargers are required to meet the 2 mg/L effluent limitation as quickly as possible and, in any event, within three years following modification of the NPDES permit. If the discharger voluntarily accepts a permit to require installation and operation of nitrogen removal facilities to meet a monthly average total nitrogen effluent limitation of 10 mg/L for April through October, the discharger will be allowed an additional year to meet the phosphorus effluent limitation.

All new source dischargers with a permit issued after July 1, 1988, and a design flow greater than or equal to 0.05 MGD that propose to discharge to "nutrient-enriched waters" will also be required to meet a monthly average total phosphorus effluent limitation of 2 mg/L. All dischargers to "nutrient-enriched waters" that, at the time of that designation were subject to effluent limitations more stringent than the 2 mg/L monthly average total phosphorus, are required to continue to meet the more stringent phosphorus limitation.

The initial regulations impacted 20 municipal and 5 industrial dischargers. An additional 10 were already meeting more stringent total phosphorus standards. One additional discharger was affected when this water quality standard was amended to add the tidal freshwater portion of the Chowan River to the list of "nutrient-enriched waters."

The estimated cost to the regulated community of the original regulations ranged from \$27.5 million to \$228 million, depending on the type of phosphorus removal technology selected. Costs of phosphorus removal were estimated for three treatment technologies. The least expensive alternative, biological phosphorus removal, was estimated to cost \$16.51 million, plus an additional \$6.75 million to \$11 million for royalty fees. Chemical addition with simultaneous precipitation was estimated to cost about \$88.86 million. The most expensive of the alternatives explored, chemical addition with post-precipitation, was estimated to cost about \$228 million.

The policy regulation also contains language that allows VWCB to require monitoring of discharges when the permittee has the potential for discharging monthly average total phosphorus greater than 2 mg/L and also allows adjoining States to petition the Board to consider rule makings to control nutrients entering tributaries to their nutrient-enriched waters.

The policy regulation states that after the point source controls are implemented and the effects of this policy and the nonpoint source control programs are evaluated, VWCB should recognize that it may be necessary to impose further limitations on dischargers of nutrients to control undesirable growths of aquatic plants. This policy can thus be viewed as the first phase of a strategy to protect Virginia's waters from the effects of nutrient enrichment.

Appendix C

Part VIII. Nutrient Enriched Waters. 9 VAC 25-260-330, 340, and 350. Virginia Water Quality Standards regulation.

October 2008 version.

NUTRIENT ENRICHED WATERS

9 VAC 25-260-330. Purpose.

The Board recognizes that nutrients are contributing to undesirable growths of aquatic plant life in surface waters of the Commonwealth. This standard establishes a designation of "nutrient enriched waters". Designations of surface waters of the Commonwealth as "nutrient enriched waters" are determined by the Board based upon an evaluation of the historical water quality data for one or more of the following indicators of nutrient enrichment: chlorophyll "a" concentrations, dissolved oxygen fluctuations, and concentrations of total phosphorus.

9 VAC 25-260-340. (Repealed.)

9 VAC 25-260-350. Designation of nutrient enriched waters.

The following state waters are hereby designated as "nutrient enriched waters":

1. Smith Mountain Lake and all tributaries* of the impoundment upstream to their headwaters;
2. Lake Chesdin from its dam upstream to where the Route 360 bridge (Goodes Bridge) crosses the Appomattox River, including all tributaries to their headwaters that enter between the dam and the Route 360 bridge;
3. South Fork Rivanna Reservoir and all tributaries of the impoundment upstream to their headwaters;
4. New River and its tributaries, except Peak Creek above Interstate 81, from Claytor Dam upstream to Big Reed Island Creek (Claytor Lake.)
5. Peak Creek from its headwaters to its mouth (confluence with Claytor Lake), including all tributaries* to their headwaters.

* When the word "tributaries" is used in this standard, it does not refer to the mainstem of the water body that has been named.

6. (Repealed.)

7. (Repealed.)

8. (Repealed.)

9. (Repealed.)

10. (Repealed.)

11. (Repealed.)

12. (Repealed.)

13. (Repealed.)

14. (Repealed.)

15. (Repealed.)

16. (Repealed.)

17. (Repealed.)

18. (Repealed.)

19. (Repealed.)

20. (Repealed.)

21. Tidal freshwater Blackwater River from the Norfolk and Western railway bridge at Burdette, Virginia, and tidal freshwater Nottoway River from the Norfolk and Western railway bridge at Courtland, Virginia, to the state line, including all tributaries to their headwaters that enter the tidal freshwater portions of the Blackwater River and the Nottoway River.

22. Stony Creek from its confluence with the North Fork Shenandoah River to its headwaters including all named and unnamed tributaries to their headwaters.

B. Whenever any water body is designated as "nutrient enriched waters," the board shall modify the VPDES permits of point source dischargers into the "nutrient enriched waters" as provided in the board's Policy for Nutrient Enriched Waters (9 VAC 25-40-10 et seq.).

Appendix D

CHAPTER 40 POLICY FOR NUTRIENT ENRICHED WATERS

9 VAC 25-40-10. Purpose.

This policy provides for the control of discharges of nutrients from point sources affecting state waters that have been designated "nutrient enriched waters" in 9 VAC 25260-350.

9 VAC 25-40-20. Authority.

The Board has adopted this policy under the authority of §§ 62.1-44.15(3), 62.144.15(10) and 62.1-44.15(14) of the Code of Virginia.

9 VAC 25-40-30. Strategy for "nutrient enriched waters".

As specified here, the board shall reopen the NPDES permits of certain point source dischargers to "nutrient enriched waters" and shall impose effluent limitations on nutrients in the discharges authorized by those permits and certain new permits.

A. All dischargers authorized by NPDES permits issued on or before July 1, 1988, to discharge 1 MGD or more to "nutrient enriched waters" shall be required to meet a monthly average total phosphorus effluent limitation of 2 mg/l as quickly as possible and in any event within 3 years following modification of the NPDES permit.

At the time of modification of the NPDES permit, any discharger who voluntarily accepts a permit to require installation and operation of nitrogen removal facilities to meet a monthly average total nitrogen effluent limitation of 10 mg/l for the months of April through October shall be allowed an additional year to meet the phosphorus effluent limitation in 9 VAC 25-40-30 A.

B. All new source dischargers as defined in 9 VAC 25-30-10 with a permit issued after July 1, 1988 and a design flow greater than or equal to 0.05 MGD who propose to discharge to "nutrient enriched waters" shall be required to meet a monthly average total phosphorus effluent limitation of 2 mg/l.

C. This policy shall not be construed to relax any effluent limitation concerning a nutrient that is imposed under any other requirement of state or federal law. No time extensions outlined in 9 VAC 25-40-30 A for installation and operation of nitrogen removal facilities shall be granted to a discharger if such an effluent limitation or a time extension is already imposed under any other requirement of state or federal law or regulation.

9 VAC 25-40-40. Permit Amendments.

Whenever the board determines that a permittee has the potential for discharging monthly average total phosphorus concentrations greater than or equal to 2 mg/l or monthly average total nitrogen concentrations greater than or equal to 10 mg/l to "nutrient enriched waters," the board may reopen the NPDES permit to impose monitoring requirements for nutrients in the discharge.

9 VAC 25-40-50. Possibility of further limitations.

The board anticipates that, following implementation of the foregoing requirements and evaluation of effects of this policy and of the results of the non-point source control programs, further limitations on discharges of phosphorus or of other nutrients may be necessary to control undesirable growths of aquatic plants.

9 VAC 25-40-60. Other State Petitions.

The Board may entertain petitions from adjoining states to consider rulemakings to control nutrients entering tributaries to "nutrient enriched waters" of the adjoining state.

Statutory Authority

§ 62.1-44.15(10) of the Code of Virginia

Historical Notes

Derived from §6; eff. May 25, 1988

Appendix E

NUTRIENT CONTROL STANDARDS WORKSHOP

May 14-15, 1987
Williamsburg, Virginia

Summary Report

prepared by the

Institute for Environmental Negotiation
Division of Urban & Environmental Planning
University of Virginia

Introduction

In 1985 the Virginia General Assembly established, a joint subcommittee to examine nutrient enrichment problems in Virginia's portion of the Chesapeake Bay. The committee recommended the Virginia Water Control Board (VWCB) develop:

water quality standards to protect the Bay and its tributaries from nutrient enrichment; and strategies to implement those standards.

The legislature directed the VWCB to do so by June 1986, and in the fall of 1986 the VWCB appointed a Technical Advisory Committee (TAC) to assist them. (A membership list is attached.)

There were a number of specific issues the Board wanted advice on prior to developing these standards:

1. Should the state develop narrative or numerical standards or both? A number of states have only narrative standards, others use a combination. At present Virginia has a general narrative standard with reference to nutrient related problems, but has no specific nutrient standards or criteria.
2. What are the most appropriate parameter(s) for nutrient control standards? States with numerical standards have used a variety of parameters including total phosphorus, nitrogen (or its toxic versions nitrate, nitrite, ammonia), chlorophyll a, dissolved oxygen, and others. (Virginia is currently developing separate standards for toxics.)
3. What are the appropriate numerical levels for standards? Most states recognize that numerical nutrient standards must be set in ways that allow for differences in water body types and background conditions.
4. What are the appropriate monitoring, sampling, and evaluation methods? Monitoring frequency and method, and whether compliance should be determined based on reasonable averages; one time exceedence, etc. are all part of an effective strategy.

5. What should be done about a variety of other issues related to effective implementation of the standards? These include but are not limited to: ways to address non-point source problems, where resources should be directed for greater effectiveness, and what data and research priorities should be.

Prior to this workshop members completed two rounds of a Delphi questionnaire process in which they expressed preliminary views on the questions listed above. The workshop, facilitated by staff from the Institute for Environmental Negotiation, was designed to build on the Delphi process and develop as much consensus as possible among these experts on issues related to developing nutrient control standards. This report summarizes the major recommendations of the committee and the rationales behind them. .

Overall Approach.

As a first step in developing standards to protect state waters from nutrient enrichment the Water Control Board has to select an overall approach or type of standard (narrative or numerical, instream or effluent, statewide or by water body type or basin) that will serve as the basis for future control strategies. In the two Delphi Questionnaires completed by TAC members prior to the workshop, a majority of the group favored:

- a) a combination of narrative and numerical standards;
- b) instream standards; and
- c) standards by water body types, i.e., lakes, estuaries, etc.

In discussing the overall approach during the workshop, TAC members raised a number of issues, most of which revolved around the question of whether the state should establish instream or effluent standards or both.

Instream vs. Effluent Standards

Members began by clarifying the distinction between instream and effluent standards: instream standards refer to numerical limits for certain parameters as measured in the water body; effluent standards refer to uniform limits on the discharge of certain constituents by all point sources; permit limits refer to the restrictions placed in a permit on

the constituents in an effluent discharge by a point source. There is an obvious link between achieving instream standards and regulating point source discharges through effluent standards, permits, or some combination of the two.

It was suggested that an instream standard was the best way to maintain water quality and provide a sound basis for a nutrient management program consistent with a state policy of protecting all beneficial uses. With an instream standard approach, when monitoring shows the standard has been exceeded, this becomes a trigger for further analysis waste load allocation modeling, and management programs that place limits and requirements on both point and non-point sources. Effective implementation of an instream standard requires careful analysis of cause and effect relationships between the nutrient problem as identified by the 'trigger,' and various potential sources. It also requires identification of the appropriate management area, i.e., how far back up stream one should go in assigning wasteload allocations. It was suggested a "test of reasonableness" was the best way to approach this, including all areas and discharges "reasonably" closely connected with the problem.

While all members agreed instream standards were necessary, some thought they should be accompanied by statewide effluent standards as well. Effluent standards alone provide no way to address non-point sources. This problem is overcome, however, if effluent standards are used in conjunction with an instream standard.

Proponents of statewide effluent standards -argued that such standard His are easy to administer and enforce, can be implemented inexpensively (in the case of biological removal of phosphorus) and provide direct immediate reduction in total nutrient load. Arguments offered against such standards were that requiring across the board nutrient removal even in places where nutrient enrichment is not a problem places a burden on industries and municipalities with no commensurate benefit to water quality. It was also suggested that uniform effluent standards with a limited scientific basis in instream quality might be challenged in court.

Other issues

Members said narrative and numerical standards are both needed because they serve different functions. Narrative standards provide an overall statement prohibiting actions that degrade water quality and give the state discretion in doing what is needed to protect the resource. They cover all the situations that cannot be fully anticipated and defined and can allow for regional differences. Numerical standards, on the other hand: set specific limits that serve as the basis for point and non-point source regulation.

Some TAC members questioned whether Virginia could set water quality standards without setting certain goals or use classifications for various waters. Virginia's anti-degradation policy prevents classification of waters as a basis for differential protection; the waters of the state must be protected to allow for all beneficial uses. It is, however, possible to set standards by water body type or, geographic region where there is a scientific basis for this. It was pointed out that to develop attainable standards the state will have to take account of background levels of nutrients and the geo-chemical factors affecting these in the various regions and waters of the state.

Recommendation: Virginia should adopt a combination of narrative and numerical nutrient standards. The numerical standards should be statewide instream standards developed for specific water body types such as. lakes, rivers, and estuaries. The narrative portion of the standard should contain general language on protecting all waters from nutrient enrichment and acknowledge the need to allow some regional variation in standards if naturally occurring differences in nutrient levels justify this.

Water Quality Parameters

in the Delphi questionnaires completed by TAC members, six parameters received the most support as candidates for nutrient control standards: chlorophyll a; dissolved oxygen maximum and minimum; total phosphorus; inorganic nitrogen; orthophosphorus; and total nitrogen..

As a first step in refining this list at the workshop, TAC members were asked to select the parameter(s) they considered most appropriate for a nutrient control standard. Inorganic nitrogen and orthophosphorus received no support and were eliminated from the list. In discussing the w remaining four parameters, advantages and disadvantages were identified.

Chlorophyll a

The major advantage of chlorophyll a is that since it reflects the amount of plant material in the water, it is the best measure of an actual eutrophication problem. High chlorophyll a levels signal that there is a problem, making it an excellent standard to "trigger" nutrient management programs.

Disadvantages of chlorophyll a are that it only measures the consequences of nutrient enrichment, i. e., eutrophication. It is possible to have fairly high nutrient levels without a lot of algal growth. Because of the nutrient transport phenomenon, chlorophyll a problems may manifest themselves at some distance from upstream loading, making appropriate assignment of responsibility difficult. Also, the level of chlorophyll a in water may vary as a result of turbidity, stream flow, and other factors unrelated to nutrient levels. Chlorophyll a can be difficult to sample because it is not evenly dispersed and usual sampling methods would not measure the amount of macrophytic or periphytic plant life.

Dissolved Oxygen

The standard proposed for dissolved oxygen was maximum/minimum values over a 24-hour period () D.O.)) D.O. is directly related to the health of fish and plant populations and the overall productivity of waters and is affected by both algal and macrophytic growth. The primary cause of dissolved oxygen variation is the photosynthesis process connected with plant growth and for this reason it is a very good indicator of eutrophic conditions. ,

Disadvantages include the fact that D.O. variation is a consequence of eutrophication and therefore even further removed from actual nutrient levels than chlorophyll a. Variation in dissolved oxygen levels in different water body types was also suggested as a problem and D.O. can be affected by turbidity and natural aeration as well as organic loading.

Total Phosphorus and Total Nitrogen

TAC members discussed total phosphorus and total nitrogen simultaneously as possible standards. The major advantages of using TN and TP are that this ties the standard directly to the underlying cause of the eutrophication problem -excess nutrients. When TP and/or TN standards are exceeded no cause and effect relationships have to be established before going directly to management strategies (although relative shares and waste load allocations must still be developed). Using TN and TP also provides a way to address upstream nutrient transport.

The disadvantages of TP .and TN are that it is possible to have high levels of nutrients in certain bodies of water without having excess algal growth. Different levels cause different problems in different bodies of water. While these may ultimately cause problems downstream they do not cause any immediate problems and it may not be necessary to take any action.

General Discussion

In considering the various parameters, considerable discussion revolved around whether one should use the causes of eutrophication (TN. and TP) or the symptoms (algal growth as represented by chlorophyll s, and) D.O.) as the standard. In the case of the latter, the standard would be exceeded only when an actual eutrophication problem exists.

They would serve as a trigger for follow-up monitoring and initiation of management strategies. Use of the nutrients themselves as standards on the other hand is directed toward reducing overall nutrient loading and can be more easily tied to various point and non-point source discharges. Enforcement problems could arise with either approach. In the case of chlorophyll a and) D.O. it may be difficult to tie the problem to specific discharges. In the case of TN and TP, the state could be left trying to enforce a standard when no observable water quality problem exists.

Recommendation: Chlorophyll a,) D.O., TN and TP are all possible parameters to use as nutrient standards. While using all four would be most desirable it is probably not practical or necessary. The most appropriate parameters) should be selected for each basic water body type.

Standards for Specific Water Body Types

To develop recommendations regarding parameters, numerical values and sampling techniques for specific water body types, the TAC members divided into two groups: One group considered standards for freshwater lakes and flowing waters. The other group considered standards for estuaries and tidal fresh waters.

Freshwater Lakes

Each of the four parameters was considered to develop a recommendation for fresh water lakes.

Chlorophyll a: Most members favored use of a chlorophyll a standard for lakes. A numerical level of 25 :g/l as a monthly average with a maximum one time exceedence level of 50 :g/l was proposed. These values received general support from the group. (here was discussion about whether the chlorophyll standards should be based on planktonic chlorophyll only or same consideration given to macrophytic chlorophyll as well. It was determined that a planktonic measure would be easier to sample and would accurately reflect the eutrophic condition of the lake.

It was suggested that monitoring samples be taken at 1/2 the Secchi depth as long as that depth was greater than one foot. An alternative proposal was to use an integrated mixed layer sample which some members argued would yield more reliable results. The use of Secchi depth is, however, a well-recognized and reliable method and it was favored for its simplicity.

Group members thought the numerical chlorophyll standard should be combined with a narrative element that would deal with the problems caused by high chlorophyll levels: taste, odor, and clogged filters at water treatment plants.

Dissolved Oxygen: It was the consensus of the group that due to wide variation in D.O. at different depths and the difficulty this creates in setting standards and sampling techniques and the fact that D.O. problems are symptoms which would be reflected in other standards, no standard for D.O. should be recommended. The group did agree that a narrative component addressing the conditions associated with D.O. problems should be drafted.

Total Phosphorus: The group suggested two possible standards for total phosphorus in lake waters. A level of 50 ug/l as a weighted mean based on the water mass, or a level of 25 ug/l as a mixed layer mean. These levels were judged to be of equal validity as a measure of total P. (it was noted that if chlorophyll were sampled on a mixed layer basis this might be the favored approach since the two samples could be taken at the same time.)

Total Nitrogen The group discussed the possibility of linking the standard for total nitrogen to the standard for phosphorus. It was suggested that some N to P ratio could be used or that the nitrogen standard could be set at ten times the phosphorus standard. After discussion, the group agreed that no nitrogen standard should be set. Phosphorus is almost always the limiting factor in the eutrophication of Virginia's warm water lakes and the group thought a nitrogen standard would be unnecessary.

Recommendation: In freshwater lakes the state should consider setting a chlorophyll a standard of 25 ug/l as a monthly average, with a one-time exceedence level of 50 ug/l with both measured at 1/2 the Secchi Depth (if > 1 foot). This should be combined with a total phosphorus standard of 50 ug/l as a weighted mean or 25 ug/l as a mixed layer mean. A narrative component should be developed as well to address more general chlorophyll a and D.O. problems in lakes.

Flowing Waters

In considering each of the four parameters as standards for flowing waters, the group concentrated on the special characteristics of stream environments.

Chlorophyll a: In discussing chlorophyll a, members focused on the need to develop a standard that would take account of macrophytes and periphyton -- the major types of plant growth found in flowing waters. The group discussed the differences in stream type and the need for different sampling methods for chlorophyll. It was suggested that a chlorophyll standard for streams would require at least two sub-categories of flowing water: low order streams and high order streams.

After considering the advantages and disadvantages of a chlorophyll standard for flowing water, the group concluded that no numerical standard should be used. A narrative standard was recommended to be phrased in terms of the amount of plant coverage of the stream bottom: "Visible growth of green plants on 40% of the wetted perimeter of the stream bottom." Such a standard would take account of macrophytic vegetation without requiring a different standard for differing stream types. The suggested figure of 40% was recognized. as a rough approximation only. Some other percentage might be substituted after more careful consideration.

Dissolved oxygen: The group agreed that dissolved oxygen in streams is also affected by stream type. Therefore, rather than setting precise numbers for a D.O. standard, it was suggested that the standard be related to the oxygen saturation value of the water in question. The standard would be violated by a fluctuation over 24 hours greater than 1/3 of the oxygen saturation value. (again, the 1/3 value was a suggested figure which might need to be modified in actually setting the standard.) Relating the standard to the oxygen saturation value would avoid the need for altering the standard for different stream types while reflecting the wide fluctuations characteristic of dissolved oxygen problems.

Total Phosphorus: In considering a phosphorus standard for flowing water, the group agreed that in some regions of Virginia, a significant amount of the phosphorus in streams comes from natural sources. Given this divergence in background levels for streams, the group suggested a range of values for the phosphorus standard from 100 to 200 :g/l, depending on the natural background levels of phosphorus in the region.

Total Nitrogen: The group agreed that no standard for nitrogen in flowing waters was necessary.

Recommendation: The water quality standards for flowing waters should be a 24 hour dissolved oxygen fluctuation of greater than 1/3 of the oxygen saturation value (with the 1/3 to be tested/refined; a TP range between 100 and 200 :g/l depending on established background conditions; and a narrative standard 'visible growth of green plants on 40X (with the 40% to be tested/refined) of the wetted perimeter of the stream bottom.'

Tidal Waters

The second sub-group considered tidal waters: estuaries and tidal fresh, and the appropriateness of the four parameters for those water body types. In discussing the first parameter, chlorophyll a, a number of strategic issues were addressed that have implications for the other parameters as well.

Chlorophyll a: Members thought it was essential to establish a reference point from which an appropriate chlorophyll a standard could be developed. To do this they first made a distinction between stressed and unstressed waters. For unstressed waters, it was suggested that background levels be the point of reference and that the standard be a function in excess of background. For stressed waters a point of reference other than current conditions would be needed since restoration rather than non-degradation would be the state's environmental objective. It was implied that a common understanding of "stressed" was in the participants minds – at least in the narrative sense that stress could be recognized based on certain observations.

The problems inherent in defining the concept "background" (i.e., how far back in time or distance it is necessary to go in order to establish the background condition, or how to interpret naturally occurring conditions that exceed contemplated standards) were pointed out by several participants. For unstressed bodies, a working definition based on available data was suggested. This would reflect average conditions not associated with signs of stress. Based on familiarity with the Potomac it was suggested that this point of reference might be 50 ug/l. Another participant noted that this number would mean that only the James would be out of compliance. Following the suggestion that establishing a reference point is primarily an empirical question; a logical next step would be to do this by examining and interpreting existing data.

A number of suggestions were made about the function that would relate the standard to this reference point. These included 20% above background, one or two standard deviations above background, or some other form of probability distribution. A final suggestion was a standard of 20% above background which should not be exceeded by more than 30%, 95% of the time.

If examination of the available data showed relatively little variation in background levels among water bodies of a particular type, a tabular presentation of the standard could be developed once these background levels had been established and the appropriate function agreed upon.

The following was suggested as an example of background chlorophyll a numerical values that might be found upon examination of background data.

	:	—
tidal rivers	20	10
estuaries	10	2
embayments	50	25

Such a table could then be used to establish standards as some function of these background conditions. As a remediation target stressed bodies could be restored to the standards established for unstressed bodies.

Dissolved Oxygen: The group discussed the relationship between diurnal dissolved oxygen fluctuation and chlorophyll levels in estuaries, and tidal fresh waters. They agreed that background chlorophyll levels would affect dissolved oxygen levels and therefore the) D.O. standard could be related to background chlorophyll as well. The group also considered using a) D.O. standard relating D.O. fluctuation to a percentage of the maximum saturation value, or setting only a maximum D.O. level. The consensus was that the best approach would be to assess background chlorophyll levels and set) D.O. standards from them.

Total Phosphorus and Total Nitrogen: It was-generally agreed that phosphorus and nitrogen are good indicators of potential eutrophication problems. Considerable discussion took place about measuring TP/TN in surficial sediments as well as in transport. There was agreement that TP/TN would be important factors in remediation efforts and in nutrient load allocation strategies but there continued to be division within the group about including total phosphorus and total nitrogen in the standard.

To get a better sense of opinion a straw poll was taken with the following results:

<u>Options</u>	Supporters
(A) Chi- a and ,& DO standards (TN/TP monitored only)	9
(B) Chl a,) D0, TN/TP standards	1
(C) TN/TP (sediments) standards	2

Recommendation: Chlorophyll a and) D.O. should be used as the standards for estuaries and tidal fresh waters, supplemented by monitoring for TN and TP. The chlorophyll standard should be expressed as some function of background chlorophyll a levels. The) D.O. standard should also be developed relative to background chlorophyll a levels.

Summary of Proposed Standards by Water Body Type

	<u>Freshwater Lakes</u>	<u>Flowing Waters</u>	<u>Estuaries</u>	<u>Tidal Fresh</u>
Chlorophyll a	25 ug/l monthly average 50 ug/l one time maximum	Narrative Stnd. only	120% (or other function) of Background	120% (or other function) of Background
Dissolved Oxygen	Narrative Stnd. Only	24 Hour Fluc-tuation > 1/3 Oxygen Satur-ation	Stnd. Related to Background Chlorophyll	Stnd. Related to Background Chlorophyll
Total Phosphorus	50 ug/l	100ug/l to 200 ug/l Allowing Regional Variation	No Standard; Monitoring Only	No Standard; Monitoring Only
Total Nitrogen	No Standard Monitoring Only	No Standard Monitoring Only	No Standard Monitoring Only	No Standard Monitoring Only

Content of the Narrative Standard

In the closing discussion of the workshop, TAC members were asked to consider the role of narrative standards in controlling eutrophication. Virginia's existing narrative standard, which emphasizes preserving beneficial uses and limiting common eutrophication problems (taste, odor, and nuisance aquatic plants) was compared to North Carolina's approach to narrative nutrient standards. North Carolina has defined a special classification of 'nutrient sensitive waters' where special controls on

..
nutrient enrichment may be imposed unless such controls would cause economic hardship. The North Carolina example raised several issues for discussion.

TAC members agreed on the value of narrative standards - major changes can occur in a waterbody which may not be reflected in the parameters chosen as standards. These changes may require intervention and management to prevent future problems. Narrative standards can provide the basis for this including allowing the Board to designate special nutrient management areas when necessary.

There was considerable discussion of the use of economic hardship as a justification for allowing nutrient standards to be violated. TAC members noted that if an economically depressed area were allowed to exceed established nutrient standards, nutrients could be transported downstream and cause eutrophication problems far from the site of the economic hardship. Such a situation might, in fact, pose hardship on downstream uses of water, depending on the effects. Determining whose economic hardship should control the situation would not be an easy task:, and from a scientific standpoint, a significant gap in a nutrient management strategy could frustrate an entire program.

Recommendation: The state should develop a narrative nutrient standard that permits the state to give special attention or consideration to problem areas including some classification such as 'nutrient management area' if this is deemed necessary.

Elements in an Effective Nutrient Control Strategy

During an informal evening Roundtable session TAC members discussed a number of issues and concerns related to establishing an effective nutrient control strategy.

Non-Point Source Issues

A majority of the issues raised dealt with non-point source contributions to eutrophication problems and some of the ways to manage them. It was suggested that one of the reasons non-point sources are so hard to control is that the negative water quality effects often occur at a great distance from the non-point inputs making it hard for people to recognize their responsibility. This creates a situation like the "Tragedy of the Commons" problem in land use where the cumulative effect of individual decisions that by themselves are not harmful can destroy a common resource.

The differences between voluntary and mandatory non-point source controls were discussed. Voluntary BMP's have been helpful in reducing non-point source pollution, but not all owners and local governments participate and when ownership or management changes, BMP's may be neglected. Maryland has a non-point source program in which mandatory regulations based on a narrative standard back up their voluntary BMP program. Other innovative approaches to non-point source management that were mentioned included a "pollution trading" approach being used in Denver and various non-point source demonstration projects undertaken by the T.V.A.

TAC members discussed the cost of non-point source pollution control. The Water Control Board is required to consider economic impacts in the standard development process. It was suggested the best way to handle this is to have a standard that directs nutrient control management efforts where they are most needed. Using this approach, a significant problem is identified through some "trigger." Nutrient controls are then linked to watershed loading allocations for all the sources within that watershed. While relative shares of non-point source pollution can be difficult to determine, members suggested the use of existing knowledge/data combined with aerial photographs provides one reasonable approach. An alternative to developing wasteload allocations throughout the watershed of a stressed lake would be to undertake lake restoration at the site. A major problem with this approach is deciding who should pay. One suggestion was to allocate costs to citizens throughout the watershed.

Relationship Between Standards and Research

It was noted that standards drive basic research and this role should be recognized. Some suggested areas for scientific inquiry include:

- the availability of non-point source nutrients to aquatic plants;
- the long-term effects on aquatic systems of controlling a single nutrient;
- trophic changes and the food chain; and
- field studies on various non-point source controls.

Goals for research should be set along with the standards.

Relationship Between Standards and Implementation

Members were unanimous that just setting standards would not be enough. The legislative impetus for setting standards and developing an implementation program provides the state with an opportunity to make significant contributions in the area of nutrient management. Once standards have been set, management programs -- additional monitoring, waste load allocation, permit review, voluntary or mandatory BMP's -- must be developed where problems exist, and then revised as needed to achieve maximum effectiveness.

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Appendix F:

Status of Chesapeake Bay Nutrient Criteria Development

The Chesapeake 2000 agreement committed its signatories (the states of Pennsylvania, Maryland and Virginia; the District of Columbia; the Chesapeake Bay Commission and the EPA) to, “by 2001, define the water quality conditions necessary to protect aquatic living resources.” New York, Delaware and West Virginia agreed to the same commitment through a separate six-state memorandum of understanding with the EPA. Those water quality conditions will be defined through the Chesapeake Bay-specific numeric water quality criteria for dissolved oxygen, water clarity and chlorophyll *a* (response variables) that have been developed by a team of Chesapeake Bay watershed scientists and managers, including representatives from the Commonwealth of Virginia. EPA will publish these criteria in the spring of 2003. Collectively, these three water quality conditions provide the best and most direct measures of the effects of too much nutrient and sediment pollution on the Bay’s aquatic living resources – fish, crabs, oysters, their prey species and submerged aquatic vegetation (SAV). These criteria are being developed as part of a larger effort to restore Chesapeake Bay water quality. The criteria will apply to the Chesapeake Bay and all tidal tributaries and embayments in the state of Maryland, Virginia, Delaware, and the District of Columbia. The Chesapeake Bay and its tidal tributaries will be divided by the states into regulatory areas (designated use zones) for different segments of the Bay based on depth, hydrology, and aquatic community where different water quality criteria will apply depending on the aquatic life found in that zone. Combining these zones with numeric water quality criteria will provide an overall standard for achieving desired aquatic habitat conditions. Models will then be applied to determine nutrient-loading reductions needed in each tributary to maintain the numeric criteria (to address the critical causal variable.) (The Chesapeake Bay Executive Summary from EPA Draft Criteria document can be found at <http://www.chesapeakebay.net/baycriteria.htm>.) Virginia has committed via its 106 agreement with EPA to publish a Notice of Intended Rulemaking Amendment once the final Bay criteria are published and to complete the rulemaking process within 18 –24 months after the publication date of the NOIRA in the Virginia Register and newspapers.

Appendix G

Virginia Administrative Code

Database updated through December 11, 2009

CHAPTER 11

PUBLIC PARTICIPATION GUIDELINES

Part I

Purpose and Definitions

9VAC25-11-10. Purpose.

The purpose of this chapter is to promote public involvement in the development, amendment or repeal of the regulations of the State Water Control Board. This chapter does not apply to regulations, guidelines, or other documents exempted or excluded from the provisions of the Administrative Process Act (§ 2.2-4000 et seq. of the Code of Virginia).

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

9VAC25-11-20. Definitions.

The following words and terms when used in this chapter shall have the following meanings unless the context clearly indicates otherwise:

"Administrative Process Act" means Chapter 40 (§ 2.2-4000 et seq.) of Title 2.2 of the Code of Virginia.

"Agency" means the State Water Control Board, which is the unit of state government empowered by the agency's basic law to make regulations or decide cases. Actions specified in this chapter may be fulfilled by state employees as delegated by the agency.

"Basic law" means provisions in the Code of Virginia that delineate the basic authority and responsibilities of an agency.

"Commonwealth Calendar" means the electronic calendar for official government meetings open to the public as required by § 2.2-3707 C of the Freedom of Information Act.

"Negotiated rulemaking panel" or "NRP" means an ad hoc advisory panel of interested parties established by an agency to consider issues that are controversial with the assistance of a facilitator or mediator, for the purpose of reaching a consensus in the development of a proposed regulatory action.

"Notification list" means a list used to notify persons pursuant to this chapter. Such a list may include an electronic list maintained through the Virginia Regulatory Town Hall or other list maintained by the agency.

"Open meeting" means any scheduled gathering of a unit of state government empowered by an agency's basic law to make regulations or decide cases, which is related to promulgating, amending or repealing a regulation.

"Person" means any individual, corporation, partnership, association, cooperative, limited liability company, trust, joint venture, government, political subdivision, or any other legal or commercial entity and any successor, representative, agent, agency, or instrumentality thereof.

"Public hearing" means a scheduled time at which members or staff of the agency will meet for the purpose of receiving public comment on a regulatory action.

"Regulation" means any statement of general application having the force of law, affecting the rights or conduct of any person, adopted by the agency in accordance with the authority conferred on it by applicable laws.

"Regulatory action" means the promulgation, amendment, or repeal of a regulation by the agency.

"Regulatory advisory panel" or "RAP" means a standing or ad hoc advisory panel of interested parties established by the agency for the purpose of assisting in regulatory actions.

"Town Hall" means the Virginia Regulatory Town Hall, the website operated by the Virginia Department of Planning and Budget at www.townhall.virginia.gov, which has online public comment forums and displays information about regulatory meetings and regulatory actions under consideration in Virginia and sends this information to registered public users.

"Virginia Register" means the Virginia Register of Regulations, the publication that provides official legal notice of new, amended and repealed regulations of state agencies, which is published under the provisions of Article 6 (§ 2.2-4031 et seq.) of the Administrative Process Act.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

Part II

Notification of Interested Persons

9VAC25-11-30. Notification list.

A. The agency shall maintain a list of persons who have requested to be notified of regulatory actions being pursued by the agency.

B. Any person may request to be placed on a notification list by registering as a public user on the Town Hall or by making a request to the agency. Any person who requests to be placed on a notification list shall elect to be notified either by electronic means or through a postal carrier.

C. The agency may maintain additional lists for persons who have requested to be informed of specific regulatory issues, proposals, or actions.

D. When electronic mail is returned as undeliverable on multiple occasions at least 24 hours apart, that person may be deleted from the list. A single undeliverable message is insufficient cause to delete the person from the list.

E. When mail delivered by a postal carrier is returned as undeliverable on multiple occasions, that person may be deleted from the list.

F. The agency may periodically request those persons on the notification list to indicate their desire to either continue to be notified electronically, receive documents through a postal carrier, or be deleted from the list.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

9VAC25-11-40. Information to be sent to persons on the notification list.

A. To persons electing to receive electronic notification or notification through a postal carrier as described in 9VAC25-11-30, the agency shall send the following information:

1. A notice of intended regulatory action (NOIRA).

2. A notice of the comment period on a proposed, a re-proposed, or a fast-track regulation and hyperlinks to, or instructions on how to obtain, a copy of the regulation and any supporting documents.

3. A notice soliciting comment on a final regulation when the regulatory process has been extended pursuant to § 2.2-4007.06 or 2.2-4013 C of the Code of Virginia.

B. The failure of any person to receive any notice or copies of any documents shall not affect the validity of any regulation or regulatory action.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

Part III

Public Participation Procedures

9VAC25-11-50. Public comment.

A. In considering any nonemergency, nonexempt regulatory action, the agency shall afford interested persons an opportunity to submit data, views, and arguments, either orally or in writing, to the agency. Such opportunity to comment shall include an online public comment forum on the Town Hall.

1. To any requesting person, the agency shall provide copies of the statement of basis, purpose, substance, and issues; the economic impact analysis of the proposed or fast-track regulatory action; and the agency's response to public comments received.

2. The agency may begin crafting a regulatory action prior to or during any opportunities it provides to the public to submit comments.

B. The agency shall accept public comments in writing after the publication of a regulatory action in the Virginia Register as follows:

1. For a minimum of 30 calendar days following the publication of the notice of intended regulatory action (NOIRA).

2. For a minimum of 60 calendar days following the publication of a proposed regulation.

3. For a minimum of 30 calendar days following the publication of a repropoed regulation.

4. For a minimum of 30 calendar days following the publication of a final adopted regulation.

5. For a minimum of 30 calendar days following the publication of a fast-track regulation.

6. For a minimum of 21 calendar days following the publication of a notice of periodic review.

7. Not later than 21 calendar days following the publication of a petition for rulemaking.

C. The agency may determine if any of the comment periods listed in subsection B of this section shall be extended.

D. If the Governor finds that one or more changes with substantial impact have been made to a proposed regulation, he may require the agency to provide an additional 30 calendar days to solicit additional public comment on the changes in accordance with § 2.2-4013 C of the Code of Virginia.

E. The agency shall send a draft of the agency's summary description of public comment to all public commenters on the proposed regulation at least five days before final adoption of the regulation pursuant to § 2.2-4012 E of the Code of Virginia.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

9VAC25-11-60. Petition for rulemaking.

A. As provided in § 2.2-4007 of the Code of Virginia, any person may petition the agency to consider a regulatory action.

B. A petition shall include but is not limited to the following information:

1. The petitioner's name and contact information;
2. The substance and purpose of the rulemaking that is requested, including reference to any applicable Virginia Administrative Code sections; and
3. Reference to the legal authority of the agency to take the action requested.

C. The agency shall receive, consider and respond to a petition pursuant to § 2.2-4007 and shall have the sole authority to dispose of the petition.

D. The petition shall be posted on the Town Hall and published in the Virginia Register.

E. Nothing in this chapter shall prohibit the agency from receiving information or from proceeding on its own motion for rulemaking.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

9VAC25-11-70. Appointment of regulatory advisory panel.

A. The agency may appoint a regulatory advisory panel (RAP) to provide professional specialization or technical assistance when the agency determines that such expertise is necessary to address a specific regulatory issue or action or when individuals indicate an interest in working with the agency on a specific regulatory issue or action.

B. Any person may request the appointment of a RAP and request to participate in its activities. The agency shall determine when a RAP shall be appointed and the composition of the RAP.

C. A RAP may be dissolved by the agency if:

1. The proposed text of the regulation is posted on the Town Hall, published in the Virginia Register, or such other time as the agency determines is appropriate; or
2. The agency determines that the regulatory action is either exempt or excluded from the requirements of the Administrative Process Act.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

9VAC25-11-80. Appointment of negotiated rulemaking panel.

A. The agency may appoint a negotiated rulemaking panel (NRP) if a regulatory action is expected to be controversial.

B. An NRP that has been appointed by the agency may be dissolved by the agency when:

1. There is no longer controversy associated with the development of the regulation;
2. The agency determines that the regulatory action is either exempt or excluded from the requirements of the Administrative Process Act; or
3. The agency determines that resolution of a controversy is unlikely.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

9VAC25-11-90. Meetings.

Notice of any open meeting, including meetings of a RAP or NRP, shall be posted on the Virginia Regulatory Town Hall and Commonwealth Calendar at least seven working days prior to the date of the meeting. The exception to this requirement is any meeting held in accordance with § 2.2-3707 D of the Code of Virginia allowing for contemporaneous notice to be provided to participants and the public.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

9VAC25-11-100. Public hearings on regulations.

A. The agency shall indicate in its notice of intended regulatory action whether it plans to hold a public hearing following the publication of the proposed stage of the regulatory action.

B. The agency may conduct one or more public hearings during the comment period following the publication of a proposed regulatory action.

C. An agency is required to hold a public hearing following the publication of the proposed regulatory action when:

1. The agency's basic law requires the agency to hold a public hearing;
2. The Governor directs the agency to hold a public hearing; or
3. The agency receives requests for a public hearing from at least 25 persons during the public comment period following the publication of the notice of intended regulatory action.

D. Notice of any public hearing shall be posted on the Town Hall and Commonwealth Calendar at least seven working days prior to the date of the hearing. The agency shall also notify those persons who requested a hearing under subdivision C 3 of this section.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

9VAC25-11-110. Periodic review of regulations.

A. The agency shall conduct a periodic review of its regulations consistent with:

1. An executive order issued by the Governor pursuant to § 2.2-4017 of the Administrative Process Act to receive comment on all existing regulations as to their effectiveness, efficiency, necessity, clarity, and cost of compliance; and
2. The requirements in § 2.2-4007.1 of the Administrative Process Act regarding regulatory flexibility for small businesses.

B. A periodic review may be conducted separately or in conjunction with other regulatory actions.

C. Notice of a periodic review shall be posted on the Town Hall and published in the Virginia Register.

Statutory Authority

§§ 2.2-4007.02 and 62.1-44.15 of the Code of Virginia.

Historical Notes

Derived from Virginia Register Volume 25, Issue 5, eff. January 1, 2009.

Appendix H

Code of Virginia

§ 2.2-4000. Short title; purpose.

A. This chapter may be cited as the "Administrative Process Act."

B. The purpose of this chapter is to supplement present and future basic laws conferring authority on agencies either to make regulations or decide cases as well as to standardize court review thereof save as laws hereafter enacted may otherwise expressly provide. This chapter shall not supersede or repeal additional procedural requirements in such basic laws.

(1975, c. 503, §§ 9-6.14:1, 9-6.14:3; 1977, c. 647; 1984, c. 5; 2001, c. 844.)

§ 2.2-4001. Definitions.

As used in this chapter, unless the context requires a different meaning:

"Agency" means any authority, instrumentality, officer, board or other unit of the state government empowered by the basic laws to make regulations or decide cases.

"Agency action" means either an agency's regulation or case decision or both, any violation, compliance, or noncompliance with which could be a basis for the imposition of injunctive orders, penal or civil sanctions of any kind, or the grant or denial of relief or of a license, right, or benefit by any agency or court.

"Basic law" or "basic laws" means provisions of the Constitution and statutes of the Commonwealth authorizing an agency to make regulations or decide cases or containing procedural requirements therefor.

"Case" or "case decision" means any agency proceeding or determination that, under laws or regulations at the time, a named party as a matter of past or present fact, or of threatened or contemplated private action, either is, is not, or may or may not be (i) in violation of such law or regulation or (ii) in compliance with any existing requirement for obtaining or retaining a license or other right or benefit.

"Guidance document" means any document developed by a state agency or staff that provides information or guidance of general applicability to the staff or public to interpret or implement statutes or the agency's rules or regulations, excluding agency minutes or documents that pertain only to the internal management of agencies. Nothing in this definition shall be construed or interpreted to expand the identification or release of any document otherwise protected by law.

"Hearing" means agency processes other than those informational or factual inquiries of an informal nature provided in §§ 2.2-4007.01 and 2.2-4019 and includes only (i) opportunity for private parties to submit factual proofs in formal proceedings as provided in § 2.2-4009 in connection with the making of regulations or (ii) a similar right of private parties or requirement of public agencies as provided in § 2.2-4020 in connection with case decisions.

"Hearing officer" means an attorney selected from a list maintained by the Executive Secretary of the Supreme Court in accordance with § 2.2-4024.

"Public assistance and social services programs" means those programs specified in § 63.2-100.

"Rule" or "regulation" means any statement of general application, having the force of law, affecting the rights or conduct of any person, adopted by an agency in accordance with the authority conferred on it by applicable basic laws.

"Subordinate" means (i) one or more but less than a quorum of the members of a board constituting an agency, (ii) one or more of its staff members or employees, or (iii) any other person or persons designated by the agency to act in its behalf.

(1975, c. 503, § 9-6.14:4; 1977, cc. 377, 381; 1979, c. 613; 1984, c. 187; 1985, cc. 67, 602; 1997, c. 11; 2001, c. 844; 2002, c. 747; 2007, cc. 873, 916.)

§ 2.2-4002. Exemptions from chapter generally.

A. Although required to comply with § 2.2-4103 of the Virginia Register Act (§ 2.2-4100 et seq.), the following agencies shall be exempted from the provisions of this chapter, except to the extent that they are specifically made subject to §§ 2.2-4024, 2.2-4030 and 2.2-4031:

1. The General Assembly.
2. Courts, any agency of the Supreme Court, and any agency that by the Constitution is expressly granted any of the powers of a court of record.
3. The Department of Game and Inland Fisheries in promulgating regulations regarding the management of wildlife and for all case decisions rendered pursuant to any provisions of Chapters 2 (§ 29.1-200 et seq.), 3 (§ 29.1-300 et seq.), 4 (§ 29.1-400 et seq.), 5 (§ 29.1-500 et seq.), and 7 (§ 29.1-700 et seq.) of Title 29.1.
4. The Virginia Housing Development Authority.
5. Municipal corporations, counties, and all local, regional or multijurisdictional authorities created under this Code, including those with federal authorities.
6. Educational institutions operated by the Commonwealth, provided that, with respect to § 2.2-4031, such educational institutions shall be exempt from the publication requirements only with respect to regulations that pertain to (i) their academic affairs, (ii) the selection, tenure, promotion and disciplining of faculty and employees, (iii) the selection of students, and (iv) rules of conduct and disciplining of students.
7. The Milk Commission in promulgating regulations regarding (i) producers' licenses and bases, (ii) classification and allocation of milk, computation of sales and shrinkage, and (iii) class prices for producers' milk, time and method of payment, butterfat testing and differential.
8. The Virginia Resources Authority.
9. Agencies expressly exempted by any other provision of this Code.
10. The Department of General Services in promulgating standards for the inspection of buildings for asbestos pursuant to § 2.2-1164.
11. The State Council of Higher Education for Virginia, in developing, issuing, and revising guidelines pursuant to § 23-9.6:2.

12. The Commissioner of Agriculture and Consumer Services in adopting regulations pursuant to subsection B of § 3.2-6002 and in adopting regulations pursuant to § 3.2-6023.

13. The Commissioner of Agriculture and Consumer Services and the Board of Agriculture and Consumer Services in promulgating regulations pursuant to subsections B and D of § 3.2-3601, subsection B of § 3.2-3701, § 3.2-4002, subsections B and D of § 3.2-4801, §§ 3.2-5121 and 3.2-5206, and subsection A of § 3.2-5406.

14. The Board of Optometry when specifying therapeutic pharmaceutical agents, treatment guidelines, and diseases and abnormal conditions of the human eye and its adnexa for TPA-certification of optometrists pursuant to Article 5 (§ 54.1-3222 et seq.) of Chapter 32 of Title 54.1.

15. The Virginia War Memorial Foundation.

16. The Virginia Medicaid Prior Authorization Advisory Committee in making recommendations to the Board of Medical Assistance Services regarding prior authorization for prescription drug coverage pursuant to Article 4 (§ 32.1-331.12 et seq.) of Chapter 10 of Title 32.1.

17. The State Board of Education, in developing, issuing, and revising guidelines pursuant to § 22.1-203.2.

18. The Virginia Racing Commission, (i) when acting by and through its duly appointed stewards or in matters related to any specific race meeting or (ii) in promulgating technical rules regulating actual live horse racing at race meetings licensed by the Commission.

19. The Virginia Small Business Financing Authority.

20. The Virginia Economic Development Partnership Authority.

21. The Board of Agriculture and Consumer Services in adopting, amending or repealing regulations pursuant to subsection A (ii) of § 59.1-156.

22. The Insurance Continuing Education Board pursuant to § 38.2-1867.

23. The Board of Health in promulgating the list of diseases that shall be reported to the Department of Health pursuant to § 32.1-35 and in adopting, amending or repealing regulations pursuant to subsection C of § 35.1-14 that incorporate the Food and Drug Administration's Food Code pertaining to restaurants or food service.

24. The nonprofit, nonstock corporation established by the Commissioner of Agriculture and Consumer Services pursuant to subdivision B 5 of § 3.2-102.

25. (Expires December 31, 2010) The Secretary of Natural Resources in setting a date of closure for the Chesapeake Bay purse seine fishery for Atlantic menhaden for reduction purposes pursuant to § 28.2-1000.2.

26. The Board of Pharmacy when specifying special subject requirements for continuing education for pharmacists pursuant to § 54.1-3314.1.

B. Agency action relating to the following subjects shall be exempted from the provisions of this chapter:

1. Money or damage claims against the Commonwealth or agencies thereof.
2. The award or denial of state contracts, as well as decisions regarding compliance therewith.
3. The location, design, specifications or construction of public buildings or other facilities.
4. Grants of state or federal funds or property.
5. The chartering of corporations.
6. Customary military, naval or police functions.
7. The selection, tenure, dismissal, direction or control of any officer or employee of an agency of the Commonwealth.
8. The conduct of elections or eligibility to vote.
9. Inmates of prisons or other such facilities or parolees therefrom.
10. The custody of persons in, or sought to be placed in, mental, penal or other state institutions as well as the treatment, supervision, or discharge of such persons.
11. Traffic signs, markers or control devices.
12. Instructions for application or renewal of a license, certificate, or registration required by law.
13. Content of, or rules for the conduct of, any examination required by law.
14. The administration of pools authorized by Chapter 47 (§ 2.2-4700 et seq.) of this title.
15. Any rules for the conduct of specific lottery games, so long as such rules are not inconsistent with duly adopted regulations of the State Lottery Board, and provided that such regulations are published and posted.
16. Orders condemning or closing any shellfish, finfish, or crustacea growing area and the shellfish, finfish or crustacea located thereon pursuant to Article 2 (§ 28.2-803 et seq.) of Chapter 8 of Title 28.2.
17. Any operating procedures for review of child deaths developed by the State Child Fatality Review Team pursuant to § 32.1-283.1.
18. The regulations for the implementation of the Health Practitioners' Monitoring Program and the activities of the Health Practitioners' Monitoring Program Committee pursuant to Chapter 25.1 (§ 54.1-2515 et seq.) of Title 54.1.
19. The process of reviewing and ranking grant applications submitted to the Commonwealth Neurotrauma Initiative Advisory Board pursuant to Chapter 3.1 (§ 51.5-12.1 et seq.) of Title 51.5.
20. Loans from the Small Business Environmental Compliance Assistance Fund pursuant to Article 4 (§ 10.1-1197.1 et seq.) of Chapter 11.1 of Title 10.1.
21. The Virginia Breeders Fund created pursuant to § 59.1-372.

22. The types of pari-mutuel wagering pools available for live or simulcast horse racing.
23. The administration of medication or other substances foreign to the natural horse.

C. Minor changes to regulations published in the Virginia Administrative Code under the Virginia Register Act, Chapter 41 (§ 2.2-4100 et seq.) of this title, made by the Virginia Code Commission pursuant to § 30-150, shall be exempt from the provisions of this chapter.

(1985, c. 602, § 9-6.14:4.1; 1986, c. 615; 1987, cc. 375, 652; 1988, cc. 364, 424, 498, 723, 765, 820; 1989, cc. 54, 299, 478; 1990, cc. 721, 968; 1991, cc. 80, 294, 344; 1992, cc. 200, 409, 488, 592, 793; 1993, cc. 537, 669, 898; 1994, cc. 237, 577, 649, 740, 743, 801; 1995, cc. 103, 499, 516; 1996, cc. 51, 152, 158, 189, 205, 279, 320, 345, 573, 590, 598, 638, 705, 735, 818, 1012; 1997, cc. 87, 88, 109, 212, 390, 439, 567, 624, 785, 806, 845, 850, 861, 868; 1998, cc. 39, 619, 784; 1999, cc. 412, 421, 433, 603; 2000, cc. 382, 400, 924, 1011; 2001, cc. 465, 523, 688, 820, 844; 2003, cc. 639, 695; 2004, c. 802; 2006, c. 442; 2007, cc. 41, 870, 932; 2008, c. 672; 2009, c. 472.)

§ 2.2-4003. Venue.

In all proceedings under § 2.2-4019 or 2.2-4020 venue shall be in the city or county where the administrative agency maintains its principal office or as the parties may otherwise agree. In all proceedings under § 2.2-4026, venue shall be as specified in subdivision 1 of § 8.01-261.

(1975, c. 503, § 9-6.14:5; 1977, c. 624; 2001, c. 844; 2007, cc. 873, 916.)

§ 2.2-4004. Severability.

The provisions of regulations adopted under this chapter or the application thereof to any person or circumstances that are held invalid shall not affect the validity of other regulations, provisions or applications that can be given effect without the invalid provisions or applications. The provisions of all regulations are severable unless (i) the regulation specifically provides that its provisions are not severable or (ii) it is apparent that two or more regulations or provisions must operate in accord with one another.

(1987, c. 55, § 9-6.14:5.1; 2001, c. 844.)

§ 2.2-4005. Review of exemptions by Joint Legislative Audit and Review Commission.

The Joint Legislative Audit and Review Commission shall conduct a review periodically of the exemptions authorized by this chapter. The purpose of this review shall be to assess whether there are any exemptions that should be discontinued or modified.

(1985, c. 602, § 9-6.14:4.1; 1986, c. 615; 1987, cc. 375, 652; 1988, cc. 364, 424, 498, 723, 765, 820; 1989, cc. 54, 299, 478; 1990, cc. 721, 968; 1991, cc. 80, 294, 344; 1992, cc. 200, 409, 488, 592, 793; 1993, cc. 537, 669, 898; 1994, cc. 237, 577, 649, 740, 743, 801; 1995, cc. 103, 499, 516; 1996, cc. 51, 152, 158, 189, 205, 279, 320, 345, 573, 590, 598, 638, 705, 735, 818, 1012; 1997, cc. 87, 88, 109, 212, 390, 439, 567, 624, 785, 806, 845, 850, 861, 868; 1998, cc. 39, 619, 784; 1999, cc. 412, 421, 433, 603; 2000, cc. 382, 400, 924, 1011; 2001, c. 844.)

§ 2.2-4006. Exemptions from requirements of this article.

A. The following agency actions otherwise subject to this chapter and § 2.2-4103 of the Virginia Register Act shall be exempted from the operation of this article:

1. Agency orders or regulations fixing rates or prices.
2. Regulations that establish or prescribe agency organization, internal practice or procedures, including delegations of authority.
3. Regulations that consist only of changes in style or form or corrections of technical errors. Each promulgating agency shall review all references to sections of the Code of Virginia within their regulations each time a new supplement or replacement volume to the Code of Virginia is published to ensure the accuracy of each section or section subdivision identification listed.
4. Regulations that are:
 - a. Necessary to conform to changes in Virginia statutory law or the appropriation act where no agency discretion is involved;
 - b. Required by order of any state or federal court of competent jurisdiction where no agency discretion is involved; or
 - c. Necessary to meet the requirements of federal law or regulations, provided such regulations do not differ materially from those required by federal law or regulation, and the Registrar has so determined in writing. Notice of the proposed adoption of these regulations and the Registrar's determination shall be published in the Virginia Register not less than 30 days prior to the effective date of the regulation.
5. Preliminary program permit fees of the Department of Environmental Quality assessed pursuant to subsection C of § 10.1-1322.2.
6. Regulations of the Pesticide Control Board adopted pursuant to subsection B of § 3.2-3929 or clause (v) or (vi) of subsection C of § 3.2-3931 after having been considered at two or more Board meetings and one public hearing.
7. Regulations of the regulatory boards served by (i) the Department of Labor and Industry pursuant to Title 40.1 and (ii) the Department of Professional and Occupational Regulation or the Department of Health Professions pursuant to Title 54.1 that are limited to reducing fees charged to regulants and applicants.
8. The development and issuance of procedural policy relating to risk-based mine inspections by the Department of Mines, Minerals and Energy authorized pursuant to §§ 45.1-161.82 and 45.1-161.292:55.
9. General permits issued by the (a) State Air Pollution Control Board pursuant to Chapter 13 (§ 10.1-1300 et seq.) of Title 10.1 or (b) State Water Control Board pursuant to the State Water Control Law (§ 62.1-44.2 et seq.), Chapter 24 (§ 62.1-242 et seq.) of Title 62.1 and Chapter 25 (§ 62.1-254 et seq.) of Title 62.1, (c) Virginia Soil and Water Conservation Board pursuant to the Virginia Stormwater Management Act (§ 10.1-603.1 et seq.) of Title 10.1, and (d) the development and issuance of general wetlands permits by the Marine Resources Commission pursuant to subsection B of § 28.2-1307, if the respective Board or Commission (i) provides a Notice of Intended Regulatory Action in conformance with the provisions of § 2.2-4007.01, (ii) following the passage of 30 days from the publication of the Notice of Intended Regulatory

Action forms a technical advisory committee composed of relevant stakeholders, including potentially affected citizens groups, to assist in the development of the general permit, (iii) provides notice and receives oral and written comment as provided in § 2.2-4007.03, and (iv) conducts at least one public hearing on the proposed general permit.

10. The development and issuance by the Board of Education of guidelines on constitutional rights and restrictions relating to the recitation of the pledge of allegiance to the American flag in public schools pursuant to § 22.1-202.

11. Regulations of the Board of the Virginia College Savings Plan adopted pursuant to § 23-38.77.

12. Regulations of the Marine Resources Commission.

13. Regulations adopted by the Board of Housing and Community Development pursuant to (i) Statewide Fire Prevention Code (§ 27-94 et seq.), (ii) the Industrialized Building Safety Law (§ 36-70 et seq.), (iii) the Uniform Statewide Building Code (§ 36-97 et seq.), and (iv) § 36-98.3, provided the Board (a) provides a Notice of Intended Regulatory Action in conformance with the provisions of § 2.2-4007.01, (b) publishes the proposed regulation and provides an opportunity for oral and written comments as provided in § 2.2-4007.03, and (c) conducts at least one public hearing as provided in §§ 2.2-4009 and 36-100 prior to the publishing of the proposed regulations. Notwithstanding the provisions of this subdivision, any regulations promulgated by the Board shall remain subject to the provisions of § 2.2-4007.06 concerning public petitions, and §§ 2.2-4013 and 2.2-4014 concerning review by the Governor and General Assembly.

14. Amendments to the list of drugs susceptible to counterfeiting adopted by the Board of Pharmacy pursuant to subsection B of § 54.1-3307.

B. Whenever regulations are adopted under this section, the agency shall state as part thereof that it will receive, consider and respond to petitions by any interested person at any time with respect to reconsideration or revision. The effective date of regulations adopted under this subsection shall be in accordance with the provisions of § 2.2-4015, except in the case of emergency regulations, which shall become effective as provided in subsection B of § 2.2-4012.

C. A regulation for which an exemption is claimed under this section or § 2.2-4002, or 2.2-4011 and that is placed before a board or commission for consideration shall be provided at least two days in advance of the board or commission meeting to members of the public that request a copy of that regulation. A copy of that regulation shall be made available to the public attending such meeting.

(1985, c. 602, § 9-6.14:4.1; 1986, c. 615; 1987, cc. 375, 652; 1988, cc. 364, 424, 498, 723, 765, 820; 1989, cc. 54, 299, 478; 1990, cc. 721, 968; 1991, cc. 80, 294, 344; 1992, cc. 200, 409, 488, 592, 793; 1993, cc. 537, 669, 898; 1994, cc. 237, 577, 649, 740, 743, 801; 1995, cc. 103, 499, 516; 1996, cc. 51, 152, 158, 189, 205, 279, 320, 345, 573, 590, 598, 638, 705, 735, 818, 1012; 1997, cc. 87, 88, 109, 212, 390, 439, 567, 624, 785, 806, 845, 850, 861, 868; 1998, cc. 39, 619, 784; 1999, cc. 412, 421, 433, 603; 2000, cc. 382, 400, 924, 1011; 2001, c. 844; 2003, c. 436; 2005, c. 102; 2006, cc. 632, 719; 2007, cc. 873, 916.)

§ 2.2-4007. Petitions for new or amended regulations; opportunity for public comment.

A. Any person may petition an agency to request the agency to develop a new regulation or amend an existing regulation. The petition shall state (i) the substance and purpose of the rulemaking that is requested, including reference to any applicable Virginia Administrative Code sections, and (ii) reference to the legal authority of the agency to take the action requested.

B. Within 14 days of receiving a petition, the agency shall send a notice identifying the petitioner, the nature of the petitioner's request and the agency's plan for disposition of the petition to the Registrar for publication in the Virginia Register of Regulations in accordance with the provisions of subsection B of § 2.2-4031.

C. A 21-day period for acceptance of written public comment on the petition shall be provided after publication in the Virginia Register. The agency shall issue a written decision to grant or deny the petitioner's request within 90 days following the close of the comment period. However, if the rulemaking authority is vested in an entity that has not met within that 90-day period, the entity shall issue a written decision no later than 14 days after it next meets. The written decision issued by the agency shall include a statement of its reasons and shall be submitted to the Registrar for publication in the Virginia Register of Regulations. Agency decisions to initiate or not initiate rulemaking in response to petitions shall not be subject to judicial review.

(1984, c. 5, § 9-6.14:7.1; 1985, c. 602; 1989, c. 71; 1991, c. 488; 1993, cc. 898, 944; 1994, c. 938; 1995, cc. 25, 677, 717, 790; 1997, c. 87; 2001, c. 844; 2002, cc. 241, 391, 747; 2003, c. 224; 2005, cc. 619, 682; 2007, cc. 873, 916.)

§ 2.2-4007.01. Notice of intended regulatory action; public hearing.

A. In the case of all regulations, except those regulations exempted by § 2.2-4002, 2.2-4006, 2.2-4011, or 2.2-4012.1, an agency shall provide the Registrar of Regulations with a Notice of Intended Regulatory Action that describes the subject matter and intent of the planned regulation. At least 30 days shall be provided for public comment, to include an on-line public comment forum on the Virginia Regulatory Town Hall, after publication of the Notice of Intended Regulatory Action. An agency shall not file proposed regulations with the Registrar until the public comment period on the Notice of Intended Regulatory Action has closed.

B. Agencies shall state in the Notice of Intended Regulatory Action whether they plan to hold a public hearing on the proposed regulation after it is published. Agencies shall hold such public hearings if required by basic law. If the agency states an intent to hold a public hearing on the proposed regulation in the Notice of Intended Regulatory Action, then it shall hold the public hearing. If the agency states in its Notice of Intended Regulatory Action that it does not plan to hold a hearing on the proposed regulation, then no public hearing is required unless, prior to completion of the comment period specified in the Notice of Intended Regulatory Action, (i) the Governor directs the agency to hold a public hearing or (ii) the agency receives requests for a public hearing from at least 25 persons.

(2007, cc. 873, 916.)

§ 2.2-4007.02. Public participation guidelines.

A. Public participation guidelines for soliciting the input of interested parties in the formation and development of its regulations shall be developed, adopted, and used by each agency pursuant to the provisions of this chapter. The guidelines shall set out any methods for the

identification and notification of interested parties and any specific means of seeking input from interested persons or groups that the agency intends to use in addition to the Notice of Intended Regulatory Action. The guidelines shall set out a general policy for the use of standing or ad hoc advisory panels and consultation with groups and individuals registering interest in working with the agency. Such policy shall address the circumstances in which the agency considers the panels or consultation appropriate and intends to make use of the panels or consultation.

B. In formulating any regulation, including but not limited to those in public assistance and social services programs, the agency pursuant to its public participation guidelines shall afford interested persons an opportunity to submit data, views, and arguments, either orally or in writing, to the agency, to include an on-line public comment forum on the Virginia Regulatory Town Hall, or other specially designated subordinate. However, the agency may begin drafting the proposed regulation prior to or during any opportunities it provides to the public to submit comments.

(2007, cc. 873, 916.)

§ 2.2-4007.03. Informational proceedings; effect of noncompliance.

A. In the case of all regulations, except those regulations exempted by § 2.2-4002, 2.2-4006, or 2.2-4011, the proposed regulation and general notice of opportunity for oral or written submittals as to that regulation shall be posted on the Virginia Regulatory Town Hall and published in the Virginia Register of Regulations in accordance with the provisions of subsection B of § 2.2-4031. In addition, the agency may, in its discretion, (i) publish the notice in any newspaper and (ii) publicize the notice through press releases and such other media as will best serve the purpose and subject involved. The Register and any newspaper publication shall be made at least 60 days in advance of the last date prescribed in the notice for such submittals. All notices, written submittals, and transcripts and summaries or notations of oral presentations, as well as any agency action thereon, shall be matters of public record in the custody of the agency.

B. If an agency wishes to change a proposed regulation before adopting it as a final regulation, it may choose to publish a revised proposed regulation, provided the latter is subject to a public comment period of at least 30 additional days and the agency complies in all other respects with this section.

C. In no event shall the failure to comply with the requirements of this section be deemed mere harmless error for the purposes of § 2.2-4027.

(2007, cc. 873, 916.)

§ 2.2-4007.04. Economic impact analysis.

A. Before delivering any proposed regulation under consideration to the Registrar as required in § 2.2-4007.05, the agency shall submit on the Virginia Regulatory Town Hall a copy of that regulation to the Department of Planning and Budget. In addition to determining the public benefit, the Department of Planning and Budget in coordination with the agency shall, within 45 days, prepare an economic impact analysis of the proposed regulation, as follows:

1. The economic impact analysis shall include but need not be limited to the projected number of businesses or other entities to whom the regulation would apply; the identity of any localities and types of businesses or other entities particularly affected by the regulation; the projected number

of persons and employment positions to be affected; the impact of the regulation on the use and value of private property, including additional costs related to the development of real estate for commercial or residential purposes; and the projected costs to affected businesses, localities, or entities of implementing or complying with the regulations, including the estimated fiscal impact on such localities and sources of potential funds to implement and comply with such regulation. A copy of the economic impact analysis shall be provided to the Joint Commission on Administrative Rules;

2. If the regulation may have an adverse effect on small businesses, the economic impact analysis shall also include (i) an identification and estimate of the number of small businesses subject to the regulation; (ii) the projected reporting, recordkeeping, and other administrative costs required for small businesses to comply with the regulation, including the type of professional skills necessary for preparing required reports and other documents; (iii) a statement of the probable effect of the regulation on affected small businesses; and (iv) a description of any less intrusive or less costly alternative methods of achieving the purpose of the regulation. As used in this subdivision, "small business" has the same meaning as provided in subsection A of § 2.2-4007.1; and

3. In the event the Department cannot complete an economic impact statement within the 45-day period, it shall advise the agency and the Joint Commission on Administrative Rules as to the reasons for the delay. In no event shall the delay exceed 30 days beyond the original 45-day period.

B. Agencies shall provide the Department with such estimated fiscal impacts on localities and sources of potential funds. The Department may request the assistance of any other agency in preparing the analysis. The Department shall deliver a copy of the analysis to the agency drafting the regulation, which shall comment thereon as provided in § 2.2-4007.05, a copy to the Registrar for publication with the proposed regulation, and an electronic copy to each member of the General Assembly. No regulation shall be promulgated for consideration pursuant to § 2.2-4007.05 until the impact analysis has been received by the Registrar. For purposes of this section, the term "locality, business, or entity particularly affected" means any locality, business, or entity that bears any identified disproportionate material impact that would not be experienced by other localities, businesses, or entities. The analysis shall represent the Department's best estimate for the purposes of public review and comment on the proposed regulation. The accuracy of the estimate shall in no way affect the validity of the regulation, nor shall any failure to comply with or otherwise follow the procedures set forth in this subsection create any cause of action or provide standing for any person under Article 5 (§ 2.2-4025 et seq.) or otherwise to challenge the actions of the Department hereunder or the action of the agency in adopting the proposed regulation.

(2007, cc. 316, 561, 873, 916.)

§ 2.2-4007.05. Submission of proposed regulations to the Registrar.

Before promulgating any regulation under consideration, the agency shall deliver a copy of that regulation to the Registrar together with a summary of the regulation and a separate and concise statement of (i) the basis of the regulation, defined as the statutory authority for promulgating the regulation, including an identification of the section number and a brief statement relating the content of the statutory authority to the specific regulation proposed; (ii) the purpose of the regulation, defined as the rationale or justification for the new provisions of the regulation, from

the standpoint of the public's health, safety, or welfare; (iii) the substance of the regulation, defined as the identification and explanation of the key provisions of the regulation that make changes to the current status of the law; (iv) the issues of the regulation, defined as the primary advantages and disadvantages for the public, and as applicable for the agency or the state, of implementing the new regulatory provisions; and (v) the agency's response to the economic impact analysis submitted by the Department of Planning and Budget pursuant to § 2.2-4007.04. Any economic impact estimate included in the agency's response shall represent the agency's best estimate for the purposes of public review and comment, but the accuracy of the estimate shall in no way affect the validity of the regulation. Staff as designated by the Code Commission shall review proposed regulation submission packages to ensure that the requirements of this subsection are met prior to publication of the proposed regulation in the Register. The summary; the statement of the basis, purpose, substance, and issues; the economic impact analysis; and the agency's response shall be published in the Virginia Register of Regulations and be available on the Virginia Regulatory Town Hall, together with the notice of opportunity for oral or written submittals on the proposed regulation.

(2007, cc. 873, 916.)

§ 2.2-4007.06. Changes between proposed and final regulations.

If one or more changes with substantial impact are made to a proposed regulation from the time that it is published as a proposed regulation to the time it is published as a final regulation, any person may petition the agency within 30 days from the publication of the final regulation to request an opportunity for oral and written submittals on the changes to the regulation. If the agency receives requests from at least 25 persons for an opportunity to submit oral and written comments on the changes to the regulation, the agency shall (i) suspend the regulatory process for 30 days to solicit additional public comment and (ii) file notice of the additional 30-day public comment period with the Registrar of Regulations, unless the agency determines that the changes made are minor or inconsequential in their impact. The comment period, if any, shall begin on the date of publication of the notice in the Register. Agency denial of petitions for a comment period on changes to the regulation shall be subject to judicial review.

(2007, cc. 873, 916.)

§ 2.2-4007.07. State Air Pollution Control Board; variances.

The provisions of §§ 2.2-4007 through 2.2-4007.06 shall not apply to the issuance by the State Air Pollution Control Board of variances to its regulations.

(2007, cc. 873, 916.)

§ 2.2-4007.1. Regulatory flexibility for small businesses; periodic review of regulations.

A. As used in this section, "small business" means a business entity, including its affiliates, that (i) is independently owned and operated and (ii) employs fewer than 500 full-time employees or has gross annual sales of less than \$6 million.

B. In addition to the requirements of §§ 2.2-4007 through 2.2-4007.06, prior to the adoption of any proposed regulation, the agency proposing a regulation shall prepare a regulatory flexibility analysis in which the agency shall consider utilizing alternative regulatory methods, consistent with health, safety, environmental, and economic welfare, that will accomplish the objectives of

applicable law while minimizing the adverse impact on small businesses. The agency shall consider, at a minimum, each of the following methods of reducing the effects of the proposed regulation on small businesses:

1. The establishment of less stringent compliance or reporting requirements;
2. The establishment of less stringent schedules or deadlines for compliance or reporting requirements;
3. The consolidation or simplification of compliance or reporting requirements;
4. The establishment of performance standards for small businesses to replace design or operational standards required in the proposed regulation; and
5. The exemption of small businesses from all or any part of the requirements contained in the proposed regulation.

C. Prior to the adoption of any proposed regulation that may have an adverse effect on small businesses, each agency shall notify the Joint Commission on Administrative Rules, through the Virginia Regulatory Town Hall, of its intent to adopt the proposed regulation. The Joint Commission on Administrative Rules shall advise and assist agencies in complying with the provisions of this section.

D. In addition to the requirements of § 2.2-4017, on or before July 1, 2009, an agency shall review its existing regulations to determine whether they should be continued without change or be amended or repealed, consistent with the stated objectives of applicable law, to minimize the economic impact of regulations on small businesses. If an agency head determines that completion of the review of existing regulations is not feasible by July 1, 2009, that agency shall publish a statement certifying that determination. An agency may extend the date required by this subsection in increments of one year, not to exceed a total of five years.

E. In addition to other requirements of § 2.2-4017, all final regulations adopted after July 1, 2005, shall be reviewed every five years to ensure that they minimize the economic impact on small businesses in a manner consistent with the stated objectives of applicable law.

F. The regulatory review required by this section shall include consideration of:

1. The continued need for the rule;
2. The nature of complaints or comments received concerning the regulation from the public;
3. The complexity of the regulation;
4. The extent to which the regulation overlaps, duplicates, or conflicts with federal or state law or regulation; and
5. The length of time since the regulation has been evaluated or the degree to which technology, economic conditions, or other factors have changed in the area affected by the regulation.

(2005, cc. 619, 682; 2007, cc. 873, 916.)

§ 2.2-4007.2. Regulations requiring the submission of documents or payments.

A. On or after January 1, 2010, each agency having regulations promulgated in accordance with the Administrative Process Act (§ 2.2-4000 et seq.) that require the submission of documents or payments, including fees and fines, shall (i) examine such regulations to determine whether the submission of the required documents or payments may be accomplished by electronic means, and (ii) if so, consider amending the regulation that is being promulgated to offer the alternative of submitting the documents or payments by electronic means. If an agency chooses to amend the regulation to provide the alternative of submitting required documents or payments by electronic means, such action shall be exempt from the operation of Article 2 (§ 2.2-4006 et seq.) of Chapter 40 of Title 2.2 provided the amended regulation is (a) adopted by December 31, 2010, and (b) consistent with federal and state law and regulations.

B. Nothing in this section shall be construed to create an independent or private cause of action to enforce its provisions.

C. Unless otherwise exempt, any amendments to an agency's regulations pursuant to this section made after December 31, 2010, shall be subject to the requirements of the Administrative Process Act (§ 2.2-4000 et seq.).

D. For the purposes of this section,

"Agency" and "regulations" mean the same as those terms are defined in § 2.2-4001.

"Electronic" means the same as that term is defined in § 59.1-480.

(2009, cc. 85, 624.)

§ 2.2-4008. Availability of guidance documents.

It shall be the duty of every agency to annually file with the Registrar for publication in the Virginia Register of Regulations a list of any guidance documents upon which the agency currently relies. The filing shall be made on or before January 1 of each year in a format to be developed by the Registrar. Each agency shall also (i) maintain a complete list of all of its currently operative guidance documents and make the list available for public inspection, (ii) make available for public inspection the full texts of all guidance documents to the extent inspection is permitted by law, and (iii) upon request, make copies of such lists or guidance documents available without charge, at cost, or on payment of a reasonable fee.

(1997, c. 11, § 9-6.14:7.2; 2001, c. 844.)

§ 2.2-4009. Evidentiary hearings on regulations.

Where an agency proposes to consider the exercise of authority to promulgate a regulation, it may conduct or give interested persons an opportunity to participate in a public evidentiary proceeding; and the agency shall always do so where the basic law requires a hearing. Evidentiary hearings may be limited to the trial of factual issues directly related to the legal validity of the proposed regulation in any of the relevant respects outlined in § 2.2-4027 of this chapter.

General notice of the proceedings shall be published as prescribed in § 2.2-4007.01. In addition, where the proposed regulation is to be addressed to named persons, the latter shall also be given the same notice individually by mail or otherwise if acknowledged in writing. The proceedings may be conducted separately from, and in any event the record thereof shall be separate from,

any other or additional proceedings the agency may choose or be required to conduct for the reception of general data, views, and argument pursuant to § 2.2-4007.02 or otherwise. Any probative evidence may be received except that the agency shall as a matter of efficiency exclude irrelevant, immaterial, insubstantial, privileged, or repetitive proofs, and may deny rebuttal, or cross-examination. Testimony may be admitted in written form provided those who have prepared it are made available for examination in person.

The agency or one or more of its subordinates specially designated for the purpose shall preside at the taking of evidence and may administer oaths and affirmations. The proceedings shall be recorded verbatim and the record thereof shall be made available to interested persons for transcription at their expense or, if transcribed by or for the agency, for inspection or purchase at cost.

Where subordinates preside at the taking of the evidence, they shall report their recommendations and proposed findings and conclusions that shall be made available upon request to the participants in the taking of evidence as well as other interested persons and serve as a basis for exceptions, briefs, or oral argument to the agency itself. Whether or not subordinates take the evidence, after opportunity for the submittal of briefs on request and such oral argument as may be scheduled, the agency may settle the terms of the regulation and shall promulgate it only upon (i) its findings of fact based upon the record of evidence made pursuant to this section and facts of which judicial notice may be taken, (ii) statements of basis and purpose as well as comment upon data received in any informational proceedings held under § 2.2-4007.01 and (iii) the conclusions required by the terms of the basic law under which the agency is operating.

(1975, c. 503, § 9-6.14:8; 1985, c. 602; 2001, c. 844; 2007, cc. 873, 916.)

§ 2.2-4010. Pilot programs for regulations imposing local government mandates.

Where an agency proposes to consider the exercise of authority to promulgate a regulation that will impose a statewide mandate on the Commonwealth's localities, the agency shall consider, where appropriate, implementing the regulation on a limited basis with a representative number of localities. An agency may use such a pilot program to determine the effectiveness or impact of proposed regulations prior to statewide adoption.

(1993, c. 168, § 9-6.14:8.1; 2001, c. 844.)

§ 2.2-4011. Emergency regulations; publication; exceptions.

A. Regulations that an agency finds are necessitated by an emergency situation may be adopted by an agency upon consultation with the Attorney General, which approval shall be granted only after the agency has submitted a request stating in writing the nature of the emergency, and the necessity for such action shall be at the sole discretion of the Governor.

B. Agencies may also adopt emergency regulations in situations in which Virginia statutory law or the appropriation act or federal law or federal regulation requires that a regulation be effective in 280 days or less from its enactment, and the regulation is not exempt under the provisions of subdivision A. 4. of § 2.2-4006. In such cases, the agency shall state in writing the nature of the emergency and of the necessity for such action and may adopt the regulations. Pursuant to § 2.2-4012, such regulations shall become effective upon approval by the Governor and filing with the Registrar of Regulations.

C. All emergency regulations shall be limited to no more than twelve months in duration. During the twelve-month period, an agency may issue additional emergency regulations as needed addressing the subject matter of the initial emergency regulation, but any such additional emergency regulations shall not be effective beyond the twelve-month period from the effective date of the initial emergency regulation. If the agency wishes to continue regulating the subject matter governed by the emergency regulation beyond the twelve-month limitation, a regulation to replace the emergency regulation shall be promulgated in accordance with this article. The Notice of Intended Regulatory Action to promulgate a replacement regulation shall be filed with the Registrar within sixty days of the effective date of the emergency regulation and published as soon as practicable, and the proposed replacement regulation shall be filed with the Registrar within 180 days after the effective date of the emergency regulation and published as soon as practicable.

D. In the event that an agency concludes that despite its best efforts, a replacement regulation cannot be adopted before expiration of the 12-month period described in subsection C, it may seek the prior written approval of the Governor to extend the duration of the emergency regulation for a period of not more than six additional months. Any such request must be submitted to the Governor at least 30 days prior to the scheduled expiration of the emergency regulation and shall include a description of the agency's efforts to adopt a replacement regulation together with the reasons that a replacement regulation cannot be adopted before the expiration of the emergency regulation. Upon approval of the Governor, the duration of the emergency regulation shall be extended for a period of no more than six months. Such approval shall be in the sole discretion of the Governor and shall not be subject to judicial review. Agencies shall notify the Registrar of Regulations of the new expiration date of the emergency regulation as soon as practicable.

E. Emergency regulations shall be published as soon as practicable in the Register.

F. The Regulations of the Marine Resources Commission shall be excluded from the provisions of this section.

(1975, c. 503, § 9-6.14:9; 1977, cc. 450, 459; 1981, c. 387; 1982, c. 425; 1983, c. 295; 1984, c. 5; 1985, c. 602, § 9-6.14:4.1; 1986, c. 615; 1987, cc. 375, 652; 1988, cc. 364, 424, 498, 723, 765, 820; 1989, cc. 54, 71, 299, 478; 1990, cc. 721, 968; 1991, cc. 80, 294, 344; 1992, cc. 200, 409, 488, 592, 793, 829; 1993, cc. 537, 669, 898; 1994, cc. 237, 577, 649, 740, 743, 801, 938; 1995, cc. 103, 499, 516; 1996, cc. 51, 152, 158, 189, 205, 279, 320, 345, 573, 590, 598, 638, 705, 735, 818, 1012; 1997, cc. 87, 88, 109, 212, 390, 439, 567, 624, 785, 806, 845, 850, 861, 868; 1998, cc. 39, 619, 784; 1999, cc. 412, 421, 433, 603; 2000, cc. 382, 400, 924, 1011; 2001, c. 844; 2007, cc. 873, 916.)

§ 2.2-4012. Purpose; adoption; effective date; filing; duties of Registrar of Regulations.

A. The purpose of the regulatory procedures shall be to provide a regulatory plan that is predictable, based on measurable and anticipated outcomes, and is inclined toward conflict resolution.

B. Subject to the provisions of §§ 2.2-4013 and 2.2-4014, all regulations, including those that agencies, pursuant to § 2.2-4002, 2.2-4006, or 2.2-4011, may elect to dispense with the public procedures provided by §§ 2.2-4007.01 and 2.2-4009, may be formally and finally adopted by the signed order of the agency so stating. No regulation except an emergency regulation or a

noncontroversial regulation promulgated pursuant to § 2.2-4012.1 shall be effective until the expiration of the applicable period as provided in § 2.2-4015. In the case of an emergency regulation filed in accordance with § 2.2-4011, the regulation shall become effective upon its adoption and filing with the Registrar of Regulations, unless a later date is specified. The originals of all regulations shall remain in the custody of the agency as public records subject to judicial notice by all courts and agencies. They, or facsimiles thereof, shall be made available for public inspection or copying. Full and true copies shall also be additionally filed, registered, published, or otherwise made publicly available as required by other laws.

C. Prior to the publication for hearing of a proposed regulation, copies of the regulation and copies of the summary and statement as to the basis, purpose, substance, issues, and the economic impact estimate of the regulation submitted by the Department of Planning and Budget and the agency's response thereto as required by § 2.2-4007.04 shall be transmitted to the Registrar of Regulations, who shall retain these documents.

D. All regulations adopted pursuant to this chapter shall contain a citation to the section of the Code of Virginia that authorizes or requires the regulations and, where the regulations are required to conform to federal law or regulation in order to be valid, a citation to the specific federal law or regulation to which conformity is required.

E. Immediately upon the adoption by any agency of any regulation in final form, a copy of (i) the regulation, (ii) a then current summary and statement as to the basis, purpose, substance, issues, and the economic impact estimate of the regulation submitted by the Department of Planning and Budget, and (iii) the agency's summary description of the nature of the oral and written data, views, or arguments presented during the public proceedings and the agency's comments thereon shall be transmitted to the Registrar of Regulations, who shall retain these documents as permanent records and make them available for public inspection. A draft of the agency's summary description of public comment shall be sent by the agency to all public commenters on the proposed regulation at least five days before final adoption of the regulation.

(1975, c. 503, § 9-6.14:9; 1977, cc. 450, 459; 1981, c. 387; 1982, c. 425; 1983, c. 295; 1984, c. 5; 1989, c. 71; 1992, c. 829; 1993, c. 898; 1994, c. 938; 2001, c. 844; 2003, c. 224; 2007, cc. 873, 916.)

§ 2.2-4012.1. Fast-track rulemaking process.

Notwithstanding any other provision, rules that are expected to be noncontroversial may be promulgated or repealed in accordance with the process set out in this section. Upon the concurrence of the Governor, and after written notice to the applicable standing committees of the Senate of Virginia and the House of Delegates, and to the Joint Commission on Administrative Rules, the agency may submit a fast-track regulation without having previously published a Notice of Intended Regulatory Action. The fast-track regulation shall be published in the Virginia Register of Regulations and posted on the Virginia Regulatory Town Hall, along with an agency statement setting out the reasons for using the fast-track rulemaking process. Such regulations shall be subject to the requirements set out in §§ 2.2-4007.03, 2.2-4007.04, and 2.2-4007.05, except that the time for receiving public comment need not exceed 30 days after (i) publication of the regulation in the Virginia Register of Regulations and (ii) a public comment forum opens on the Virginia Regulatory Town Hall. The time for preparation of the economic impact analysis shall not exceed 30 days. If an objection to the use of the fast-track process is received within the public comment period from 10 or more persons, any member of the

applicable standing committee of either house of the General Assembly or of the Joint Commission on Administrative Rules, the agency shall (i) file notice of the objection with the Registrar of Regulations for publication in the Virginia Register, and (ii) proceed with the normal promulgation process set out in this article with the initial publication of the fast-track regulation serving as the Notice of Intended Regulatory Action. Otherwise, the regulation will become effective or shall be repealed as appropriate, 15 days after the close of the comment period, unless the regulation or repeal is withdrawn or a later effective date is specified by the agency.

(2003, c. 224; 2007, cc. 873, 916.)

§ 2.2-4013. Executive review of proposed and final regulations; changes with substantial impact.

A. The Governor shall adopt and publish procedures by executive order for review of all proposed regulations governed by this chapter by June 30 of the year in which the Governor takes office. The procedures shall include (i) review by the Attorney General to ensure statutory authority for the proposed regulations; and (ii) examination by the Governor to determine if the proposed regulations are (a) necessary to protect the public health, safety and welfare and (b) clearly written and easily understandable. The procedures may also include review of the proposed regulation by the appropriate Cabinet Secretary.

The Governor shall transmit his comments, if any, on a proposed regulation to the Registrar and the agency no later than fifteen days following the completion of the public comment period provided for in § 2.2-4007.03. The Governor may recommend amendments or modifications to any regulation that would bring that regulation into conformity with statutory authority or state or federal laws, regulations or judicial decisions.

Not less than fifteen days following the completion of the public comment period provided for in § 2.2-4007.03, the agency may (i) adopt the proposed regulation if the Governor has no objection to the regulation; (ii) modify and adopt the proposed regulation after considering and incorporating the Governor's objections or suggestions, if any; or (iii) adopt the regulation without changes despite the Governor's recommendations for change.

B. Upon final adoption of the regulation, the agency shall forward a copy of the regulation to the Registrar of Regulations for publication as soon as practicable in the Register. All changes to the proposed regulation shall be highlighted in the final regulation, and substantial changes to the proposed regulation shall be explained in the final regulation.

C. If the Governor finds that one or more changes with substantial impact have been made to the proposed regulation, he may require the agency to provide an additional thirty days to solicit additional public comment on the changes by transmitting notice of the additional public comment period to the agency and to the Registrar within the thirty-day adoption period described in subsection D, and publishing the notice in the Register. The additional public comment period required by the Governor shall begin upon publication of the notice in the Register.

D. A thirty-day final adoption period for regulations shall commence upon the publication of the final regulation in the Register. The Governor may review the final regulation during this thirty-day final adoption period and if he objects to any portion or all of a regulation, the Governor may file a formal objection to the regulation, suspend the effective date of the regulation in accordance with subsection B of § 2.2-4014, or both.

If the Governor files a formal objection to the regulation, he shall forward his objections to the Registrar and agency prior to the conclusion of the thirty-day final adoption period. The Governor shall be deemed to have acquiesced to a promulgated regulation if he fails to object to it or if he fails to suspend the effective date of the regulation in accordance with subsection B of § 2.2-4014 during the thirty-day final adoption period. The Governor's objection, or the suspension of the regulation, or both if applicable, shall be published in the Register.

A regulation shall become effective as provided in § 2.2-4015.

E. This section shall not apply to the issuance by the State Air Pollution Control Board of variances to its regulations.

(1984, c. 5, § 9-6.14:9.1; 1993, cc. 551, 772, 898; 1995, cc. 25, 736; 2001, c. 844; 2007, cc. 873, 916.)

§ 2.2-4014. Legislative review of proposed and final regulations.

A. After publication of the Register pursuant to § 2.2-4031, the standing committee of each house of the General Assembly to which matters relating to the content of the regulation are most properly referable or the Joint Commission on Administrative Rules may meet and, during the promulgation or final adoption process, file with the Registrar and the promulgating agency an objection to a proposed or final adopted regulation. The Registrar shall publish any such objection received by him as soon as practicable in the Register. Within 21 days after the receipt by the promulgating agency of a legislative objection, that agency shall file a response with the Registrar, the objecting legislative committee or the Joint Commission on Administrative Rules, and the Governor. If a legislative objection is filed within the final adoption period, subdivision A 1 of § 2.2-4015 shall govern.

B. In addition or as an alternative to the provisions of subsection A, the standing committee of both houses of the General Assembly to which matters relating to the content are most properly referable or the Joint Commission on Administrative Rules may suspend the effective date of any portion or all of a final regulation with the Governor's concurrence. The Governor and (i) the applicable standing committee of each house or (ii) the Joint Commission on Administrative Rules may direct, through a statement signed by a majority of their respective members and by the Governor, that the effective date of a portion or all of the final regulation is suspended and shall not take effect until the end of the next regular legislative session. This statement shall be transmitted to the promulgating agency and the Registrar within the 30-day adoption period, and shall be published in the Register.

If a bill is passed at the next regular legislative session to nullify a portion but not all of the regulation, then the promulgating agency (i) may promulgate the regulation under the provision of subdivision A 4 a of § 2.2-4006, if it makes no changes to the regulation other than those required by statutory law or (ii) shall follow the provisions of §§ 2.2-4007.01 through 2.2-4007.06, if it wishes to also make discretionary changes to the regulation. If a bill to nullify all or a portion of the suspended regulation, or to modify the statutory authority for the regulation, is not passed at the next regular legislative session, then the suspended regulation shall become effective at the conclusion of the session, unless the suspended regulation is withdrawn by the agency.

C. A regulation shall become effective as provided in § 2.2-4015.

D. This section shall not apply to the issuance by the State Air Pollution Control Board of variances to its regulations.

(1984, c. 5, § 9-6.14:9.2; 1993, cc. 551, 772; 2001, c. 844; 2002, c. 677; 2003, c. 212; 2004, c. 777; 2007, cc. 873, 916.)

§ 2.2-4015. Effective date of regulation; exception.

A. A regulation adopted in accordance with this chapter and the Virginia Register Act (§ 2.2-4100 et seq.) shall become effective at the conclusion of the thirty-day final adoption period provided for in subsection D of § 2.2-4013, or any other later date specified by the agency, unless:

1. A legislative objection has been filed in accordance with § 2.2-4014, in which event the regulation, unless withdrawn by the agency, shall become effective on a date specified by the agency that shall be after the expiration of the applicable twenty-one-day extension period provided in § 2.2-4014;
2. The Governor has exercised his authority in accordance with § 2.2-4013 to require the agency to provide for additional public comment, in which event the regulation, unless withdrawn by the agency, shall become effective on a date specified by the agency that shall be after the period for which the Governor has provided for additional public comment;
3. The Governor and (i) the appropriate standing committees of each house of the General Assembly or (ii) the Joint Commission on Administrative Rules have exercised their authority in accordance with subsection B of § 2.2-4014 to suspend the effective date of a regulation until the end of the next regular legislative session; or
4. The agency has suspended the regulatory process in accordance with § 2.2-4007.06, or for any reason it deems necessary or appropriate, in which event the regulation, unless withdrawn by the agency, shall become effective in accordance with subsection B.

B. Whenever the regulatory process has been suspended for any reason, any action by the agency that either amends the regulation or does not amend the regulation but specifies a new effective date shall be considered a readoption of the regulation for the purposes of appeal. If the regulation is suspended under § 2.2-4007.06, such readoption shall take place after the thirty-day public comment period required by that subsection. Suspension of the regulatory process by the agency may occur simultaneously with the filing of final regulations as provided in subsection B of § 2.2-4013.

When a regulation has been suspended, the agency must set the effective date no earlier than fifteen days from publication of the readoption action and any changes made to the regulation. During that fifteen-day period, if the agency receives requests from at least twenty-five persons for the opportunity to comment on new substantial changes, it shall again suspend the regulation pursuant to § 2.2-4007.06.

C. This section shall not apply to the issuance by the State Air Pollution Control Board of variances to its regulations.

(1984, c. 5, § 9-6.14:9.3; 1993, cc. 551, 772, 898; 1995, c. 25; 2001, c. 844; 2002, cc. 391, 677; 2004, c. 777; 2007, cc. 873, 916.)

§ 2.2-4016. Withdrawal of regulation.

Nothing in this chapter shall prevent any agency from withdrawing any regulation at any time prior to the effective date of that regulation. A regulation may be repealed after its effective date only in accordance with the provisions of this chapter that govern the adoption of regulations.

(1984, c. 5, § 9-6.14:9.4; 1985, c. 602; 2001, c. 844.)

§ 2.2-4017. Periodic review of regulations.

Each Governor shall mandate through executive order a procedure for periodic review during that Governor's administration of regulations of agencies within the executive branch of state government. The procedure shall include (i) a review by the Attorney General to ensure statutory authority for regulations and (ii) a determination by the Governor whether the regulations are (a) necessary for the protection of public health, safety and welfare and (b) clearly written and easily understandable.

The Governor may require each agency (i) to review all regulations promulgated by that agency to determine whether new regulations should be adopted and old regulations amended or repealed, and (ii) to prepare a written report summarizing the agency's findings about its regulations, its reasons for its findings and any proposed course of action.

(1984, c. 5, § 9-6.14:25; 2001, c. 844.)

§ 2.2-4018. Exemptions from operation of Article 3.

The following agency actions otherwise subject to this chapter shall be exempted from the operation of this article.

1. The assessment of taxes or penalties and other rulings in individual cases in connection with the administration of the tax laws.
2. The award or denial of claims for workers' compensation.
3. The grant or denial of public assistance or social services.
4. Temporary injunctive or summary orders authorized by law.
5. The determination of claims for unemployment compensation or special unemployment.
6. The suspension of any license, certificate, registration or authority granted any person by the Department of Health Professions or the Department of Professional and Occupational Regulation for the dishonor, by a bank or financial institution named, of any check, money draft or similar instrument used in payment of a fee required by statute or regulation.
7. The determination of accreditation or academic review status of a public school or public school division or approval by the Board of Education of a school division corrective action plan required by § 22.1-253.13:3.

(1985, c. 602, § 9-6.14:4.1; 1986, c. 615; 1987, cc. 375, 652; 1988, cc. 364, 424, 498, 723, 765, 820; 1989, cc. 54, 299, 478; 1990, cc. 721, 968; 1991, cc. 80, 294, 344; 1992, cc. 200, 409, 488, 592, 793; 1993, cc. 537, 669, 898; 1994, cc. 237, 577, 649, 740, 743, 801; 1995, cc. 103, 499, 516; 1996, cc. 51, 152, 158, 189, 205, 279, 320, 345, 573, 590, 598, 638, 705, 735, 818, 1012;

1997, cc. 87, 88, 109, 212, 390, 439, 567, 624, 785, 806, 845, 850, 861, 868; 1998, cc. 39, 619, 784; 1999, cc. 412, 421, 433, 603; 2000, cc. 382, 400, 924, 1011; 2001, c. 844; 2002, c. 747; 2004, c. 965.)

§ 2.2-4019. Informal fact finding proceedings.

A. Agencies shall ascertain the fact basis for their decisions of cases through informal conference or consultation proceedings unless the named party and the agency consent to waive such a conference or proceeding to go directly to a formal hearing. Such conference-consultation procedures shall include rights of parties to the case to (i) have reasonable notice thereof, (ii) appear in person or by counsel or other qualified representative before the agency or its subordinates, or before a hearing officer for the informal presentation of factual data, argument, or proof in connection with any case, (iii) have notice of any contrary fact basis or information in the possession of the agency that can be relied upon in making an adverse decision, (iv) receive a prompt decision of any application for a license, benefit, or renewal thereof, and (v) be informed, briefly and generally in writing, of the factual or procedural basis for an adverse decision in any case.

B. Agencies may, in their case decisions, rely upon public data, documents or information only when the agencies have provided all parties with advance notice of an intent to consider such public data, documents or information. This requirement shall not apply to an agency's reliance on case law and administrative precedent.

(1975, c. 503, § 9-6.14:11; 1986, c. 615; 1989, c. 601; 1993, c. 898; 1994, c. 748; 1995, c. 398; 2001, c. 844.)

§ 2.2-4020. Formal hearings; litigated issues.

A. The agency shall afford opportunity for the formal taking of evidence upon relevant fact issues in any case in which the basic laws provide expressly for decisions upon or after hearing and may do so in any case to the extent that informal procedures under § 2.2-4019 have not been had or have failed to dispose of a case by consent.

B. Parties to formal proceedings shall be given reasonable notice of the (i) time, place, and nature thereof, (ii) basic law under which the agency contemplates its possible exercise of authority, and (iii) matters of fact and law asserted or questioned by the agency. Applicants for licenses, rights, benefits, or renewals thereof have the burden of approaching the agency concerned without such prior notice but they shall be similarly informed thereafter in the further course of the proceedings whether pursuant to this section or to § 2.2-4019.

C. In all such formal proceedings the parties shall be entitled to be accompanied by and represented by counsel, to submit oral and documentary evidence and rebuttal proofs, to conduct such cross-examination as may elicit a full and fair disclosure of the facts, and to have the proceedings completed and a decision made with dispatch. The burden of proof shall be upon the proponent or applicant. The presiding officers at the proceedings may (i) administer oaths and affirmations, (ii) receive probative evidence, exclude irrelevant, immaterial, insubstantial, privileged, or repetitive proofs, rebuttal, or cross-examination, rule upon offers of proof, and oversee a verbatim recording of the evidence, (iii) hold conferences for the settlement or simplification of issues by consent, (iv) dispose of procedural requests, and (v) regulate and expedite the course of the hearing. Where a hearing officer presides, or where a subordinate designated for that purpose presides in hearings specified in subsection F of § 2.2-4024, he shall

recommend findings and a decision unless the agency shall by its procedural regulations provide for the making of findings and an initial decision by the presiding officers subject to review and reconsideration by the agency on appeal to it as of right or on its own motion. The agency shall give deference to findings by the presiding officer explicitly based on the demeanor of witnesses.

D. Prior to the recommendations or decisions of subordinates, the parties concerned shall be given opportunity, on request, to submit in writing for the record (i) proposed findings and conclusions and (ii) statements of reasons therefor. In all cases, on request, opportunity shall be afforded for oral argument (i) to hearing officers or subordinate presiding officers, as the case may be, in all cases in which they make such recommendations or decisions or (ii) to the agency in cases in which it makes the original decision without such prior recommendation and otherwise as it may permit in its discretion or provide by general rule. Where hearing officers or subordinate presiding officers, as the case may be, make recommendations or decisions, the agency shall receive and act on exceptions thereto.

E. All decisions or recommended decisions shall be served upon the parties, become a part of the record, and briefly state or recommend the findings, conclusions, reasons, or basis therefor upon the evidence presented by the record and relevant to the basic law under which the agency is operating together with the appropriate order, license, grant of benefits, sanction, relief, or denial thereof.

(1975, c. 503, § 9-6.14:12; 1986, c. 615; 1991, c. 584; 1993, c. 898; 1995, c. 398; 2001, c. 844.)

§ 2.2-4020.1. Summary case decisions.

A. Any person who has (i) applied for a permit, certificate, or license from an agency or (ii) received written notice of a potential violation from an agency may request a summary case decision from the agency. The request for a summary case decision shall be in writing, signed by or on behalf of the requestor, and be submitted to the agency secretary as defined by the Rules of the Supreme Court of Virginia. The request shall include:

1. A statement that no material facts are in dispute;
2. A proposed stipulation of all such undisputed material facts concerning the application or notice;
3. A clear and concise statement of the questions of law to be decided by summary case decision; and
4. A statement that the requestor waives his right to any other administrative proceeding provided in this article by the agency on the questions of law to be decided by summary case decision.

B. Within 21 days of receipt of a complete request for summary case decision, the agency shall determine whether the matter in dispute properly may be decided by summary case decision and shall promptly notify the requestor of its determination in writing. If a request for summary case decision is not complete, the agency may request additional specific information from the requestor. The agency shall decide the matter by summary case decision if it determines that there are no disputed issues of material fact. However, if (i) an informal fact-finding proceeding as provided in § 2.2-4019, a formal hearing as provided in § 2.2-4020, or other proceeding authorized by the agency's basic law concerning the application or notice has been scheduled, the

requestor has been notified, and the issues that are the subject of such proceeding or hearing include questions that are the subject of the request for summary case decision or (ii) the matter must be decided through any public participation requirements under this chapter or the agency's basic law, the agency shall not be required to decide the matter by summary case decision.

C. Denial of a request for summary case decision shall not be subject to judicial review in accordance with this chapter and the Rules of the Supreme Court of Virginia, and shall not prejudice any rights the requestor has or may have under this chapter or the agency's basic law. Nothing in this article shall prevent an agency from consolidating the summary case decision proceeding into, or proceeding with, a separate informal fact-finding proceeding, formal hearing, or other proceeding authorized by the agency's basic law concerning the matter in question.

D. Upon granting a request for summary case decision, the agency shall establish a schedule for the parties to submit briefs on the questions of law in dispute and may, by agreement of the parties, provide for oral argument.

E. All decisions or recommended decisions shall be served on the requestor, become a part of the record, and briefly state or recommend the findings, conclusions, reasons, or basis therefor upon the evidence contained in the record and relevant to the basic law under which the agency is operating, together with the appropriate order, license, grant of benefits, sanction, relief, or denial thereof.

(2006, c. 702.)

§ 2.2-4021. Timetable for decision; exemptions.

A. In cases where a board or commission meets to render (i) an informal fact-finding decision or (ii) a decision on a litigated issue, and information from a prior proceeding is being considered, persons who participated in the prior proceeding shall be provided an opportunity to respond at the board or commission meeting to any summaries of the prior proceeding prepared by or for the board or commission.

B. In any informal fact-finding, formal proceeding, or summary case decision proceeding in which a hearing officer is not used or is not empowered to recommend a finding, the board, commission, or agency personnel responsible for rendering a decision shall render that decision within 90 days from the date of the informal fact-finding, formal proceeding, or completion of a summary case decision proceeding, or from a later date agreed to by the named party and the agency. If the agency does not render a decision within 90 days, the named party to the case decision may provide written notice to the agency that a decision is due. If no decision is made within 30 days from agency receipt of the notice, the decision shall be deemed to be in favor of the named party. The preceding sentence shall not apply to case decisions before (i) the State Water Control Board or the Department of Environmental Quality to the extent necessary to comply with the federal Clean Water Act, (ii) the State Air Pollution Control Board or the Department of Environmental Quality to the extent necessary to comply with the federal Clean Air Act, or (iii) the Virginia Soil and Water Conservation Board or the Department of Conservation and Recreation to the extent necessary to comply with the federal Clean Water Act. An agency shall provide notification to the named party of its decision within five days of the decision.

C. In any informal fact-finding, formal proceeding, or summary case decision proceeding in which a hearing officer is empowered to recommend a finding, the board, commission, or agency

personnel responsible for rendering a decision shall render that decision within 30 days from the date that the agency receives the hearing officer's recommendation. If the agency does not render a decision within 30 days, the named party to the case decision may provide written notice to the agency that a decision is due. If no decision is made within 30 days from agency receipt of the notice, the decision is deemed to be in favor of the named party. The preceding sentence shall not apply to case decisions before (i) the State Water Control Board or the Department of Environmental Quality to the extent necessary to comply with the federal Clean Water Act, (ii) the State Air Pollution Control Board or the Department of Environmental Quality to the extent necessary to comply with the federal Clean Air Act, or (iii) the Virginia Soil and Water Conservation Board or the Department of Conservation and Recreation to the extent necessary to comply with the federal Clean Water Act. An agency shall provide notice to the named party of its decision within five days of the decision.

D. The provisions of subsection B notwithstanding, if the board members or agency personnel who conducted the informal fact-finding, formal proceeding, or summary case decision proceeding are unable to attend to official duties due to sickness, disability, or termination of their official capacity with the agency, then the timeframe provisions of subsection B shall be reset and commence from the date that either new board members or agency personnel are assigned to the matter or a new proceeding is conducted if needed, whichever is later. An agency shall provide notice within five days to the named party of any incapacity of the board members or agency personnel that necessitates a replacement or a new proceeding.

(1975, c. 503, §§ 9-6.14:11, 9-6.14:12; 1986, c. 615; 1989, c. 601; 1991, c. 584; 1993, c. 898; 1994, c. 748; 1995, c. 398; 2001, c. 844; 2005, c. 102; 2006, c. 702.)

§ 2.2-4022. Subpoenas, depositions and requests for admissions.

The agency or its designated subordinates may, and on request of any party to a case shall, issue subpoenas requiring testimony or the production of books, papers, and physical or other evidence. Any person so subpoenaed who objects may, if the agency does not quash or modify the subpoena at his timely request as illegally or improvidently granted, immediately procure by petition a decision on the validity thereof in the circuit court as provided in § 2.2-4003; and otherwise in any case of refusal or neglect to comply with an agency subpoena, unless the basic law under which the agency is operating provides some other recourse, enforcement, or penalty, the agency may procure an order of enforcement from such court. Depositions de bene esse and requests for admissions may be directed, issued, and taken on order of the agency for good cause shown; and orders or authorizations therefor may be challenged or enforced in the same manner as subpoenas. Nothing in this section shall be taken to authorize discovery proceedings.

(1975, c. 503, § 9-6.14:13; 2001, c. 844.)

§ 2.2-4023. Final orders.

The terms of any final agency case decision, as signed by it, shall be served upon the named parties by mail unless service otherwise made is duly acknowledged by them in writing. The signed originals shall remain in the custody of the agency as public records subject to judicial notice by all courts and agencies; and they, or facsimiles thereof, together with the full record or file in every case shall be made available for public inspection or copying except (i) so far as the agency may withhold the same in whole or part for the purpose of protecting individuals mentioned from personal embarrassment, obloquy, or disclosures of a private nature including

statements respecting the physical, mental, moral, or financial condition of such individuals or (ii) for trade secrets or, so far as protected by other laws, other commercial or industrial information imparted in confidence. Final orders may be recorded, enforced, and satisfied as orders or decrees of a circuit court upon certification of such orders by the agency head or his designee.

(1975, c. 503, § 9-6.14:14; 2001, c. 844; 2009, c. 797.)

§ 2.2-4024. Hearing officers.

A. In all formal hearings conducted in accordance with § 2.2-4020, the hearing shall be presided over by a hearing officer selected from a list prepared by the Executive Secretary of the Supreme Court and maintained in the Office of the Executive Secretary of the Supreme Court. Parties to informal fact-finding proceedings conducted pursuant to § 2.2-4019 may agree at the outset of the proceeding to have a hearing officer preside at the proceeding, such agreement to be revoked only by mutual consent. The Executive Secretary may promulgate rules necessary for the administration of the hearing officer system and shall have the authority to establish the number of hearing officers necessary to preside over administrative hearings in the Commonwealth.

Prior to being included on the list, all hearing officers shall meet the following minimum standards:

1. Active membership in good standing in the Virginia State Bar;
2. Active practice of law for at least five years; and
3. Completion of a course of training approved by the Executive Secretary of the Supreme Court. In order to comply with the demonstrated requirements of the agency requesting a hearing officer, the Executive Secretary may require additional training before a hearing officer shall be assigned to a proceeding before that agency.

B. On request from the head of an agency, the Executive Secretary shall name a hearing officer from the list, selected on a rotation system administered by the Executive Secretary. Lists reflecting geographic preference and specialized training or knowledge shall be maintained by the Executive Secretary if an agency demonstrates the need.

C. A hearing officer shall voluntarily disqualify himself and withdraw from any case in which he cannot accord a fair and impartial hearing or consideration, or when required by the applicable rules governing the practice of law in the Commonwealth. Any party may request the disqualification of a hearing officer by filing an affidavit, prior to the taking of evidence at a hearing, stating with particularity the grounds upon which it is claimed that a fair and impartial hearing cannot be accorded, or the applicable rule of practice requiring disqualification.

The issue shall be determined not less than ten days prior to the hearing by the Executive Secretary of the Supreme Court.

D. Any hearing officer empowered by the agency to provide a recommendation or conclusion in a case decision matter shall render that recommendation or conclusion within ninety days from the date of the case decision proceeding or from a later date agreed to by the named party and the agency. If the hearing officer does not render a decision within ninety days, then the named party to the case decision may provide written notice to the hearing officer and the Executive Secretary of the Supreme Court that a decision is due. If no decision is made within thirty days from

receipt by the hearing officer of the notice, then the Executive Secretary of the Supreme Court shall remove the hearing officer from the hearing officer list and report the hearing officer to the Virginia State Bar for possible disciplinary action, unless good cause is shown for the delay.

E. The Executive Secretary shall remove hearing officers from the list, upon a showing of cause after written notice and an opportunity for a hearing. When there is a failure by a hearing officer to render a decision as required by subsection D, the burden shall be on the hearing officer to show good cause for the delay. Decisions to remove a hearing officer may be reviewed by a request to the Executive Secretary for reconsideration, followed by judicial review in accordance with this chapter.

F. This section shall not apply to hearings conducted by (i) any commission or board where all of the members, or a quorum, are present; (ii) the Alcoholic Beverage Control Board, the Virginia Workers' Compensation Commission, the State Corporation Commission, the Virginia Employment Commission, the Department of Motor Vehicles under Title 46.2 (§ 46.2-100 et seq.), § 58.1-2409, or Chapter 27 (§ 58.1-2700 et seq.) of Title 58.1, the Motor Vehicle Dealer Board under Chapter 15 (§ 46.2-1500 et seq.) of Title 46.2, or the Board of Towing and Recovery Operators under Chapter 28 (§ 46.2-2800 et seq.) of Title 46.2; or (iii) any panel of a health regulatory board convened pursuant to § 54.1-2400, including any panel having members of a relevant advisory board to the Board of Medicine. All employees hired after July 1, 1986, pursuant to §§ 65.2-201 and 65.2-203 by the Virginia Workers' Compensation Commission to conduct hearings pursuant to its basic laws shall meet the minimum qualifications set forth in subsection A. Agency employees who are not licensed to practice law in the Commonwealth, and are presiding as hearing officers in proceedings pursuant to clause (ii) shall participate in periodic training courses.

G. Notwithstanding the exemptions of subsection A of § 2.2-4002, this article shall apply to hearing officers conducting hearings of the kind described in § 2.2-4020 for the Department of Game and Inland Fisheries, the Virginia Housing Development Authority, the Milk Commission and the Virginia Resources Authority pursuant to their basic laws.

(1986, c. 615, § 9-6.14:14.1; 1988, c. 865; 1990, c. 219; 1991, c. 214; 1992, c. 659; 1993, c. 898; 1995, cc. 744, 776, 803, 805; 1996, cc. 189, 205, 639, 658; 2001, c. 844; 2002, cc. 448, 698; 2009, c. 806.)

§ 2.2-4025. Exemptions operation of this article; limitations.

A. This article shall not apply to any agency action that (i) is placed beyond the control of the courts by constitutional or statutory provisions expressly precluding court review, (ii) involves solely the internal management or routine of an agency, (iii) is a decision resting entirely upon an inspection, test, or election save as to want of authority therefor or claim of arbitrariness or fraud therein, (iv) is a case in which the agency is acting as an agent for a court, or (v) encompasses matters subject by law to a trial de novo in any court.

B. The provisions of this article, however, shall apply to case decisions regarding the grant or denial of Temporary Assistance for Needy Families, Medicaid, food stamps, general relief, auxiliary grants, or state-local hospitalization. However, no appeal may be brought regarding the adequacy of standards of need and payment levels for public assistance and social services programs. Notwithstanding the provisions of § 2.2-4027, the review shall be based solely upon the agency record, and the court shall be limited to ascertaining whether there was evidence in

the agency record to support the case decision of the agency acting as the trier of fact. If the court finds in favor of the party complaining of agency action, the court shall remand the case to the agency for further proceedings. The validity of any statute, regulation, standard or policy, federal or state, upon which the action of the agency was based shall not be subject to review by the court. No intermediate relief shall be granted under § 2.2-4028.

(1975, c. 503, §§ 9-6.14:4.1, 9-6.14:15, 9-6.14:16; 1986, c. 615; 1989, cc. 677, 734; 2001, c. 844; 2002, c. 747.)

§ 2.2-4026. Right, forms, venue.

Any person affected by and claiming the unlawfulness of any regulation, or party aggrieved by and claiming unlawfulness of a case decision and whether exempted from the procedural requirements of Article 2 (§ 2.2-4006 et seq.) or 3 (§ 2.2-4018 et seq.) of this chapter, shall have a right to the direct review thereof by an appropriate and timely court action against the agency or its officers or agents in the manner provided by the rules of the Supreme Court of Virginia. Actions may be instituted in any court of competent jurisdiction as provided in § 2.2-4003, and the judgments of the courts of original jurisdiction shall be subject to appeal to or review by higher courts as in other cases unless otherwise provided by law. In addition, when any regulation or case decision is the subject of an enforcement action in court, it shall also be reviewable by the court as a defense to the action, and the judgment or decree therein shall be appealable as in other cases.

(1975, c. 503, § 9-6.14:16; 1986, c. 615; 1989, cc. 677, 734; 2001, c. 844.)

§ 2.2-4027. Issues on review.

The burden shall be upon the party complaining of agency action to designate and demonstrate an error of law subject to review by the court. Such issues of law include: (i) accordance with constitutional right, power, privilege, or immunity, (ii) compliance with statutory authority, jurisdiction limitations, or right as provided in the basic laws as to subject matter, the stated objectives for which regulations may be made, and the factual showing respecting violations or entitlement in connection with case decisions, (iii) observance of required procedure where any failure therein is not mere harmless error, and (iv) the substantiality of the evidentiary support for findings of fact. The determination of such fact issue shall be made upon the whole evidentiary record provided by the agency if its proceeding was required to be conducted as provided in § 2.2-4009 or 2.2-4020 or, as to subjects exempted from those sections, pursuant to constitutional requirement or statutory provisions for opportunity for an agency record of and decision upon the evidence therein.

In addition to any other judicial review provided by law, a small business, as defined in subsection A of § 2.2-4007.1, that is adversely affected or aggrieved by final agency action shall be entitled to judicial review of compliance with the requirements of subdivision A 2 of § 2.2-4007.04 and § 2.2-4007.1 within one year following the date of final agency action.

When the decision on review is to be made on the agency record, the duty of the court with respect to issues of fact shall be limited to ascertaining whether there was substantial evidence in the agency record upon which the agency as the trier of the facts could reasonably find them to be as it did.

Where there is no agency record so required and made, any necessary facts in controversy shall be determined by the court upon the basis of the agency file, minutes, and records of its proceedings under § 2.2-4007.01 or 2.2-4019 as augmented, if need be, by the agency pursuant to order of the court or supplemented by any allowable and necessary proofs adduced in court except that the function of the court shall be to determine only whether the result reached by the agency could reasonably be said, on all such proofs, to be within the scope of the legal authority of the agency.

Whether the fact issues are reviewed on the agency record or one made in the review action, the court shall take due account of the presumption of official regularity, the experience and specialized competence of the agency, and the purposes of the basic law under which the agency has acted.

(1975, c. 503, § 9-6.14:17; 1989, c. 601; 2001, c. 844; 2005, cc. 619, 682; 2007, cc. 873, 916.)

§ 2.2-4028. Intermediate relief.

When judicial review is instituted or is about to be, the agency concerned may, on request of any party or its own motion, postpone the effective date of the regulation or decision involved where it deems that justice so requires. Otherwise the court may, on proper application and with or without bond, deposits in court, or other safeguards or assurances as may be suitable, issue all necessary and appropriate process to postpone the effective dates or preserve existing status or rights pending conclusion of the review proceedings if the court finds the same to be required to prevent immediate, unavoidable, and irreparable injury and that the issues of law or fact presented are not only substantial but that there is probable cause for it to anticipate a likelihood of reversible error in accordance with § 2.2-4027. Actions by the court may include (i) the stay of operation of agency decisions of an injunctive nature or those requiring the payment of money or suspending or revoking a license or other benefit and (ii) continuation of previous licenses in effect until timely applications for renewal are duly determined by the agency.

(1975, c. 503, § 9-6.14:18; 2001, c. 844.)

§ 2.2-4029. Court judgments.

Unless an error of law as defined in § 2.2-4027 appears, the court shall dismiss the review action or affirm the agency regulation or decision. Otherwise, it may compel agency action unlawfully and arbitrarily withheld or unreasonably delayed except that the court shall not itself undertake to supply agency action committed by the basic law to the agency. Where a regulation or case decision is found by the court not to be in accordance with law under § 2.2-4027, the court shall suspend or set it aside and remand the matter to the agency for further proceedings, if any, as the court may permit or direct in accordance with law.

(1975, c. 503, § 9-6.14:19; 2001, c. 844.)

§ 2.2-4030. Recovery of costs and attorneys' fees from agency.

A. In any civil case brought under Article 5 (§ 2.2-4025 et seq.) of this chapter or §§ 2.2-4002, 2.2-4006, 2.2-4011, or § 2.2-4018, in which any person contests any agency action, such person shall be entitled to recover from that agency, including the Department of Game and Inland Fisheries, reasonable costs and attorneys' fees if such person substantially prevails on the merits

of the case and the agency's position is not substantially justified, unless special circumstances would make an award unjust. The award of attorneys' fees shall not exceed \$25,000.

B. Nothing in this section shall be deemed to grant permission to bring an action against an agency if the agency would otherwise be immune from suit, or to grant a right to bring an action by a person who would otherwise lack standing to bring the action.

C. Any costs and attorneys' fees assessed against an agency under this section shall be charged against the operating expenses of the agency for the fiscal year in which the assessment is made, and shall not be reimbursed from any other source.

(1981, c. 446, § 9-6.14:21; 1997, c. 692; 2001, c. 844.)

§ 2.2-4031. Publication of Virginia Register of Regulations; exceptions; notice of public hearings of proposed regulations.

A. The Registrar shall publish every two weeks a Virginia Register of Regulations that shall include (i) proposed and final regulations; (ii) emergency regulations; (iii) executive orders; (iv) notices of all public hearings on regulations; (v) petitions for rulemaking made in accordance with § 2.2-4007; and (vi) tax bulletins. The entire proposed regulation shall be published in the Register; however, if an existing regulation has been previously published in the Virginia Administrative Code, then only those sections of regulations to be amended need to be published in the Register. If the length of the regulation falls within the guidelines established by the Registrar for the publication of a summary in lieu of the full text of the regulation, then, after consultation with the promulgating agency, the Registrar may publish only the summary of the regulation. In this event, the full text of the regulation shall be available for public inspection at the office of the Registrar and the promulgating agency.

If a proposed regulation is adopted as published or, in the sole discretion of the Registrar of Regulations, the only changes that have been made are those that can be clearly and concisely explained, the adopted regulation need not be published at length. Instead, the Register shall contain a notation that the proposed regulation has been adopted as published as a proposed regulation without change or stating the changes made. The proposed regulation shall be clearly identified with a citation to the issue and page numbers where published.

A copy of all reporting forms the promulgating agency anticipates will be incorporated into or be used in administering the regulation shall be published with the proposed and final regulation in the Register.

B. Each regulation shall be prefaced with a summary explaining that regulation in plain and clear language. Summaries shall be prepared by the promulgating agency and approved by the Registrar prior to their publication in the Register. The notice required by § 2.2-4007.03 shall include (i) a statement of the date, time and place of the hearing at which the regulation is to be considered; (ii) a brief statement as to the regulation under consideration; (iii) reference to the legal authority of the agency to act; and (iv) the name, address and telephone number of an individual to contact for further information about that regulation. Agencies shall present their proposed regulations in a standardized format developed by the Virginia Code Commission in accordance with subdivision 1 of § 2.2-4104 of the Virginia Register Act (§ 2.2-4100 et seq.). Notwithstanding the exemptions allowed under § 2.2-4002, 2.2-4006 or 2.2-4011, the proposed and final regulations of all agencies shall be published in the Register. However, proposed

regulations of the Marine Resources Commission and regulations exempted by subject from the provisions of this chapter by subsection B of § 2.2-4002 shall be exempt from this section.

C. The Virginia Register of Regulations shall be published by posting the Register on the Virginia Code Commission's website. The Virginia Code Commission may arrange for the printing of the Virginia Register as provided in § 30-146.

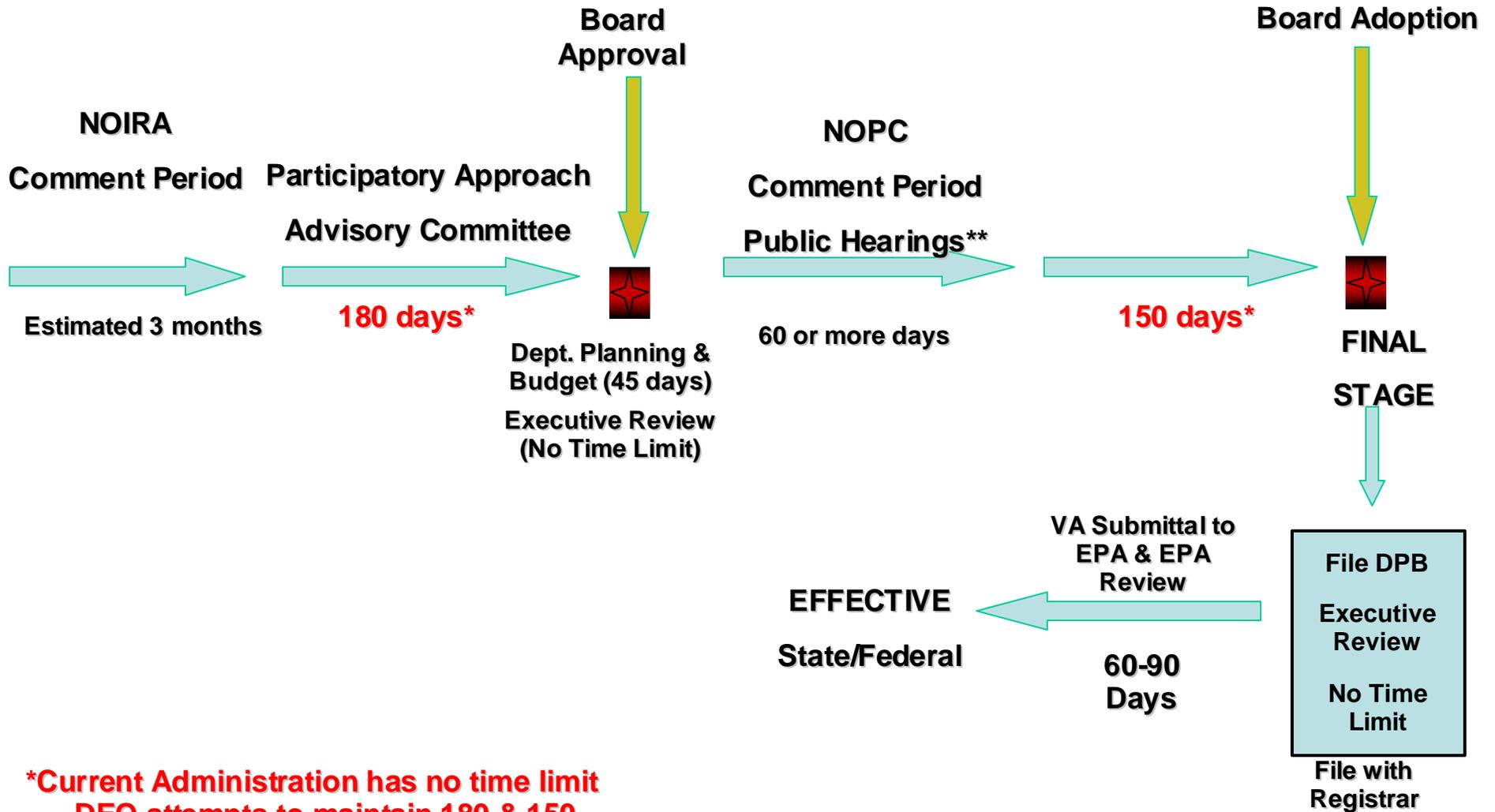
(1984, c. 5, § 9-6.14:22; 1985, cc. 67, 602; 1986, c. 615; 1988, c. 364; 1989, c. 71; 1992, c. 216; 2001, c. 844; 2002, c. 241; 2003, c. 212; 2007, cc. 300, 873, 916.)

§§ 2.2-4032. , 2.2-4033.

Repealed by Acts 2003, c. 212, cl. 2, effective March 16, 2003.

Appendix I

Rulemaking Timeline



***Current Administration has no time limit
– DEQ attempts to maintain 180 & 150
day timeframe**

Appendix J.

Questions for AAC/Stakeholder/Public Discussion:

Approach

- Which, if any, of EPA's recommended approaches are appropriate, and why?
- Should VA consider effect-based criteria derived by finding correlations between nutrient enrichment and negative changes in biological variables?
- Should criteria development be tied to ecological endpoints indicating impairment?

Form

- Are the 1987 TAC water body type, parameter and concentration recommendations for the nutrient enriched waters regulation currently applicable, including the TAC recommendation that nitrogen was not an appropriate criterion?
- What are the most likely metrics for streams, lakes, estuaries?
- Should the criteria be causal variables (Nitrogen and Phosphorus concentrations); or be response variables like water clarity, chlorophyll a, Trophic State Indices (TSIs), or other algal indices; or both?
- What approaches should VA take to demonstrate where nitrogen criteria are not needed for freshwater lakes and reservoirs and streams and rivers?
- Should narrative translators be expressed as percentages or other statistical factors or ratios

Regionalization

- Should Virginia consider adoption of ecoregion and water body type specific criteria developed by neighboring states with shared waters?

Classification

- Should criteria development be broken out into water types: streams/lakes/estuaries?
- Should waterbody and depth specific dissolved oxygen criteria be considered? In waters that experience dissolved oxygen deficiency, should dissolved oxygen be added as a response variable? Ex: State might demonstrate via a use attainability study that in a deepwater reservoir some phosphorus enrichment may be consistent with a particular game fishery designated use. A model might indicate that TP & DO adequately protect deep reservoir or lake's designated uses and chlorophyll a is not required as an independent criterion.
- Should VA utilize “use attainability” studies to refine uses, especially for lakes with multiple uses, such as promoting a game fishery while maintaining water clarity that promotes recreational swimming or should VA focus on determining appropriate, possibly more stringent criteria for a lake or reservoir that has a public water supply designated use.
- Should user perception surveys at lakes or a literature survey of user perception of lakes be used in determining appropriate criteria in lakes and reservoirs?
- What types of physical classification schemes should VA use for lakes (such as size) and streams (such as stream order)? Should VA set regulatory size thresholds for lakes and reservoirs that would eliminate from the population small lakes - such as agricultural ponds – and lakes and reservoirs without public access?
- Should VA develop site specific criteria for the two natural lakes in the state?
- Should VA consider percentage of wetted stream perimeter coverage of macrophytes as a criterion of nutrient enrichment?

Prioritization & Coverage

- If criteria development is broken out into water types, should the efforts run sequentially or concurrently?
- If N and P criteria are developed, should they be limited to site-specific studies, such as TMDLs?

Inventory of Existing Data

- Are the existing data sufficient for DEQ staff to develop water body specific criteria?

Planned Data Collection

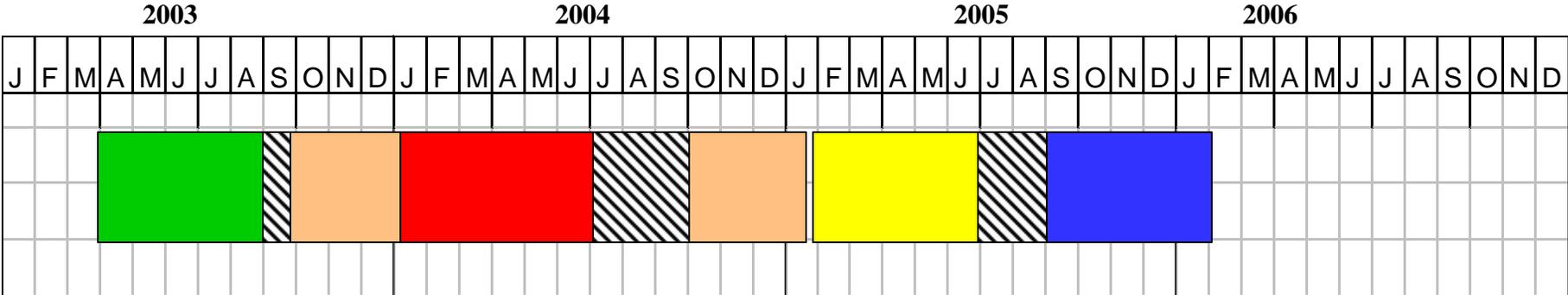
- Do DEQ staff need to conduct additional monitoring data or undertake literature surveys for default data?

Data Needs

- Should VA explore differentiation of chlorophyll a for phytoplankton vs. periphyton-dominated streams and rivers?

Appendix K

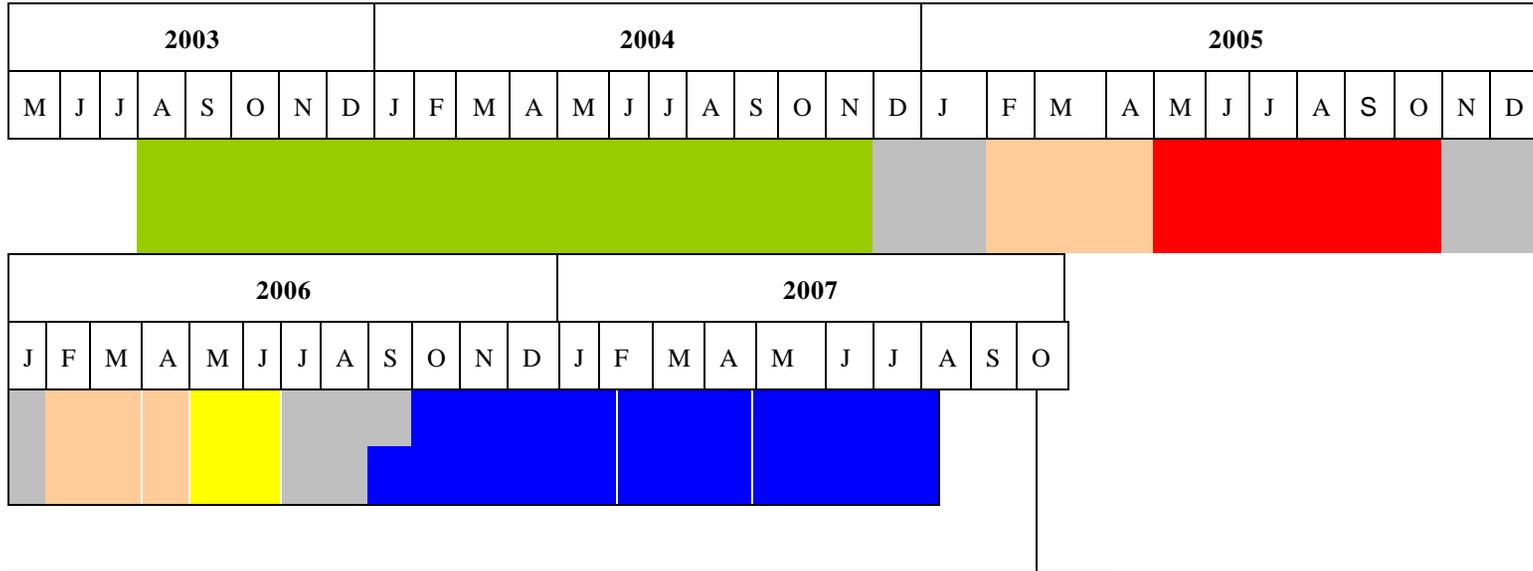
Timeline to Adopt VA Chesapeake Bay Nutrient Criteria



- Technical Review/Development and Submit NOIRA to DPB
- DPB and Executive Review of NOIRA
- NOIRA Comment Period
- 180 Days Includes Advisory Committee, Proposal Development, Board Approval for Public Comment, Submission to DPB
- DPB Economic Impact Assessment and Executive Review of NOPC
- NOPC Comment Period and Public Hearings
- 150 Days Includes Final Revisions, Board Adoption and Submission of Final Regulation to DPB
- DPB and Executive Review of Final
- Final Publication, AG Certification, Submission to EPA for Review

Appendix L

Timeline to Adopt VA Nutrient Criteria For Lakes & Reservoirs



- Technical Review/Development and Submit NOIRA to DPB**
- DPB and Executive Review of NOIRA**
- NOIRA Comment Period**
- 180 Days Includes Advisory Committee, Proposal Development, Board Approval for Public Comment, Submission to DPB**
- DPB Economic Impact Assessment and Executive Review of NOPC**
- NOPC Comment Period and Public Hearings**
- 150 Days Includes Final Revisions, Board Adoption and Submission of Final Regulation to DPB**
- DPB and Executive Review of Final NOPC**
- Final Publication, AG Certification, Submission to EPA for Review and Approval, Publication of Effective Date**

Appendix M.

Documentation Related to Nutrient Criteria for Lakes and Reservoirs, Final Regulation Agency Background Document.



Virginia
Regulatory
Town Hall

townhall.virginia.gov

Final Regulation Agency Background Document

Approving authority name	State Water Control Board
Virginia Administrative Code (VAC) citation	9 VAC 25 -260
Regulation title	Water Quality Standards
Action title	Amendments to Water Quality Standards – Criteria to Protect the Designated Uses of Lakes and Reservoirs from the Impacts of Nutrients
Document preparation date	

This information is required for executive branch review and the Virginia Registrar of Regulations, pursuant to the Virginia Administrative Process Act (APA), Executive Orders 21 (2002) and 58 (1999), and the *Virginia Register Form, Style, and Procedure Manual*.

Brief summary

Please provide a brief summary (no more than 2 short paragraphs) of the proposed new regulation, proposed amendments to the existing regulation, or the regulation proposed to be repealed. Alert the reader to all substantive matters or changes. If applicable, generally describe the existing regulation. Also, please include a brief description of changes to the regulation from publication of the proposed regulation to the final regulation.

Amendments are proposed to the state's Water Quality Standards regulation to add new numerical and narrative criteria to protect designated uses of man-made lakes and reservoirs as well as the two natural lakes in the state from the impacts of nutrients. The rulemaking also proposes clarifying that the existing dissolved oxygen criteria during times of thermal stratification should only apply to the upper layer (epilimnion) in man-made lakes and reservoirs where nutrient enrichment is controlled by applicable nutrient criteria in section 9 VAC 25-260-187 of the regulation.

Since publication of the proposal, the following changes have been made: reassignment of Lake Whitehurst from a cool to a warm water fishery and Burke Lake from a warm water to a fertilized fishery with the appropriate changes in the numeric criteria, clarification that water quality assessment of nutrient criteria (chlorophyll a and total phosphorus) will be based on the two most recent monitoring years with available data, addition of a process for confirmation of use impairments when the criteria are exceeded, and retention of the nutrient enriched waters designations in 9 VAC 25-260-350 for Smith Mountain Lake, Lake Chesdin, South Fork Rivanna Reservoir, and Claytor Lake. In addition, as a result of the retention of the nutrient enriched waters designations in 9 VAC 25-260-350, proposed deletion of references to the designations in 9 VAC 25-260-415, 420, 450 and 540 were reinstated in the final regulation.

Statement of final agency action

Please provide a statement of the final action taken by the agency including (1) the date the action was taken, (2) the name of the agency taking the action, and (3) the title of the regulation.

The State Water Control Board adopted at their June 1, 2006 meeting amendments to the Water Quality Standards regulation 9 VAC 25-260) to protect the designated uses of lakes and reservoirs from the impacts of nutrients:

- Definitions in 9 VAC 25-260-5 for five terms (algicides, epilimnion, lacustrine, man-made lake or reservoir, and natural lake) introduced in the proposed text amendments,
- Special Standards in 9 VAC 25-260-310 for numerical nutrient criteria to maintain the current water quality of the two natural lakes (Mountain Lake and Lake Drummond) in Virginia with references in the River Basin Tables 9 VAC 25-260-480 and 540,
- Numerical criteria for dissolved oxygen 9 VAC 25-260-50 clarification that during times of thermal stratification, the existing dissolved oxygen criteria should only apply to the upper layer in the lake-like portion of man-made lakes and reservoirs covered by nutrient criteria in 9 VAC 25-260-187, and
- Creation of a section 9 VAC 25-260-187 under Standards with More Specific Application for numerical chlorophyll a and total phosphorus criteria for 116 listed man-made lakes, allowance for site specific modifications to the criteria if the nutrient criteria specified for a man-made lake or reservoir do not provide for the attainment and maintenance of the water quality standards of downstream waters, reassignment of Lake Whitehurst from a cool to a warm water fishery and Burke Lake from a warm water to a fertilized fishery with the appropriate changes in the numeric criteria, clarification that water quality assessment of nutrient criteria (chlorophyll a and total phosphorus) will be based on the two most recent monitoring years with available data, and the addition of a process for confirmation of use impairments when the criteria are exceeded.

Legal basis

Please identify the state and/or federal legal authority to promulgate this proposed regulation, including (1) the most relevant law and/or regulation, including Code of Virginia citation and General Assembly chapter numbers, if applicable, and (2) promulgating entity, i.e., agency, board, or person. Describe the legal authority and the extent to which the authority is mandatory or discretionary.

§ 62.1-44.15(3a) of the Code of Virginia, as amended, mandates and authorizes the State Water Control Board to establish water quality standards and policies for any State waters consistent with the purpose and general policy of the State Water Control Law, and to modify, amend or cancel any such standards or policies established. The federal Clean Water Act at 303(c) mandates the State Water Control Board to review and, as appropriate, modify and adopt water quality standards. The corresponding federal water quality standards regulation at 40 CFR 131.6 describes the minimum requirements for water quality standards. The minimum requirements are use designations, water quality criteria to protect the designated uses and an antidegradation policy. All of the citations mentioned describe mandates for water quality standards.

Web Address sites where citations can be found:

Federal Regulation web site

<http://www.epa.gov/epahome/cfr40.htm>

Clean Water Act web site

<http://www4.law.cornell.edu/uscode/33/1313.html>

State Water Control Law (Code of Virginia) web site

<http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+62.1-44.2>

<http://leg1.state.va.us/cgi-bin/legp504.exe?000+cod+62.1-44.15>

The Environmental Protection Agency (EPA) Water Quality Standards regulation (40 CFR 131.12) is the regulatory basis for the EPA requiring the states to establish within the antidegradation policy the Exceptional State Waters category and the eligibility decision criteria for these waters. EPA retains approval/disapproval oversight, but delegates to the states the election and designation of specific water bodies as Exceptional State Waters.

The Office of the Attorney General has certified that the agency has the statutory authority to promulgate final text of the regulation.

Purpose

Please explain the need for the new or amended regulation. Describe the rationale or justification of the proposed regulatory action. Detail the specific reasons it is essential to protect the health, safety or welfare of citizens. Discuss the goals of the proposal and the problems the proposal is intended to solve.

Runoff from “non-point” sources such as urban, agricultural, and forest land, combined with discharges from industrial and municipal sources, have resulted in excessive levels of nutrients, particularly phosphorus, in some of the State’s waters, including lakes and reservoirs. Although nutrients such as phosphorus are necessary for the growth of algae which are an essential part of the food chain, problems occur when an overabundance of these nutrients cause excessive growths of algae. Excessive amounts of aquatic plants, particularly algae, can discolor the water, create taste and odor problems for water supply managers, reduce water clarity, and block sunlight from submerged aquatic vegetation. Another side effect of excessive algal blooms is impairment of recreational activities in the water body due to the aesthetically displeasing appearance of the water. The most serious problem resulting from algal growth occurs when the plants die and decay; at that time, they deplete the oxygen level of the water to the point where fish and other aquatic organisms cannot survive. It is important, therefore, to develop nutrient controls so that the symptoms of nutrient enrichment, i.e. the excessive growth of plants and fluctuating levels of dissolved oxygen, are avoided.

This rulemaking is needed to establish the appropriate nutrient criteria for lakes and reservoirs in the Commonwealth of Virginia because:

1) The U.S. Environmental Protection Agency (EPA) has published ecoregion water body specific nutrient related criteria and stated its intent in a National Nutrient Strategy (1998) to promulgate these default nutrient criteria for a state if the state does not adopt nutrient criteria by December 31, 2004 or submit a nutrient development plan with timelines for adoption of this criteria that are accepted by EPA. As discussed below, Virginia decided to take the latter approach.

2) These standards will be used in setting Virginia Pollutant Discharge Elimination System Permit limits and for evaluating the waters of the Commonwealth for inclusion in the Clean Water Act 305(b) report and on the 303(d) list, and

3) Waters not meeting standards will require development of a Total Maximum Daily Load (TMDL) under section 303(d) of the Clean Water Act. Adoption of water body type specific criteria and uses is necessary to define the most accurate water quality goals for clean up or TMDL development and to protect the appropriate aquatic life and recreational uses of lakes and reservoirs.

Since Virginia intended to develop state specific criteria rather than adopt the EPA published national nutrient criteria, the state submitted to EPA a nutrient criteria development plan for Virginia that EPA has accepted. EPA will use the plan to track the State's progress in nutrient criteria development. If the Commonwealth keeps to the schedule contained in the Plan, EPA is not expected to promulgate nutrient criteria for the State.

Virginia is committed through its Nutrient Criteria Development Plan to adopt new and revised water quality standards for estuaries, lakes and reservoirs, and rivers and streams. The Department is using a two step process - technical development of nutrient criteria and administrative adoption of the criteria - for each water body type. Prioritization of waters for criteria development and adoption is based on availability of data to proceed with a rulemaking. This sequential approach to the development and regulatory adoption of nutrient criteria was initiated in 2003 for estuaries with adoption of nutrient criteria for the Chesapeake Bay in 2005; the current rulemaking is for lakes and reservoirs and in 2008 a separate rulemaking will be initiated for rivers and streams.

Since mid-2003 an Academic Advisory Committee (AAC) on Freshwater Nutrient Criteria - that was formed by the Virginia Water Resources Research Center under contract to DEQ - has been providing advice to the Department on nutrient criteria development for lakes and reservoirs. The documents produced by the AAC and used by the Department in developing these amendments can be found on the Department's web site at: <http://www.deq.virginia.gov/wqs/rule.html#NUT2>.

Substance

Please identify and explain the new substantive provisions, the substantive changes to existing sections, or both where appropriate. A more detailed discussion is required under the "All changes made in this regulatory action" section.

The substantive changes that are being proposed in this regulatory action are: special nutrient standards for the two natural lakes in Virginia – Mountain Lake and Lake Drummond, chlorophyll a and total phosphorus criteria for 116 man-made lakes and reservoirs that the Department has previously monitored or plans to monitor (The total phosphorus criteria apply only when algicide treatments are made during the monitoring period of April 1 through October 31) and application of existing dissolved oxygen criteria during thermal stratification to only the upper layer in the lake-like portion of man-made lakes and reservoirs that will be protected from the effects of nutrient enrichment by the proposed numerical criteria. In addition, a statement is included to allow for site specific modifications to the criteria if the nutrient criteria specified for a man-made lake or reservoir do not provide for the attainment and maintenance of the water quality standards of downstream waters; this was proposed to address the phased development of nutrient criteria for lakes and reservoirs preceding those for rivers and streams. In response to public comment, the following additional changes were made to proposed section 187:

Reassigns Lake Whitehurst from a cool to a warm water fishery and Burke Lake from a warm water to a fertilized fishery with the appropriate changes in the numeric criteria. Clarifies that water quality assessment of nutrient criteria (chlorophyll a and total phosphorus) will be based on the two most recent

monitoring years with available data. Adds a process for confirmation of use impairments when the criteria are exceeded.

This rulemaking effort also involved an evaluation of the applicability of Virginia’s current regulatory program (Nutrient Enriched Waters) for controlling nutrients in surface waters, including lakes and reservoirs. The concept of Nutrient Enriched Waters was not incorporated into the final approach selected by the State, so a plan was developed to transition from the existing regulatory Nutrient Enriched Waters listings to the new regulatory approach by sequentially deleting currently designated Nutrient Enriched Waters as the Commonwealth adopts nutrient criteria for those waters. Consideration was given to the repeal of the following nutrient enriched waters designations in 9 VAC 25-260-350, Designation of Nutrient Enriched Waters: Smith Mountain Lake, Lake Chesdin, South Fork Rivanna Reservoir, and Claytor Lake. However, a recommendation was received during the public comment period to retain the Nutrient Enriched Waters designations for these four lakes because of the historical protection from nutrient enrichment that the companion Nutrient Policy has provided by requiring a monthly average total phosphorus effluent limit of 2 mg/L for point source discharges over a certain flow. Therefore, the proposed deletion of the Nutrient Enriched Waters designation for the four lakes has been removed from the final proposal in Attachment 3.

Issues

Please identify the issues associated with the proposed regulatory action, including:

- 1) the primary advantages and disadvantages to the public, such as individual private citizens or businesses, of implementing the new or amended provisions;*
- 2) the primary advantages and disadvantages to the agency or the Commonwealth; and*
- 3) other pertinent matters of interest to the regulated community, government officials, and the public.*

If there are no disadvantages to the public or the Commonwealth, please indicate.

The primary advantage/benefit to the public is that the proposed nutrient criteria, once implemented fully, will result in the protection of the fishery and other associated recreational uses in identified lakes and reservoirs from the effects of nutrient enrichment. The disadvantage is that 22 entities currently discharging to these waters may have to incur the costs of installing treatment for nutrient reduction

The advantage to the agency is that the adoption of these criteria will continue to meet the phased obligations to EPA of the Commonwealth’s nutrient criteria development plan and to develop nutrient criteria appropriate for Virginia waters instead of EPA promulgating default national criteria.

The advantage to the Commonwealth is that the adoption of these criteria will help protect the public water supplies and recreational lakes listed in these proposed amendments from the effects of nutrient enrichment.

There is no disadvantage to the agency or the Commonwealth that will result from the adoption of these amendments.

Pertinent matters of interest to the regulated community, government officials, and the public are the potential costs to meet the requirements of this regulation.

Changes made since the proposed stage

Please describe all changes made to the text of the proposed regulation since the publication of the proposed stage. For the Registrar’s office, please put an asterisk next to any substantive changes.

Section number	Requirement at proposed stage	What has changed	Rationale for change
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9 VAC 25-260-187	Lists man-made lakes and reservoirs that the Department has previously monitored or plans to monitor and the water body specific chlorophyll a and total phosphorus criteria to protect aquatic life and recreational designated uses in these waters from the impacts of nutrients. Allows for site specific modifications to the criteria if the nutrient criteria specified for a man-made lake or reservoir do not provide for the attainment and maintenance of the water quality standards of downstream waters.	Reassigns Lake Whitehurst from a cool to a warm water fishery and Burke Lake from a warm water to a fertilized fishery with the appropriate changes in the numeric criteria. Clarifies that water quality assessment of nutrient criteria (chlorophyll a and total phosphorus) will be based on the two most recent monitoring years with available data. Adds a process for confirmation of use impairments criteria are exceeded.	Response to substantive public comment.
9 VAC 25-260-350	Four lakes (Smith Mountain Lake, lake Chesdin, South Fork Rivanna Reservoir, and Claytor Lake) listed as "nutrient enriched waters " were proposed to be removed from the list of nutrient enriched waters since the new method of controlling nutrients in these and other man-made lakes and reservoirs will be from implementation of the criteria set forth in 9 VAC 25-260-187.	DEQ will recommend that the Board retain the Nutrient Enriched Waters designations for the four lakes.	Waters listed in this section are subject to phosphorus limits under the Nutrient Enriched Waters Policy (9 VAC 25-40 et seq.) Public comment indicated that the companion Nutrient Policy effluent limits on point sources discharges to the four lakes has historically provided protection from nutrient enrichment and should be retained to continue to provide this additional layer of protection from use impairments due to nutrients.
9 VAC 25-260-415	Deletes reference in the James River Basin, Appomattox to the "nutrient enriched waters" status of Lake Chesdin as NEW-2 because was proposed for repeal in 9 VAC 25-260-350.	DEQ will recommend that the Board retain the Nutrient Enriched Waters designation.	Waters listed in this section are subject to phosphorus limits under the Nutrient Enriched Waters Policy (9 VAC 25-40 et seq.) Public comment indicated that the companion Nutrient Policy effluent limits on point sources discharges to the four lakes has historically provided protection from nutrient enrichment and should be retained to continue to provide this additional layer of protection from

			use impairments due to nutrients.
9 VAC 25-260-420	Deletes reference in the James River Basin, Middle to the “nutrient enriched waters” status of South Fork Rivanna Reservoir as NEW-3 because was proposed for repeal in 9 VAC 25-260-350.	DEQ will recommend that the Board retain the Nutrient Enriched Waters designation.	Waters listed in this section are subject to phosphorus limits under the Nutrient Enriched Waters Policy (9 VAC 25-40 et seq.) Public comment indicated that the companion Nutrient Policy effluent limits on point sources discharges to the four lakes has historically provided protection from nutrient enrichment and should be retained to continue to provide this additional layer of protection from use impairments due to nutrients.
9 VAC 25-260-450	Deletes reference in the Roanoke River Basin Roanoke subbasin to the “nutrient enriched waters” status of Smith Mountain Lake as NEW-1 because was proposed for repeal in 9 VAC 25-260-350.	DEQ will recommend that the Board retain the Nutrient Enriched Waters designation.	Waters listed in this section are subject to phosphorus limits under the Nutrient Enriched Waters Policy (9 VAC 25-40 et seq.) Public comment indicated that the companion Nutrient Policy effluent limits on point sources discharges to the four lakes has historically provided protection from nutrient enrichment and should be retained to continue to provide this additional layer of protection from use impairments due to nutrients.
9 VAC 25-260-540	Deletes reference in the New River Basin section table to the “nutrient enriched waters” status of Claytor Lake as NEW-4 because was proposed for repeal in 9 VAC 25-260-350.	DEQ will recommend that the Board retain the Nutrient Enriched Waters designation.	Waters listed in this section are subject to phosphorus limits under the Nutrient Enriched Waters Policy (9 VAC 25-40 et seq.) Public comment indicated that the companion Nutrient Policy effluent limits on point sources discharges to the four lakes has historically provided protection from nutrient enrichment and should be retained to continue to provide this additional

			layer of protection from use impairments due to nutrients.
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Public comment

Please summarize all comments received during the public comment period following the publication of the proposed stage, and provide the agency response. If no comment was received, please so indicate.

Commenter	Comment	Agency response
EPA	9 VAC 25-260-310, 9 VAC 25-260-480, and 9 VAC 25-260-540: Support Virginia's decision to incorporate numerical values for its two natural lakes, however unable to find them in the draft. Please indicate what those values will be at your earliest convenience	<p>The natural lake standards are in the special standards and requirements section, 9 VAC 25-260 310 "cc" and "dd" and references to this section are included in the river basin tables. The wording for these special standards can be found on page 1497 of http://legis.state.va.us/codecomm/register/vol22/iss10/v22i10.pdf :</p> <p>cc. For Mountain Lake in Giles County, chlorophyll a shall not exceed 6 µg/L at a depth of 6 meters and orthophosphate-P shall not exceed 8 µg/L at a depth of one meter or less.</p> <p>dd. For Lake Drummond, located within the boundaries of Chesapeake and Suffolk in the Great Dismal Swamp, chlorophyll a shall not exceed 35 µg/L and total phosphorus shall not exceed 40 µg/L at a depth of one meter or less.</p>
EPA	EPA also suggested changes to section 6.2 of the draft agency implementation guidance which addresses when total phosphorus limitations are determined to be required in permitted discharges.	Revision to guidance was developed with input from EPA.
VAMWA, ACSA, ASA, HRSD, PCo, RWSA, UOSA, SCo, WVWA	<p>Supports:</p> <ul style="list-style-type: none"> • DEQ's reliance on an effects base approach for deriving nutrient criteria, with strong consideration of fisheries. • Application of dissolved oxygen criteria only to the epilimnion during periods of thermal stratification. • DEQ's decision to list specific reservoirs to which the nutrient standards apply. • Decision that total nitrogen and Secchi depth criteria are not necessary. 	No response needed.
VAMWA,	Recommends:	

<p>ACSA, ASA, HRSD, PCo, RWSA, UOSA, SCo, WVWA, SBos</p>	<ul style="list-style-type: none"> The nutrient standards and related guidance should allow confirmation of use impairments, prior to 303(d) listing as the TMDL process is not intended for the assessment of water bodies, but to correct impairments and a confirmatory process (such as the "Reservoir Use Attainment Evaluation Procedure" introduced by VAMWA to the Ad hoc workgroup) used prior to 303(d) listing could very well reduce the staffing and budgetary demands on DEQ by not requiring TMDLS for lakes that are meeting all designated uses. Recommended modifications in wording of the regulation. Phosphorus criteria should only apply if frequent algicide treatments are necessary. Frequent can be defined as more than one per growing season. Suggests substitute language for proposed section 187.C that allows modification of the nutrient criteria "on a site-specific basis to protect the water quality of downstream waters" to avoid confusing the concepts of site-specific criteria with the permitting task of focusing on both immediate and far-field water quality impacts. 	<p>Since the AAC in their reports to DEQ had suggested an extra step of review and evaluation prior to an impairment designation for a lake or reservoir with nutrient criteria violations, staff sought the advice of the ACC on how to do this. The AAC suggested that DEQ consult with VDGIF regarding the status of the fishery to determine whether or not the designated use for that water body was being attained. A new subsection has been added to Section 187 to require this extra step when assessing in Clean Water Act §§ 305(b) and 303(d) reports a nutrient criteria violation for a man-made lake or reservoir listed in Section 187.B.</p> <p>Algicide applications are usually tied to algal blooms so even a one time application at the time of a bloom would result in a low or zero chlorophyll reading and likely contribute to a monitoring season value that under represented the levels of algae found during the growing season. The use of total phosphorus values is intended to serve as a check at such times.</p> <p>This section was included at the request of EPA Region 3 assessment staff to recognize that the phased approach of freshwater nutrient criteria in Virginia with lake criteria preceding criteria for streams and rivers. The wording is consistent with section 10 of the VA surface water quality standards regulation and the federal water quality standards regulation.</p>
<p>WVWA</p>	<p>Requested review of Spring Hollow classification as a cool water fishery because Carvins Cove and Beaverdam are in the same geographic area and approximate elevation but are classed as warm water.</p>	<p>DEQ staff consulted with VDGIF on this issue. It is VDGIF's opinion that the 200 foot depth of Spring Hollow (the depth of the other two reservoirs mentioned are 100 feet or less) and the use of aeration equipment in Spring Hollow have created a habitat suitable for a cool water fishery. If the artificial aeration was discontinued, VDGIF said they would need to reevaluate their current classification.</p>
<p>RWSA, WVWA, LACA, MWV, VMA, VAMWA, HRPDC</p>	<p>Appreciated the opportunity for representation in the Department's nutrient criteria development process for lakes and reservoirs via the advisory committee</p>	<p>No response needed.</p>
<p>VMA, MWV</p>	<p>Supports:</p> <ul style="list-style-type: none"> Chlorophyll a criteria alone is adequate 	<p>No response needed.</p>

	<p>to protect lakes from eutrophication where algaecides are not used.</p> <ul style="list-style-type: none"> • Application of the dissolved oxygen criteria to the epilimnion of stratified lakes 	
VMA, MWV	<p>Recommend additional clarification or guidance:</p> <p>1. Definition of “man-made lake or reservoir”:</p> <ul style="list-style-type: none"> • Expand the definition of “man-made lake and reservoir” to better define the types of impoundments that will/will not be subject to water quality standards, with specific reference to water body size, retention time, designated uses, and other relevant variables. • Include a use attainability methodology that can be used, where appropriate, to evaluate and refine the designated uses of different made-made lakes and reservoirs. EPA ‘s guidance “Improving the Effectiveness of the Use Attainability (UAA) Process” as relevant foundation of the new Virginia methodology. <p>2. Definitions of “coldwater fishery, cool water fishery, fertilized fishery, and warm water fishery” in the implementation guidance:</p> <ul style="list-style-type: none"> • Revise temperature limits applicable to stockable and natural trout waters to reflect seasonal variation because cool and cold water reservoirs managed as trout fisheries cannot meet stockable and natural waters temperature limits (21°C and 20°C respectively) in their upper elevations throughout the year. • Inconsistencies in application of these terms in lakes: <ul style="list-style-type: none"> ➤ The AAC identified Lake Moomaw as a cool water lake, because it is a large multipurpose lake with the top layer managed as a warm water fishery and the bottom layer managed as a cool water fishery. However, DEQ now proposes to list it as a cold 	<p>This issue was discussed at the advisory committee meetings. EPA would not allow exclusion of “waters of the state” in the regulation based on size, depth, etc. The AAC excluded historical lake data if the reservoir had a retention time of less than five days (which indicated it acted more like a flowing rather than standing body of water) and DEQ will consider this factor when evaluating future candidate lakes for listing in Section 187.B. However, neither DEQ staff nor the AAC could locate a source for residence time data for lakes and reservoirs in the Commonwealth.</p> <p>UAAs are already an option offered in the water quality standards regulation.</p> <p>This suggestion is outside the scope of this rulemaking.</p> <p>VDGIF has confirmed that it is a cold water lake.</p> <p>DEQ consulted with VDGIF. VDGIF’s said</p>

	<p>water lake.</p> <ul style="list-style-type: none"> ➤ Douthat Lake is listed as a cool water fishery Bark Camp Lake is listed as a warm water fishery. However, both are stocked with trout in the winter and have minimal trout habitat during summer months. <p>3. Methods for assessing attainment of criteria: DEQ developed the new criteria using historical observations from a limited number of sampling locations at each lake or reservoir. However, DEQ proposes to assess attainment of the new criteria using monitoring data from other sampling locations that may not be representative of the overall water quality in the lake or reservoir. For example, data collected from isolated sections of a lake may indicate excursions of the criteria, even though data collected from the original sampling locations do not. DEQ should revise its implementation guidance to specify how such data will be used to assess attainment. In particular, DEQ should require that sampling data used to assess attainment be representative of at least 90% of a lake or reservoir.</p>	<p>that a cool water fishery was “borderline” but this classification was chosen because Douthat Lake is located within a state park with a protected watershed and minimal potential for nutrient inputs and the current fishery conditions are not likely to change.</p> <p>The implementation plan has been modified (sections 4.3 and 5.5) to address these concerns; however, the 90% statistic was not used.</p>
HRPDC, SCo	Set criteria based upon public water supply as the highest use. Regulation needs to recognize reservoirs as a separate use from fisheries and establish relevant criteria or defer to the existing regulations. The overwhelming majority of freshwater lakes in Virginia are man-made reservoirs supplying drinking water. They are not created to act as fisheries, nor are they managed as fisheries. The fact that they support a fish population should not add additional regulatory burden to the utilities that operate them and who are already regulated as finished water suppliers under EPA’s Safe Drinking Water Act.	The water quality standards regulation recognizes fisheries as a use in all state waters. To remove a fishery use from a public water supply reservoir, a UAA would have to be conducted as part of a rulemaking to make the use change.
HRPDC	<p>Fishery issues:</p> <ul style="list-style-type: none"> • In several instances the fishery in a reservoir has been overrated due to DGIF stocking programs to improve fish passage and artificial manipulation (such as installation of aeration systems to control iron and manganese problems)of the reservoirs water quality. • Several reservoirs that are interconnected by canals have been 	<p>VDGIF has advised DEQ that their fishery classifications are based on habitat suitability under current conditions. If a management practice such as an artificial aeration system was discontinued, VDGIF said they would have to evaluate whether there had been a resultant change in conditions – in this case dissolved oxygen levels - that would impact the fishery potential.</p> <p>After the State Water Control Board had approved proceeding to public hearing and</p>

	<p>assigned significantly different limits even though the water flows freely between them.</p>	<p>comment on the proposed amendments, members of the ad hoc advisory committee from the City of Norfolk asked DEQ to check with VDGIF regarding the Lake Whitehurst fishery classification. VDGIF confirmed that it is a warm water fishery like the other connected lakes. This change will be reflected in the revised criteria for Lake Whitehurst that will be presented to the State Water Control Board for adoption; staff could not modify a regulation before it went to NOPC after the SWCB had directed staff to proceed with the proposed text to public hearing and comment. This will change the criteria from than a chlorophyll a of 25 µg/l and total phosphorus of 20 µg/l to chlorophyll a of 60 µg/l and total phosphorus of 40 µg/l.</p>
HRPDC	<p>For lakes and reservoirs that are located outside of the political subdivision of the owner, the regulations are unclear as to implementation and funding responsibilities should a TMDL be established.</p>	<p>Each TMDL is different as to how far upstream there is a source that has a downstream effect and therefore needs to be controlled whether it is NPS or PS or a combination of both in origin. Potentially impacted localities and other groups would be invited to participate in this planning process for the TMDL and comment opportunities would be provided.</p>
HRPDC	<p>Several reservoirs are managed by DGIF and are actively fertilized to increase the productivity of the fishery. This seems contradictory to the intended goal of the proposed regulation, but at the same time, adds credence to the argument that nutrients are supportive of aquatic life up to a point, in that they increase the primary productivity of the water body. The proposed limits for these fertilized lakes are significantly higher than similar lakes with the same fishery status and located in the same ecoregion and as such, these standards would be appropriate for all freshwater bodies in Virginia,</p>	<p>Three urban ponds (Curtis Lake, Lake Albemarle, and Stonehouse Creek Reservoir) which are managed by VDGIF for fishery production are included in the list of 116 man-made lakes and reservoirs. These fishing ponds are generally quite small and fish production is the primary use. Water clarity suitable for swimming, drinking water, or other such uses is not maintained so those fertilized lakes criteria would not be suitable for lakes and reservoirs with multiple uses.</p>
HRPDC	<p>There has been no empirical evidence put forth suggesting that the proposed nutrient standards are protective of fishery health. In contrast, high Chlorophyll a concentrations are the result of a healthy robust phytoplankton population that is the primary food source of many species of fish and/or their prey. In extreme cases, high algal populations can deplete the water column of dissolved oxygen, resulting in fish kills, but the Chlorophyll a standards established by this regulation are no where near the levels that would deplete enough oxygen to cause harm. More research needs to be done to establish the rationale for the proposed standards; the</p>	<p>The AAC January and June 2005 reports provide documentation of this evidence.</p>

	current research is inadequate.	
HRPDC	Use of the median value to measure compliance with the Chlorophyll a standard is unsupported. Since there is no evidence that the proposed Chlorophyll a standard is harmful to the fishery, we believe that a better measurement of compliance should be to use the 95 th percentile of all readings taken during the growing season (March-October).	In the January 2005 AAC Report, both chlorophyll a and total phosphorus criteria were calculated using the median of the data set. However, at the request of the ad hoc advisory committee, the AAC re-evaluated the calculation of the chlorophyll a criteria for the 90 th percentile. The advisory committee had requested this re-evaluation because extreme (not medium or average) conditions cause impairments and the criteria should reflect those conditions. The AAC determined that the 90 th percentile was a more appropriate metric than the maximum value for criteria expression for chlorophyll a because the maximum value is biased by the number of observations while no bias by number of observations is apparent with the 90 th percentile.
HRPDC	Due to the environmental conditions that exist in Southeastern Virginia, lakes and reservoirs are typically turbid as a result of algal productivity. The blend of high temperature and direct sunlight creates perfect environmental conditions for algal growth. This results in naturally high Chlorophyll a concentrations as can be seen in most water bodies in warm temperate climates like our own. Trying to achieve Chlorophyll a concentrations that are lower than those occurring naturally is unrealistic, overly burdensome, and impossible to obtain.	The AAC retained in their criteria recommendations the EPA concept of criteria development by nutrient ecoregions so these concerns were addressed by this approach.
LACA	Questions that DCLS can accurately measure 10 micrograms per liter of Total Phosphate as find variation in duplicate samples sent to DCLS. Participate in the Virginia Water Monitoring Council; some of the bigger municipal labs with trained chemists feel 20 micrograms is the lower limit of measurement with the EPA approved analytical procedures.	DCLS has several group codes for total phosphorus analysis and the low range method measures down to .01 mg/L.
SCo	Data collected must be representative of the entire reservoir. Questions whether citizen-collected data are representative and meet QA/QC standards suitable for regulatory purposes.	These issues are addressed in the agency implementation plan.
WCRO	Recommend retaining the Nutrient Enriched waters classifications for Smith Mountain Lake and the other three lakes listed because the companion Nutrient Policy requires a monthly average total phosphorus effluent limit of 2 mg/L for point source discharges over a certain flow. The impact of this point source control of total phosphorus in effluents to the lake over the past 20 years may have helped prevent impairments in Smith Mountain Lake from nutrient enrichment.	DEQ will recommend to the Board that the Nutrient Enriched Waters designations for the four lakes not be repealed because of the historical protection from nutrient enrichment that the companion Nutrient Policy effluent limits have provided.

Enter any other statement here: The agency also received comment on the draft implementation guidance and those comments will be addressed in the final version of this plan which will be completed prior to the effective date of the amendments.

List of Acronyms Used for the Organizations:

ACSA = Amherst County Service Authority, Dan E. French, Director of Public Utilities

ASA = Alexandria Service Authority, Glenn B. Harvey

EPA =US Environmental Protection Agency Region III, Tiffany Crawford and Mark Smith, US Environmental Protection Agency, Region 3, Water Protection Division

HRSD = Hampton Roads Sanitation District, Norman E. LaBlanc, Director of Water Quality

HRPDC = Hampton Roads Planning District Commission, Arthur L. Collins, Executive Director/Secretary

LACA = Lake Anna Civic Association, Dick Clark

PCo = Powhatan County, Kurt L. Hildebrand, Director of Facilities

MWV = MeadWestvaco, Thomas G. Botkins, Jr., Environmental and Product Stewardship Manager

RWSA = Rivanna Water and Sewer Authority, Robert C. Wichser, Director, Water & Wastewater Operations

SBos = Town of South Boston, Ted Daniel, Town Manager

SCo = Spotsylvania County, Thomas M. Slaydon, Director of Utilities

UOSA = Upper Occoquan Sewage Authority, Charles P. Boepple, Executive Director

VMA = Virginia Manufacturers Association, Brooks M. Smith, Hunton & Williams on behalf of VMA

VAMWA = Virginia Association of Municipal Wastewater Agencies, Inc., Frank W. Harksen, President

WCRO = West Central Office of the Department of Environmental Quality

WVWA = Western Virginia Water Authority, Michael T. McEvoy, Executive Director, Wastewater Services

All changes made in this regulatory action

Please detail all changes that are being proposed and the consequences of the proposed changes. Detail new provisions and/or all changes to existing sections.

Current section number	Proposed new section number, if applicable	Current requirement	Proposed change and rationale
9 VAC		Definitions	Added definitions for new terms used in the

25-260-5			proposed amendments: 'algicide', 'epilimnion', 'lacustrine', 'man-made lake or reservoir', and 'natural lake.'
9 VAC 25-260- 50		Lists dissolved oxygen, pH and temperature criteria for Class I - VII waters.	Added a fourth footnote to the table in the dissolved oxygen column to recognize that for a thermally stratified man-made lake or reservoir, the dissolved oxygen criteria only apply to the epilimnion in the lacustrine portion of the water body.
9 VAC 25-260- 187		None since this is a new section.	Lists man-made lakes and reservoirs that the Department has previously monitored or plans to monitor and the water body specific chlorophyll a and total phosphorus criteria to protect aquatic life and recreational designated uses in these waters from the impacts of nutrients. Allows for site specific modifications to the criteria if the nutrient criteria specified for a man-made lake or reservoir do not provide for the attainment and maintenance of the water quality standards of downstream waters. Reassigns Lake Whitehurst from a cool to a warm water fishery with the appropriate changes in the numeric criteria. Clarifies that water quality assessment of nutrient criteria (chlorophyll a and total phosphorus) will be based on the two most recent monitoring years with available data. Adds a process for confirmation of use impairments when the criteria are exceeded.
9 VAC 25-260- 310		Contains site-specific and effluent criteria for various water bodies.	Adds two new site-specific criteria numerical nutrient criteria for the two natural lakes in Virginia: Mountain Lake and Lake Drummond.
9 VAC 25-260- 480		Chowan and Dismal Swamp Basin Albemarle Subbasin section table.	Adds to special standards column the new site-specific criteria numerical nutrient criteria "dd" for Lake Drummond.
9 VAC 25-260- 540		New River Basin section table.	Adds to special standards column the two new site-specific criteria numerical nutrient criteria "cc" for Mountain Lake.

Regulatory Flexibility Analysis

Please describe the agency's analysis of alternative regulatory methods, consistent with health, safety, environmental, and economic welfare, that will accomplish the objectives of applicable law while minimizing the adverse impact on small business. Alternative regulatory methods include, at a minimum: 1) the establishment of less stringent compliance or reporting requirements; 2) the establishment of less stringent schedules or deadlines for compliance or reporting requirements; 3) the consolidation or simplification of compliance or reporting requirements; 4) the establishment of performance standards for small businesses to replace design or operational standards required in the proposed regulation; and 5) the exemption of small businesses from all or any part of the requirements contained in the proposed regulation.

Since development of criteria for protection of lakes and reservoirs from the effects of nutrient enrichment is a national EPA initiative, EPA will promulgate the criteria if a state fails to do so. Therefore, the Department is proceeding with their nutrient criteria development plan that proposes fewer criteria and regulatory requirements that are not as burdensome on small businesses as the federal criteria. An estimated five of the 17 entities that will be affected by the proposed regulations are small businesses: Nine O Three Inc, Simmons Terminal and Restaurant, Callebs Cove Campground, Lake Anna Family Campgrounds, and Bolar Mountain Complex. These facilities may be required to remove part or all of the nutrients in their discharges and will incur an increased cost which will commensurately reduce their profits. However, these facilities have small discharges close to or below 0.02 million gallons per day (MGD), thus the impact of the proposed regulatory changes will likely not be significant. Since these small businesses are already VPDES permit holders with reporting requirements, the additional reporting requirements should not be overly burdensome.

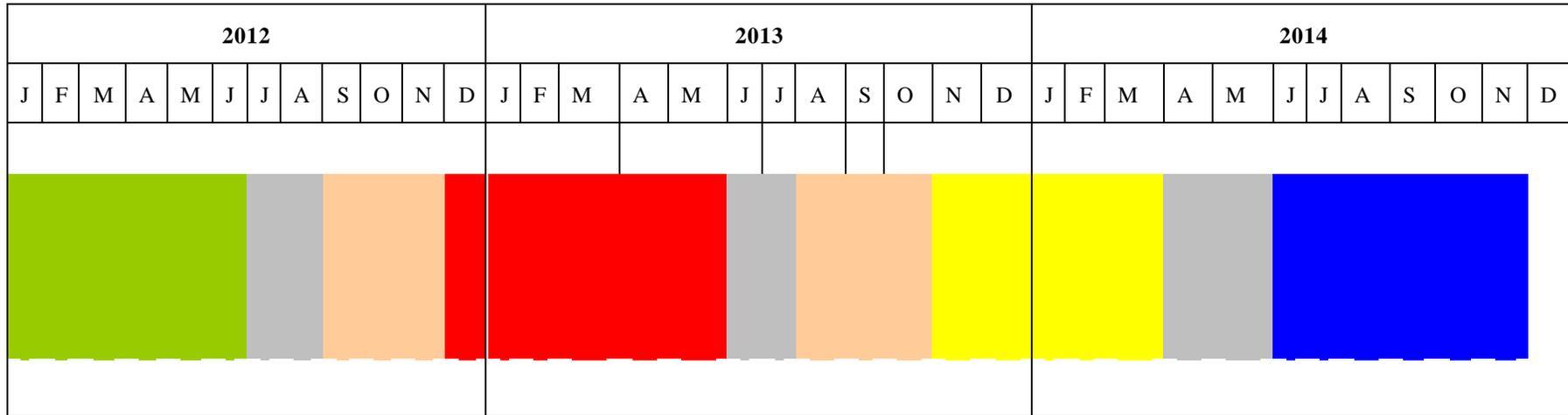
Family impact

Please assess the impact of the proposed regulatory action on the institution of the family and family stability including to what extent the regulatory action will: 1) strengthen or erode the authority and rights of parents in the education, nurturing, and supervision of their children; 2) encourage or discourage economic self-sufficiency, self-pride, and the assumption of responsibility for oneself, one's spouse, and one's children and/or elderly parents; 3) strengthen or erode the marital commitment; and 4) increase or decrease disposable family income.

The development of water quality standards is for the protection of public health and safety, which has only an indirect impact on families.

Appendix N2

Timeline to Adopt VA Nutrient Criteria For Non-Wadeable Streams & Rivers



-  Technical Review Development/Data Collection
-  DPB and Executive Review of NOIRA (9/03)
-  NOIRA Comment Period
-  180 Days Includes Advisory Committee, Proposal Development, Board Approval for Public Comment, Submission to DPB
-  DPB Economic Impact Assessment and Executive Review of NOPC
-  NOPC Comment Period and Public Hearings
-  150 Days Includes Final Revisions, Board Adoption and Submission of Final Regulation to DPB
-  DPB and Executive Review of Final NOPC
-  Final Publication, AG Certification, Submission to EPA for Review and Approval, Publication of Effective Date

Appendix O

Fiscal Year 2010 Work Plan of the Academic Advisory Committee for Freshwater Nutrient Criteria.

Fiscal Year 2010 Work Plan Water Quality Academic Advisory Committee

Prepared for the

Virginia Department of Environmental Quality
Office of Water Quality Programs

Submitted by

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Project Duration: July 1, 2009 to June 1, 2010

Freshwater Nutrient Criteria for Wadeable and Non-Wadeable Streams/Rivers

Goals and Objectives

The AAC will continue to provide assistance to Virginia DEQ in developing a scientifically sound and workable approach to nutrient criteria in freshwater streams and rivers. The goal of AAC FY10 AAC activities is to continue its work on freshwater nutrient criteria for streams and rivers and build on AAC work that was initiated during FY06-FY09.

The major objective for FY10 activities is to provide assistance to the DEQ Office of Water Quality Programs for the development of freshwater nutrient criteria for Virginia's wadeable and non-wadeable freshwater streams and rivers. FY10 work plan and specific tasks to be accomplished are described below.

Work Plan

Task 1. Wadeable Streams

Proposed tasks are intended to further develop the nutrient criteria screening value approach, including the definition of screening (and critical?) values and analysis of potential effects of nutrient criteria implementation on DEQ water monitoring resources if the Screening Value approach is to be used.

- 1a. Conduct formal evaluation of DEQ Probabilistic Monitoring data to derive potential screening values for TN and TP using the method applied as an illustrative example through analysis of the 2001-06 probmon data and discussed at the March AAC-DEQ meeting.

DEQ will provide the following data: 2001-2008 probabilistic monitoring data, including stream habitat, benthic algae, and streambed stability scores; description of process and procedure used to derive streambed stability.

- 1b. Explore potential and/or develop a rationale for defining critical values for TN and TP that considers and are intended to mitigate the "downstream loading" impacts of nutrients transported by Virginia streams to nutrient-sensitive receiving waters (Chesapeake Bay, Albemarle Sound, Gulf of Mexico via Tennessee and Ohio rivers).
- 1c. Conduct an analysis of how screening (and critical?) values derived from single point-in-time

data series, such as Probmon, can be applied within a multiple-observation assessment framework, such as DEQ will be administering as it applies nutrient criteria using ambient monitoring data. An essential question to be asked is: How should the screening/critical values be defined when analyzing the ambient monitoring database (e.g., as 12, 24, or 36 month medians? Using the 10% rule?)

DEQ will provide the following data: water and biological monitoring data for all Mountain and Piedmont Ecoregion wadeable stream locations where available:

(1) Benthic macroinvertebrate assessment, and associated habitat assessment

(2) Water monitoring data for 36 months prior to the biological monitoring observation from the biological monitoring stations where 5 or more TN, and/or 5 or more TP observations are available.

(3) The water monitoring data would include water monitoring site descriptive data (lat long, ecoregion, stream name, etc.), measured nutrient concentrations, and all available parameters used by DEQ in defining “Reference Sites” in the SCI validation studies (Specific conductivity, DO, pH, % urban area [if available].)

- 1d. Conduct an analysis of how definition of screening (and critical?) values for nutrient criteria as per task 1a (and task 1b?) would be likely to affect DEQ water monitoring staff time and resources.

DEQ will provide the following data: This analysis could be conducted using the same database described in Task 1c, or it could be conducted using a more complete ambient water-monitoring data record for Mountain and Piedmont stations over a defined period – 36 months or longer.

- 1e. Optional, based on DEQ water quality standards and biological monitoring staff preferences: Continue to advise and coordinate with DEQ Biological Monitoring staff, as they further develop, streamline, and apply a visual assessment procedure to identify visually impaired sites. Such activity may include analysis of correct assessment rates for 2009 and early 2010 visual assessment activities.

Task 2. Non-Wadeable Streams

Statistically significant relationships have been documented (Garman and Shuart 2009) among TN, Chlorophyll-a, and to a lesser degree TP, and fish community-based (INSTAR) stream health metrics using an expanded database (n=35,000 records, DEQ ambient monitoring) of all Chesapeake basin watersheds (6th-order HUCs) in Virginia. Some of these relationships (e.g. Chl-a) were highly significant predictors of both healthy and degraded stream assemblages and might reasonably serve as the basis for establishing biologically valid nutrient criteria. Some of the strong associations between nutrients and

trophic status and fish community structure at watershed scales were corroborated by analysis of a much smaller database of paired, non-wadeable streams and rivers. Specifically, fish community metrics were strongly and negatively correlated with TN and Chl-a concentrations in 77 putative non-wadeable streams. Proposed tasks for FY10 are intended to further develop the nutrient criteria for non-wadeable streams:

- 2a. Explore documented differences between responses of coastal *versus* non-coastal stream fish assemblages to nutrient and trophic status to evaluate whether or not the geographic differentiation warrants separate nutrient criteria for coastal versus non-coastal streams and rivers.
- 2b. Expand the limited, existing paired database for nonwadeable streams and rivers (Garman and Shuart 2009) through additional data mining and GIS analysis and attempt to refine proposed nutrient criteria for TN and Chl-a based on this expanded coverage.
- 2c. In collaboration with AAC and DEQ, assist with the development of a formal proposal to EPA Region III for funding that could leverage ongoing fieldwork (e.g. DEQ's ProbMon Program) and develop a separate and synoptic database of nutrient and fish community metrics for validating proposed nutrient criteria for non-wadeable streams in Virginia.

Task 3. Preliminary Investigation of Class VII Waters

The objective of Task 3 is to initiate preliminary investigation regarding a way to assess DO in Class VII waters or establishing surrogates for DO in Class VII waters (swamps). Factors likely affecting DO include: temperature; reaeration; and organic matter. AAC in collaboration with DEQ will identify data needs and create an inventory of available data.

Task 4. Meetings

4a. AAC members will meet with DEQ water quality standards staff to discuss nutrient criteria development during winter or spring of 2010.

4b. AAC representative(s) will participate in meetings scheduled by DEQ to inform stakeholders of nutrient criteria development progress.

4c. AAC representative will attend the EPA Region 3 RTAG meeting if scheduled in FY10 to present the AAC's findings and recommendations on approaches for Virginia's development of nutrient criteria for freshwater rivers and streams.

Budget: \$25,000

Appendix P

A Screening-Value Approach to Nutrient Criteria Development for Freshwater Wadeable Streams in the Mountain and Piedmont Regions of Virginia: July 2008 – June 2009 Activities

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I. Introduction

Under the Clean Water Act, criteria are components of water quality standards. The U.S. Code of Federal Regulations (CFR) defines criteria as “elements of State water quality standards, expressed as constituent concentrations, levels, or narrative statements, representing a quality of water that supports a particular use. When criteria are met, water quality will generally protect the designated use” [40 CFR 131.3(b)]. The U.S. Environmental Protection Agency (EPA) requires that all states develop criteria to protect waters from impairment by nutrient enrichment using scientifically defensible approaches that consider the effects of nutrients on designated use within the stream segment being assessed (localized effects) and on receiving water bodies located further downstream (downstream-loading effects) (U.S. EPA 2000).

When present in surface water bodies at elevated concentrations, nutrients (nitrogen and phosphorus) are water pollutants. Excess nutrients cause negative effects in surface water bodies nationwide. Recent EPA reports to Congress have listed nutrients as prominent pollutants impairing freshwater rivers and streams nationwide (Table 1).

Table 1. Prevalence of nutrient impairments in assessed rivers and streams as documented by U.S. Environmental Protection Agency National Water Quality Inventory (U.S. EPA 2009).

Year	Stream Miles Assessed	Stream Miles Affected by Nutrient Impairment	Nutrient Impaired Streams (% of assessed)
1998	842,246	84,071	10.0%
2000	699,946	52,870	7.6%
2002	695,540	52,228	7.5%
2004	563,955	38,632	6.9%

This report documents activities being conducted by the Water Quality Academic Advisory Committee (AAC) to Virginia Department of Environmental Quality (DEQ) in collaboration with Virginia DEQ for the purpose of developing nutrient criteria for wadeable, freshwater rivers and streams in the Mountain and Piedmont regions of Virginia. The Mountain region of Virginia is within the following Level III Ecoregions: Central Appalachians, Ridge and Valley, and Blue Ridge. The Piedmont region of Virginia is within the following Level III Ecoregions: Northern Piedmont and Piedmont.

Background: Virginia’s Nutrient Criteria Development Process

In Virginia, all state waters are designated to support aquatic life. Virginia water quality standards define the aquatic-life designated use as “the propagation and growth of a balanced, indigenous population of aquatic life” (Virginia DEQ 2007). In accord with EPA guidance, Virginia has developed a biological-monitoring procedure to assess the suitability of freshwater rivers and streams for the aquatic-life use. Like many other state agencies, Virginia DEQ employs benthic macroinvertebrates in determining the support of the aquatic-life use (Tetra Tech, Inc. 2003; Virginia DEQ 2006).

The Virginia DEQ has requested advice from the AAC to aid in the development of nutrient criteria for freshwater rivers and streams. The AAC is recommending that nutrient criteria for freshwater wadeable streams be defined using a unique approach, termed as the “screening value approach” (AAC 2006). This approach employs a series of monitoring procedures to determine whether the amount of nutrients in a water body allows it to support the aquatic-life use (Figure 1).

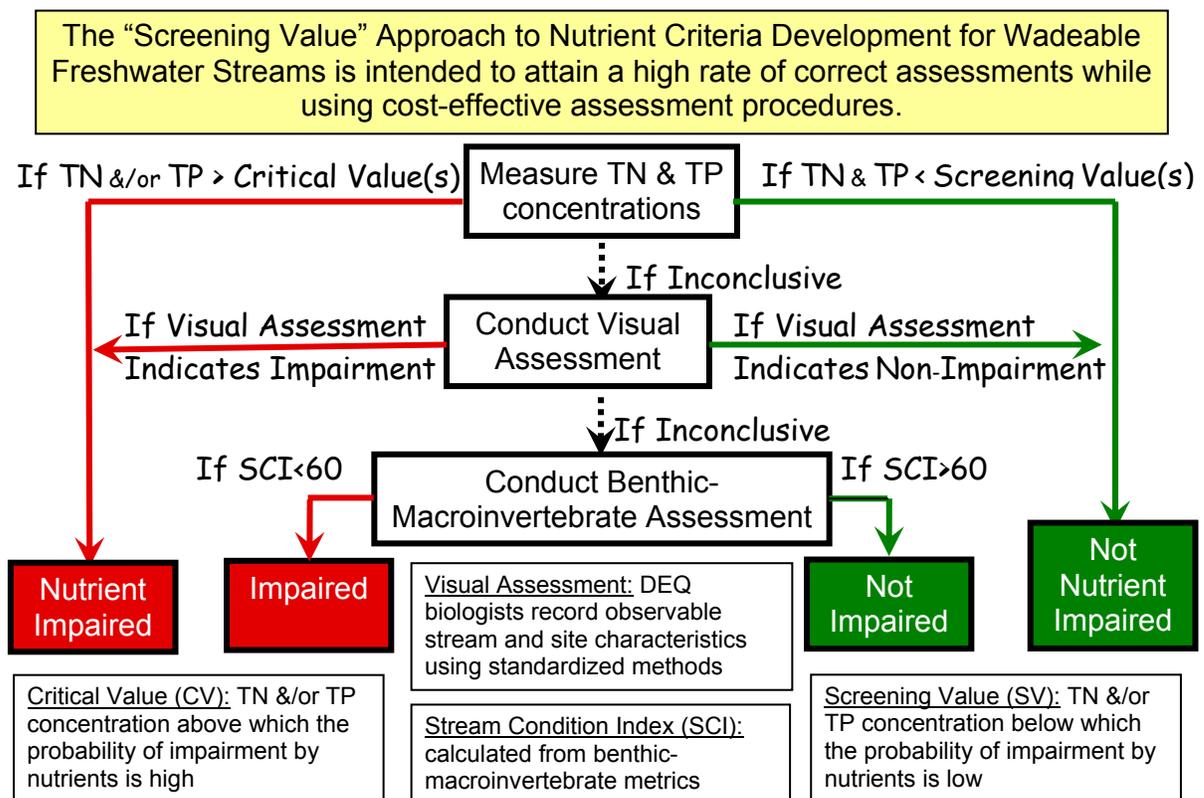


Figure 1. A proposed screening-value approach for developing nutrient criteria in Virginia’s freshwater-wadeable streams. TN = total nitrogen; TP = total phosphorus

The first stage of the screening-value approach to water-quality assessment for nutrient effects, as recommended by the AAC (2006), would employ two sets of thresholds for nitrogen (N) and phosphorus (P):

- Screening Value(s): Streams with nutrient concentrations below the screening value(s) are assessed as “not impaired by nutrients.”
- Critical Value(s): Streams with nutrient concentrations above the critical value(s) are assessed as “impaired.”

Streams that cannot be assessed using the screening or critical values would be visually assessed.

- Visual Assessment: Nutrient impairments occur due to the effects of algal and plant growth stimulated by the nutrients. A visual procedure to assess the stream for impairment by nutrients would rely on the presence or absence of visible macrophytes and algae. As proposed by the AAC, the visual assessment can have three possible outcomes: impaired by nutrients, not impaired by nutrients, or inconclusive.

If a stream’s nutrient concentrations do not allow assessment using the screening or critical values, and if the visual assessment is inconclusive, a benthic-macroinvertebrate assessment would be employed to assess the stream.

- Benthic-Macroinvertebrate Assessments: Virginia DEQ uses the assessment of the benthic-macroinvertebrate community to determine that the stream meets the aquatic-life use.

A screening-value approach is recommended as an alternative to traditional fixed-threshold criteria because nutrient effects on aquatic systems differ from the effects of traditional stressors. Whereas traditional stressors tend to exert toxic influences at the organism level, nutrient overenrichment effects are systemic (i.e., nutrients, themselves, are not generally toxic, but overenrichment of nutrients affects the stream system, such as by depleting oxygen levels, and thus causes detrimental impacts on organisms). Furthermore, unlike traditional toxic stressors, nutrients are required in surface waters to support aquatic life. Nutrients are considered a stressor in surface waters only when present in excessive amounts. Thus, variations among physical characteristics of river-and-stream systems affect those systems’ responses to nutrient enrichment. As a result, biotic responses to nutrient enrichment at specific concentration levels are highly variable among river and stream systems.

The screening-value approach is applied with the intention of limiting assessment errors despite the inherent variability of aquatic systems’ responses to nutrients. The screening-value approach has a secondary goal of achieving efficiency in the DEQ resource expenditures necessary to meet the goals of the Clean Water Act.

The AAC has been consistent in recommending that DEQ develop nutrient criteria to limit assessment errors in recognition of the costs that result from incorrect assessments (Figure 2). When streams are assessed as impaired, a TMDL study is required. Thus, when non-impaired streams are incorrectly assessed as impaired (false-positive assessment, Type I error), the resulting costs of the TMDL study utilizes resources for enforcing the Clean Water Act that could otherwise be applied elsewhere for water-quality protection. False-positive assessments can also affect investment decisions by regulated point sources discharging into that stream

segment. When impaired streams are not assessed as impaired (Type II error, false negative), costs are borne by the public in the form of lost environmental services that result from failure of that water body to support its designated uses.

		<u>Actual Condition</u>	
		Impaired	Not Impaired
Assessment Outcome:	Impaired	Correct Assessment (true positive)	Incorrect Assessment (false positive, type I error)
	Not Impaired	Incorrect Assessment, (false negative, type II error)	Correct Assessment (true negative)

Figure 2. Type I and Type II errors. The screening-value approach is being developed with the intention of limiting both Type I and Type II assessment errors.

Application of the screening-value approach requires consideration of trade-offs, given the inherent variability of streams’ responses to nutrient concentrations and the resulting uncertainty of assessment decisions based on fixed thresholds for nutrients.

When applied together, the critical and screening values define a range of nutrient concentrations (termed the “inconclusive-nutrient-concentration range”) for which additional monitoring and assessment resources must be expended for assessment (Figure 3). A conservative approach to establishing these assessment thresholds – setting the critical value at a relatively high concentration and setting the screening value at a relatively low concentration – would result in a high rate of correct assessments. Having a broad distribution of nutrient concentrations within the inconclusive-nutrient -concentration range, however, would increase the monitoring expenditures of DEQ. Given resource limitations that constrain Virginia DEQ (a taxpayer-supported public agency that operates its water-quality protection programs on funds allocated by the state legislature), an expansion of resource expenditures for water-monitoring and assessment would likely require that the agency’s other environmental protection services be reduced. The additional resource expenditures required for a visual assessment of streams that occur within the inconclusive-nutrient-concentration range would be relatively modest, but a visual assessment is expected to be adequate for only a fraction of streams in the inconclusive-nutrient-concentration range. For the remaining streams a benthic-macroinvertebrate assessment would be required. Each benthic-macroinvertebrate assessment requires on the order of one day’s investment of time by regional biologists for sampling and analysis. This level of resource expenditure is considered significant given that DEQ employs a limited number of regional biologists and that these personnel have a range of responsibilities in addition to whatever duties may result from the implementation of nutrient criteria.

The approach described above for defining critical and screening values is conservative. The implementation of a less conservative approach, one with a narrow range of inconclusive

concentrations, could be expected to reduce the agency’s monitoring expenses. The cost savings for monitoring, however, would be accompanied by an increase in the error rate of screening- and critical-value assessments. Thus, the screening-value approach embodies essential trade-offs between public benefits, which require error limitation, and water-monitoring resource expenditures.

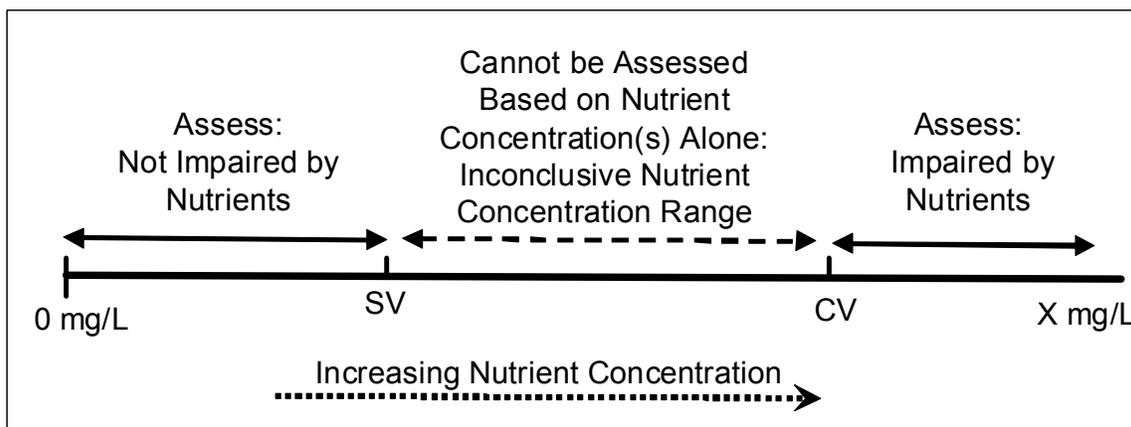


Figure 3. Graphic representation of nutrient-concentration ranges defined by the screening-value approach to nutrient criteria, as recommended by the AAC. SV = screening value; CV = critical value.

II. Pilot-Program Description and Results

Working within the context described above, the Virginia DEQ and the AAC conducted a trial run of a screening-value approach for nutrient criteria in wadeable, freshwater streams between March 2007 and June 2009. This study took place in Virginia’s Mountain and Piedmont regions (located within EPA’s Aggregate Nutrient Ecoregions XI and IX, respectively). In the text that follows, we refer to the activity as the “pilot program.”

Project Goals

The goals of the pilot program were to:

- a. Develop a visual-assessment procedure.
- b. Propose visual-assessment levels that may trigger impairment or non-impairment designations (see Figure 1), and determine the levels of uncertainty that would be associated with such designations.
- c. Propose total-nitrogen (TN) and total-phosphorus (TP) values that can serve as screening values and as critical values (see Figure 1), and determine the levels of uncertainty that would be associated with such designations.
- d. Determine the ability of the screening-value approach (Figure 1) to successfully discriminate impaired from non-impaired sites using screening- and critical-values that result with reasonable resource expenditures by DEQ.
- e. Determine the resource requirements of full-scale implementation by DEQ.

Methods

The pilot program was conducted over a time period extending from mid-2007 through mid-2009, and included site selection, development of the visual-assessment procedure, sampling, and data analysis (Figure 4).

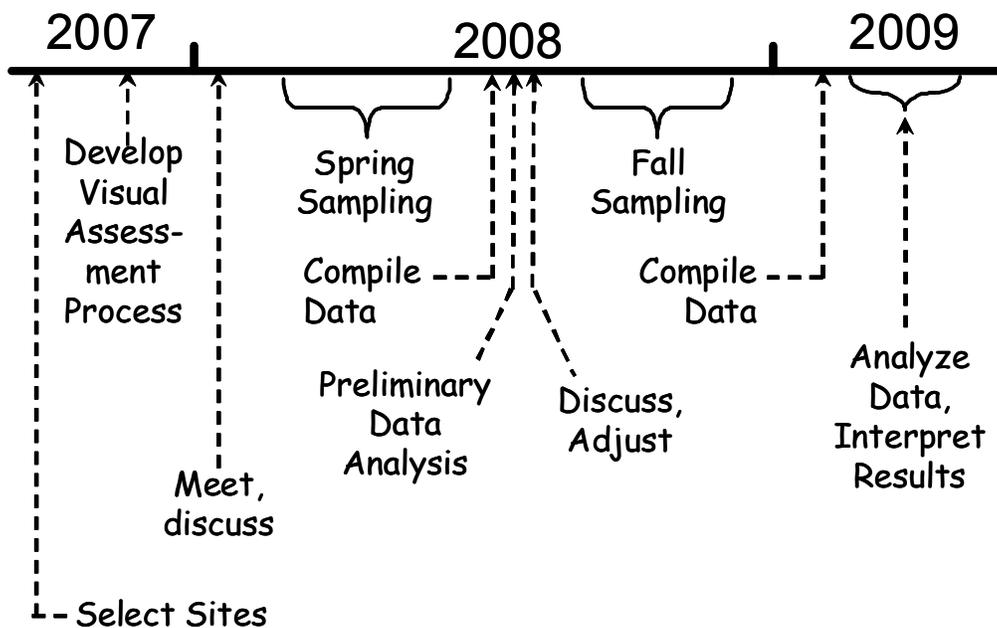


Figure 4. Pilot-program timeline for major activities.

Site Selection

Sites included in the pilot program were selected using the following method:

1. All ambient water-quality monitoring sites within Virginia's Mountain and Piedmont regions meeting either of the following two conditions were identified.
 - a.) For sites that have been in operation continuously during the previous 12 months, 5 or more TN and 5 or more TP concentrations recorded during the previous 12 months.
 - b.) For sites that have been in operation continuously only since January 2007, 3 or more TN and 3 or more TP concentrations recorded since January 2007.
2. Median TN and TP values were calculated from monitoring observations collected during the prior 12 months for each station. Using these median values, each monitoring station was placed in a TN category and a TP category (Table 2).
3. DEQ biologists in the Mountain and Piedmont regions were asked to select up to 12 monitoring stations (approximately 6 sites for sampling in the fall and 6 sites for sampling in the spring) for inclusion in the pilot program by applying the following criteria:

- a) Site is represented by recent water-quality data so it can be placed reliably within a nutrient category.
- b) Site is wadeable and suitable for benthic-macroinvertebrate sampling.
- c) Site is not known to be subject to major influence by non-nutrient stressors (urban runoff, toxics, sediments, point source discharges, etc.).
- d) Site is from the list of stations prepared by DEQ's water-monitoring data coordinator, Mr. Roger Stewart.
 - i. At least one station within each of the 6 N-concentration categories and at least one station within each of the 6 P-concentration categories are to be represented. (Note: because each station is placed in both an N-concentration category and a P-concentration category, this condition can be met with fewer than 12 sites).
 - ii. To the extent possible:
 - For the lowest N-concentration category: assure that relatively low, medium, and high P concentrations are represented; and
 - For the lowest P-concentration category: assure that relatively low, medium, and high N concentrations are represented.
- e) Sites are not clustered geographically or fluentially, and thus are distributed throughout the entire region.

Table 2. Nutrient-concentration categories used for selection of water-monitoring stations for the pilot program.

Total Nitrogen (mg/L), median	TN Category	Total Phosphorus (mg/L), median	TP Category
<0.5	1	<0.02	1
0.5 - <1.0	2	0.02 - <0.04	2
1.0 - <1.5	3	0.04 - <0.06	3
1.5 - <2.0	4	0.06 - <0.10	4
2.0 - <3.0	5	0.1 - <0.20	5
>=3.0	6	>=0.2	6

Development of a Visual-Assessment Procedure

DEQ's biologists, its water quality standards staff, and AAC member Dr. Len Smock collaborated to develop a visual-assessment procedure that can be implemented within the nutrient criteria framework (see Figure 1). The developed visual-assessment field forms are attached to this report as Appendix A (used during Spring 2008) and Appendix B (used during Fall 2008). Site attributes relevant to the potential nutrient effects, such as amount of shading (full shade, partial shade, full sun), estimated surface stream velocity (slow, moderate, fast), stream substrate (sand, gravel, cobble), stream depth and width were included on the field survey forms. The visual-assessment procedure also included a qualitative assessment by the regional biologist regarding whether or not the site is impaired by nutrients.

The visual-assessment procedure was designed to produce numeric results that are both reproducible and independent of the individual who is applying the method. Visual-assessment

components included factors such as an estimated percentage of the visible stream bottom covered with algae or macrophytes, estimated percentage of some number of rocks removed randomly from the stream bottom that are covered with algae, and the type and amount of algae present. The biologists were asked to rate each site by nature and type of algae present. Algal types that were rated included combinations of color (bright green, dark green, brown, and black) and form (film, thin mat, thick mat, short filamentous, and tall filamentous). The types listed above are for the fall rating; a similar but less inclusive set of algal color and form combinations was used for the spring rating. Biologists were asked to rate each site for presence of algal color/form combinations using a scale of 1-10%, 10-40%, 40-70%, and 70-100% coverage categories. We used these ratings to construct the Algal Index for each site by summing the algal color/form combinations that biologists described as being present, weighting each by visually estimated stream bottom coverage on a scale of 1 – 3 – 6 – 10 for the 4 categories; this constructed measure was called the “Algal Index 13610” or “Algal Index” for short.

Development of the Quality Assurance Project Plan (QAPP)

In collaboration with the AAC, DEQ developed a QAPP, which was submitted to EPA in association with an EPA grant application.

Initiation of Pilot-Program Activities

The initial schedule called for DEQ biologists to begin sampling in Fall 2007. However, administrative procedures associated with the EPA grant application had not yet been completed by that date so the initial sampling was delayed until Spring 2008. Excessively wet weather in some parts of the state, combined with the study design, which required sampling during baseflow and avoidance of sampling during time periods following scouring rains, interfered with the spring sampling. As a result, some of the sites scheduled for spring sampling were not sampled.

Trial Application Round I: Spring 2008

DEQ biologists conducted a visual assessment, a benthic-macroinvertebrate assessment, and a habitat assessment at approximately half of the sites selected for study implementation in Spring 2008. All sampling was conducted according to established DEQ protocols as detailed in DEQ Standard Operating Procedures (SOP) manuals and the QAPP prepared in association with this project. Sampling was conducted during baseflow conditions so as to be consistent with DEQ probabilistic-monitoring protocols and to assure lack of algal scouring effects. In addition, sampling took place 14 or more days after the last rain event judged by regional biologists to have caused an algal scouring effect. Benthic-macroinvertebrate sampling results were transformed to a Stream Condition Index score using DEQ standard procedures (Tetra Tech, Inc. 2003).

In-situ water-quality measures were recorded for each sampling site:

- Temperature – In-Situ, YSI or Hydro-Lab multi-probe meter (calibrated with NIST thermometer in lab).

- pH – In-Situ, YSI or Hydro-Lab multi-probe meters (calibrated and post-confirmed checked each field day, using commercially available standards)
- Dissolved oxygen – In-Situ, YSI or Hydro-Lab meter (pre-calibrated and post-confirmed each field day, using (100% RH) air standard)
- Conductivity – In-Situ, YSI or Hydro-Lab meter (calibrated and post-confirmed each field day, using commercially available standards).

In addition to these field measures, water samples were taken as point samples using standard DEQ protocols. Nutrient variables analyzed include nitrate-N ($\text{NO}_3\text{-N}$), nitrite-N ($\text{NO}_2\text{-N}$), total kjeldahl N (TKN), TN, and TP; all are expressed as mg/L as N or P. Other variables measured included suspended solids (Storet 530 – non-filterable residue) and total residue (Storet 500).

Benthic algae (periphyton) were sampled to estimate periphytic biomass. Algal biomass was scraped from 3 randomly selected rocks, and the scraped area was estimated via a tracing. The biomass samples were processed to determine chlorophyll-a (Chl-a) and ash-free dry mass (AFDM) by the Virginia Division of Consolidated Laboratory Services (DCLS) following Standard Methods (APHA 1992) for algal-biomass estimates.

Mid-Course Program Review

Data from the spring 2008 sampling was assembled and made available to the AAC and to interested parties within DEQ for analysis during the summer of 2008. First-round results were discussed with biologists on a conference call. As a result of this call, several program adjustments were made. The visual-assessment field form was modified (see Appendix B), and several regional biologists decided to move the initially selected sampling stations as needed to better achieve study goals.

Trial Application Round II: Fall 2008

The trial application protocol, as described above for Spring 2008, was repeated in the fall at the remaining sites, with minor modifications as per the mid-course program review.

Data Analysis and Interpretation: Early 2009

Data were analyzed using JMP statistical software (SAS Institute, Cary NC), using a variety of statistical procedures including one-way analysis of variance (ANOVA) and linear regression. Most variables were not normally distributed, the primary exception being Stream Condition Index (SCI). When a log transformation was able to transform a non-normally distributed variable to a normal or near-normal distribution, the log-transformed variable was used in data analysis. Otherwise, statistical analysis was performed using non-parametric procedures applied to the ranks.

Preliminary data analysis was completed in March, 2009. Results were presented and discussed at a meeting of the AAC with Virginia DEQ staff in Charlottesville on March 18, 2009.

Results: Study Process

Selection of Sites

The goal of the site selection process (described in the Methods section) was to assure that high nutrient concentrations and variable N and P concentration ranges were represented. Past studies had revealed that TN and TP concentrations in Virginia freshwater streams are correlated, and that the distributions of these nutrient concentrations are skewed.

Table 3 shows the distribution of 69 sites among nutrient categories as initially selected (upper table). However, when sampled, some sites had concentrations that differed from the expected concentration. The distribution of the 62 sites actually sampled is provided in Table 3 (lower table). The location of each monitoring site in the pilot program, the DEQ regional office conducting the monitoring, and the season in which monitoring occurred are represented in Figure 5.

Table 3. Distribution of stations among TN and TP categories as initially selected (upper table) and as actually measured during the pilot program (lower table).

		TP						
		1	2	3	4	5	6	All
(mg/L)		<0.02	0.02 - <0.04	0.04 - <0.06	0.06 - <0.10	0.1 - <0.20	>=0.2	
TN	1 <0.5	6	8	4	1	2	-	21
	2 0.5 - <1.0	1	4	4	4	3	-	16
	3 1.0 - <1.5	2	2	3	2	-	-	9
	4 1.5 - <2.0	-	2	2	1	3	1	9
	5 2.0 - <3.0	1	2	1	2	2	1	9
	6 >=3.0	-	-	1	3	-	1	5
	All	10	18	15	13	10	3	69

		TP						
		1	2	3	4	5	6	All
(mg/L)		<0.02	0.02 - <0.04	0.04 - <0.06	0.06 - <0.10	0.1 - <0.20	>=0.2	
TN	1 <0.5	5	12	4	1	2	-	24
	2 0.5 - <1.0	-	7	4	2	2	-	15
	3 1.0 - <1.5	-	1	3	3	1	-	8
	4 1.5 - <2.0	-	1	3		1	1	6
	5 2.0 - <3.0	-	-	1	1	-	2	4
	6 >=3.0	-	2	-	-	-	3	5
	All	5	23	15	7	6	6	62

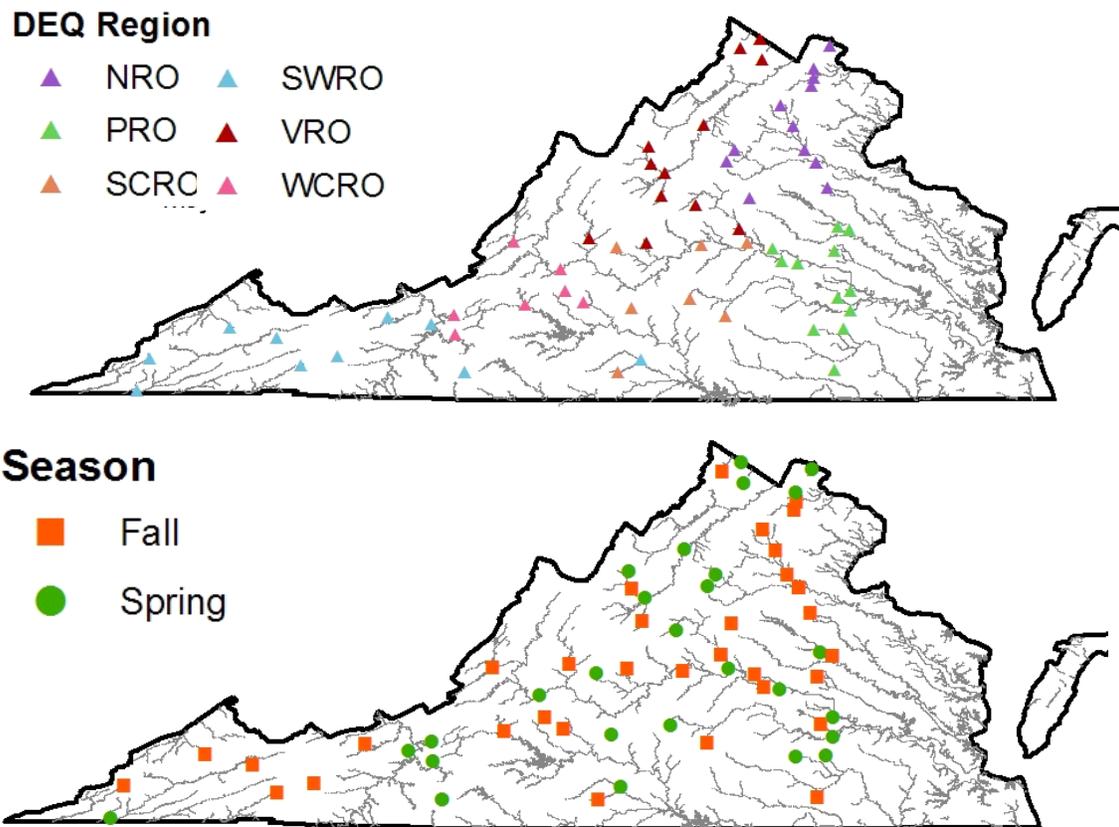


Figure 5. The 62 sites monitored and sampled by DEQ biologists during the pilot-program activity, by DEQ region and by season. NRO = Northern Regional Office; PRO = Piedmont Regional Office; SCRO = South Central Regional Office; SWRO = South West Regional Office; VRO = Valley Regional Office; and WCRO = West Central Regional Office.

Sampling

Data from 29 sites were obtained in the spring, and data from 33 sites were obtained in the fall. Benthic-macroinvertebrate assessments were replicated at one site sampled in spring and three sites sampled in fall. Impairment status (i.e., whether or not SCI < 60) for replicate samples did not differ from the primary sample, so only primary sample results are used in the following analysis. Minor adjustments were made in the visual-assessment form after the spring sampling, as several new assessment procedures were added in response to the spring experience. Sites were selected for inclusion in the study based on previously measured TN and TP concentrations, with the intention of ensuring sufficient representation of high-nutrient streams to allow characterization of the high-nutrient effects that are of primary interest in this study. Basic data from streams included in the study are described in Table 4.

Table 4. Summary statistics for the 62 water-monitoring sites sampled and characterized through the pilot program.^a

Parameter	SCI<60 ^b	SCI>60	All
Number of Observations	36	26	62
TN (median, mg/L)	0.85*	0.47	0.61
NO ₃ -N (median, mg/L)	0.54*	0.10	0.25
TKN (median, mg/L)	0.4	0.4	0.4
TP (median, mg/L)	0.045	0.03	0.04
Benthic Algae: Ash-free dry mass (AFDM, median, mg/m ²)	20.8	16.6	17.6
Benthic Algae: Chlorophyll-a (Chl-a, median, mg/m ²)	56.8	27.0	39.5
SCI (mean)	47.5	68.3	57.3

^a For replicated sites, only the first replication was used to calculate summary statistics.

^b SCI = 60 is the impairment threshold. When SCI<60, DEQ considers the site to be impaired for the aquatic-life use.

* = significantly different ($P < 0.05$, one way ANOVA using ranks) vs. SCI > 60 sites. Other water-quality and benthic-algae measures are not significantly different.

Results: Data Analysis

Biochemical Relationships

In general, the biochemical relationships occurred as expected: high-nutrient concentrations, high algae/plant densities, and low SCI scores were all correlated. However, those relationships, although often statistically significant and sometimes highly significant, did not provide a basis for development of predictive models. High variance and low coefficients of determination, R^2 , prevented the development of models with the potential for precise application.

Generally speaking, relationships with benthic algae and SCI are stronger for N than for P and are stronger for TN than for either of the two major TN components (TKN, NO₃-N). Influences of TN, NO₃-N, and TKN concentrations on the Stream Condition Index (SCI) are all negative and statistically significant ($P < 0.05$). Of the three major nitrogen measures, TN exhibits the strongest relationship ($P = 0.0002$; see Figure 6), but NO₃-N exhibited a stronger relationship ($P = 0.0031$) than did TKN ($P = 0.03$). The relationship of measured TP values with SCI was not statistically significant. Both measures of benthic algae (AFDM and Chl-a) appeared to influence SCI, with higher benthic-algae levels associated with lower SCI scores, but the relationships were weak (Figure 7).

Benthic-algae biomass increased with measured nutrient concentrations. Generally speaking, these relationships were stronger for TN than for TP, and stronger for Chl-a than for AFDM (Figure 8). Only the TN relationships were statistically significant. Of the two major nitrogen components: NO₃-N exhibited stronger relationships with benthic-algal biomass, especially Chl-a, than did TKN.

Generally speaking, nitrogen exhibited the expected biochemical relationships (i.e., positive relationship with benthic-algal biomass, negative relationship with SCI) more strongly than did TP. This is as expected given that the majority of P in most Virginia streams is generally

considered to originate from non-point sources and that the streams were sampled under baseflow conditions. Non-point-source P tends to be associated with sediments, the movement of which tends to vary closely with streamflow. Thus, the sampling conditions were not conducive to detection of sediment-associated P movement. TN tended to exhibit stronger biochemical relationships than either $\text{NO}_3\text{-N}$ or TKN but not consistently. The $\text{NO}_3\text{-N}$ data exhibited consistently stronger biochemical relationships than did TKN, which supports our interpretation of streamflow conditions as a factor that influenced results. Because NO_3 occurs only in water-soluble forms, it is easily transported through groundwater systems to the stream under baseflow conditions. In contrast, some TKN components occur as solid-phase forms whose movement tends to be more flow dependent.

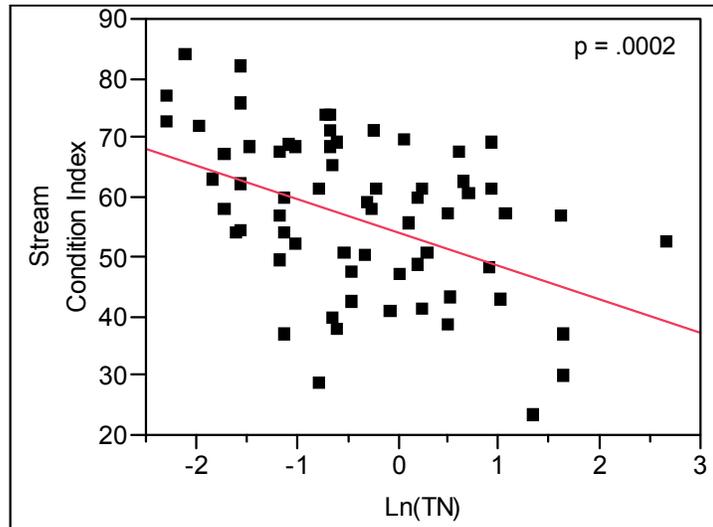


Figure 6. Linear regression of Log-transformed TN (mg/L) vs. Stream Condition Index (SCI) ($R^2 = 0.21$). The relationship was highly significant ($p = 0.0002$).

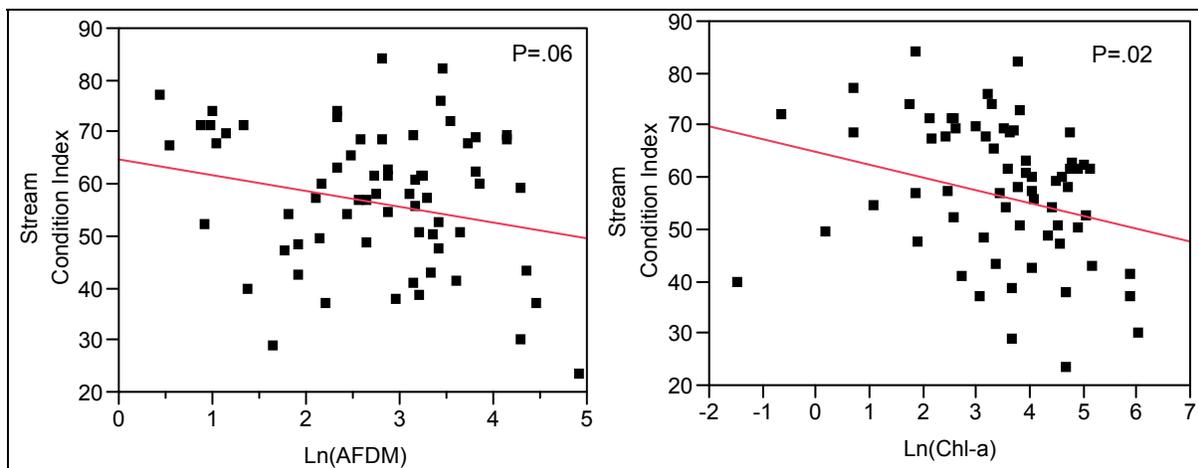


Figure 7. Linear regression of two measures of benthic-algae biomass – ash-free dry mass (AFDM, g/m^2) and Chlorophyll-a (Chl-a, mg/m^2), both log-transformed – against SCI. The R^2 is 0.06 for the Ln(AFDM) relationship (left), and 0.08 for Ln (Chl-a) (right).

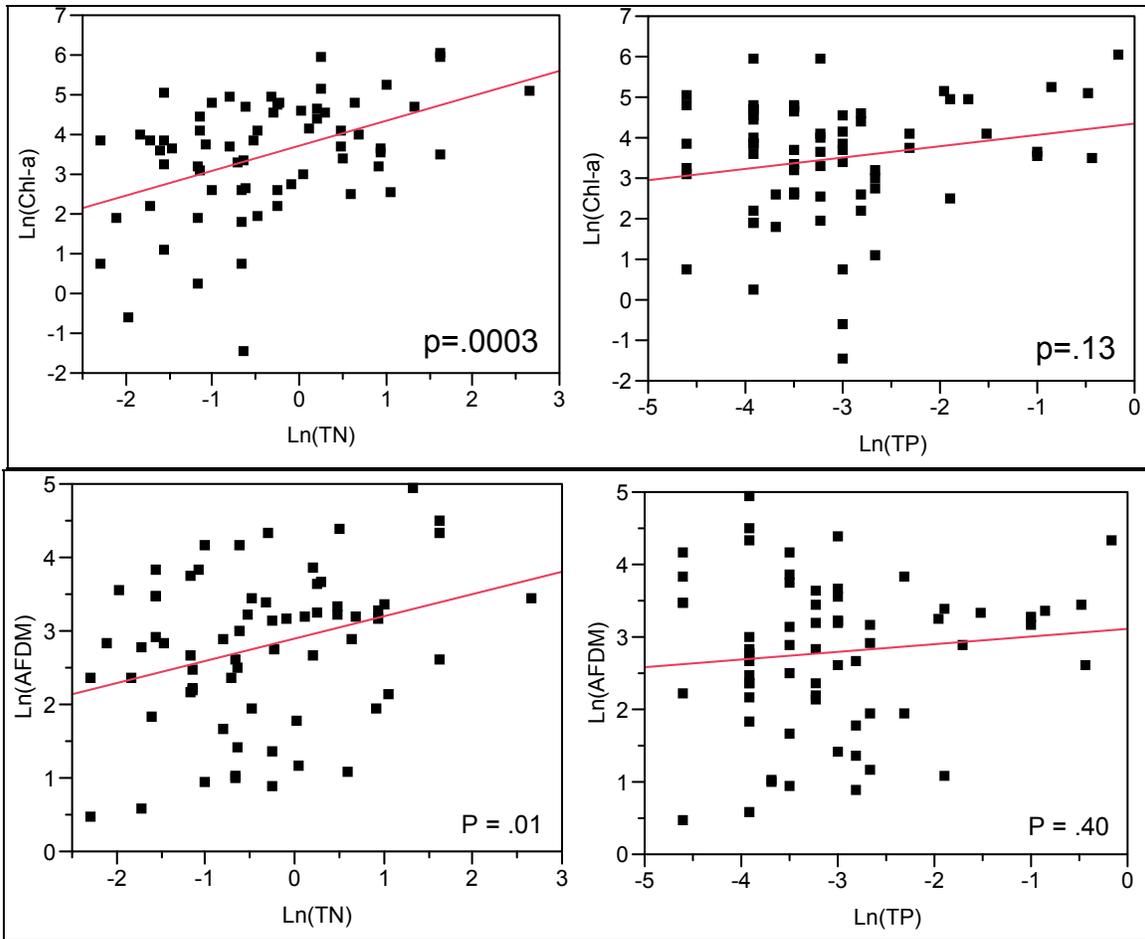


Figure 8. Linear regressions of Log-transformed TN (mg/L) and TP (mg/L) against benthic-algae biomass, expressed as Chlorophyll-a (Chl-a, mg/m^2), log-transformed (above); and ash dry mass (AFDM, g/m^2), log-transformed (below). R^2 values for these relationships are 0.19 (upper left), 0.04 (upper right), 0.11 (lower left), and 0.01 (lower right).

Visual Assessments

The visual-assessment procedure required biologists to rate sites for the probability of impairment by *nutrients* during both spring and fall, and to rate sites for a probability of impairment due to *any cause* during fall only.

Sites identified by biologists as having a high probability of being nutrient impaired based on the visual assessment usually were impaired for aquatic life according to the SCI score ($\text{SCI} < 60$) (Of 7 sites rated as high probability for nutrient impairment based on the visual assessment, 6 had $\text{SCI} < 60$) (Table 5). The visual assessments were not as successful at the other end of the spectrum. A number of the sites identified as having a low probability of nutrient impairment based on the visual assessment were identified as impaired according to the SCI (15 sites listed as impaired according to the SCI were among the 31 sites rated as low probability of nutrient impairment based on the visual assessment). Nutrient effects were visually evident at one site rated as non-impaired based on the SCI score. This site had 40-70% of the stream

bottom covered by algae (predominantly tall filamentous algae) and plants and thus given a high probability of being impaired according to the visual assessment.

Table 5. Impairment status of sites monitored in 2008 as part of the pilot program compared to the rating categories assigned by DEQ biologists.

	Impairment Probability Rating			Total
	Low	Medium	High	
<i>Spring: Nutrient Stressors Only</i>				
Not Impaired (SCI > 60)	8	4	0	12
Impaired (SCI < 60)	8	6	3	17
<i>Fall: Nutrient Stressors Only</i>				
Not Impaired (SCI > 60)	8	5	1	14
Impaired (SCI < 60)	7	9	3	19

One reason for the difficulty in defining sites as “non-impaired for nutrients” based on a visual assessment in comparison to the SCI score is that, most possibly, non-nutrient stressors were also acting at a number of sites. Comments cited by the biologists on the data forms indicated that sediments were by far the most common non-nutrient stressor. The non-nutrient factors may have influenced the SCI score but not the visual assessment, which was based on the visual presence of plants and algae.

The biologists' visual assessments of algae presence tended to agree with in-stream measurements but with high variance. AFDM corresponded more closely with biologists' visual assessments of stream-bottom coverage by algae ($P = 0.005$; Figure 9 left) than did Chl-a (not significant). The Algal Index exhibited a negative relationship with Stream Condition Index, but the relationship was weak ($P = 0.09$; Figure 9 right).

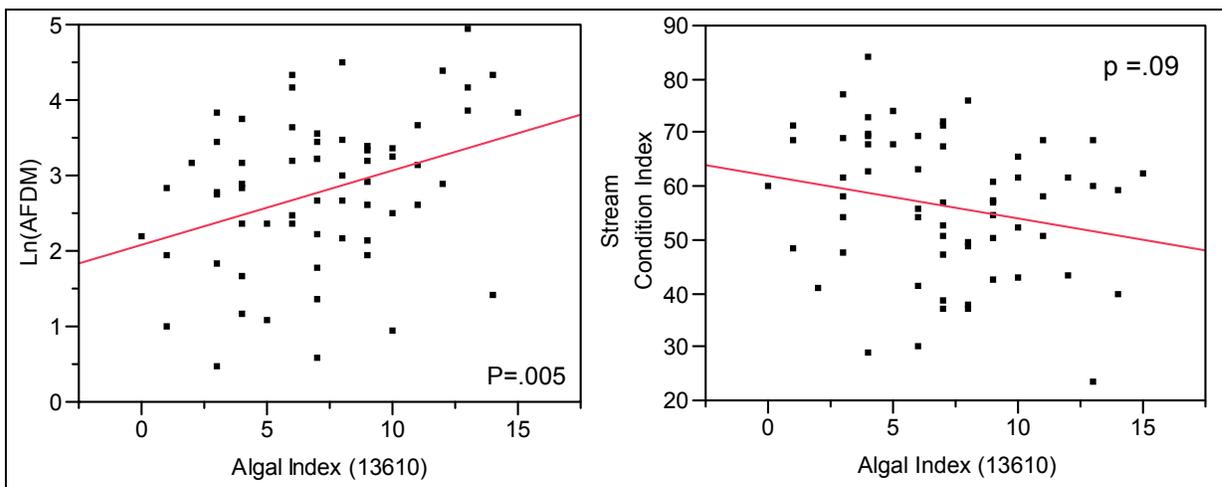


Figure 9. Relationship of Algal Index to log-transformed AFDM (g/m^2) (left) and Stream Condition Index (right). R^2 values for these relationships are 0.12 (left) and 0.05 (right).

In the fall only, regional biologists visually rated each stream for total stream bottom coverage by algae and vascular plants. The biologists' best professional judgment (BPJ) of whether or not the stream was impaired by nutrients was strongly influenced by their perceptions of algae and vascular plant presence (Table 6). The biologists' ratings of 70-100% coverage corresponded with higher levels of algal biomass (Figure 10), measured both as Chl-a and AFDM, although these results were not statistically significant. However, the visual measurement of total stream bottom coverage is meant to include both plants and algae, whereas AFDM and Chl-a are measures of benthic algae only. This difference in what is being measured adds a confounding element to this analysis. Thus, it is not surprising that the biologists' estimates did not correspond more closely with the AFDM and Chl-a values.

Table 6. Relationship of regional biologists' best professional judgment of nutrient impairment by visually estimated stream bottom coverage by plants and algae.

<i>Stream Bottom Coverage</i>	Best Professional Judgment Nutrient Impairment Probability Rating			
	Low	Medium	High	Total
A: 0 – 10%	3	0	0	3
B: 10 – 40%	5	1	0	6
C: 40 – 70%	2	5	1	8
D: 70 – 100%	4	8	3	15
Total	14	14	4	32

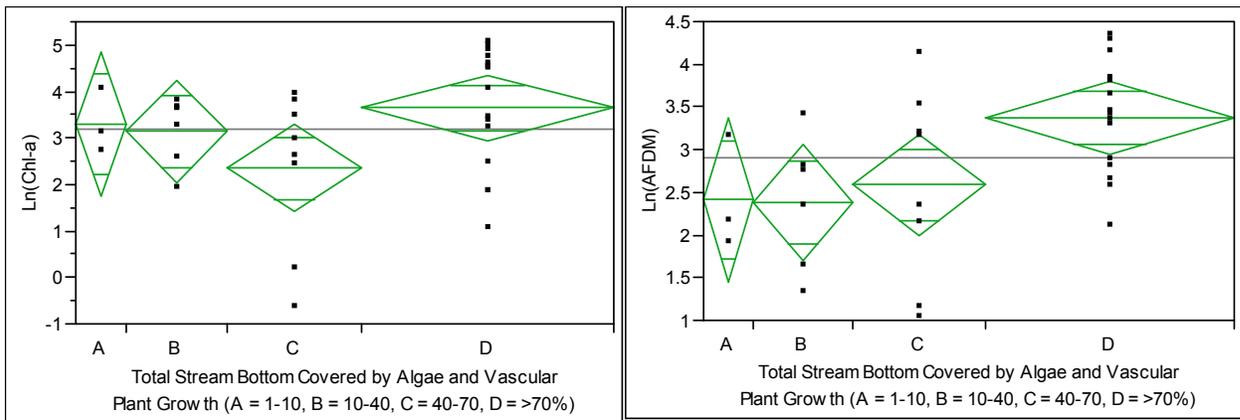


Figure 10. Correspondence of biologists' ratings of stream bottom coverage by plants and algae with measured benthic-algae levels. These results were not statistically significant.

The total stream bottom coverage visually assessed (in Fall 2008 only) by estimating algae and vascular plant growth showed no statistically significant relationship with SCI and did not confirm the expected trends. Of the 4 stream-bottom coverage categories (<10%, 10-40%, 40-70%, and >70%), the <10% category showed the highest proportion of SCI-determined

impairments (3 of 3). The 40-70% category showed the lowest proportion of SCI-determined stream impairments (2 of 8) (Figure 11). Eleven (11) of the 15 streams with >70% stream bottom coverage were considered impaired (SCI<60), but the two highest SCI's among fall-sampled streams were also within this (>70%) visual-assessment category.

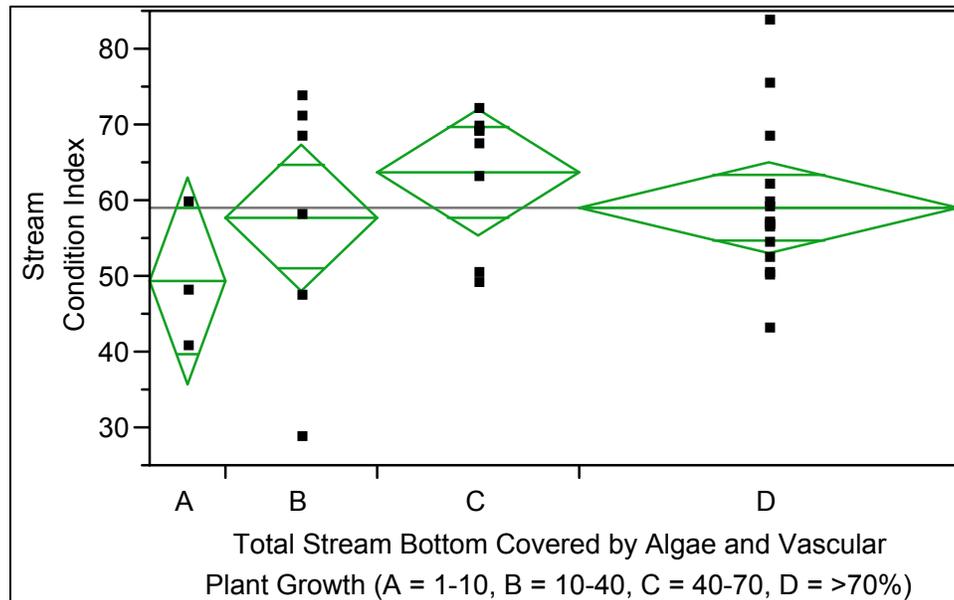


Figure 11. Relationship of Stream Condition Index to biologists' visual ratings of total stream bottom coverage by algae and plants.

Potential Critical Values and Screening Values

“Critical values” and “screening values” are defined in the study plan as in-stream concentrations that allow the stream to be assessed for nutrient impairment. Critical values can be relatively high concentrations that allow sites to be identified as “nutrient impaired,” while screening values are relatively low concentrations that allow sites to be identified as “not nutrient impaired.” Screening values were not evident from this data set, possibly because the data set does not allow discrimination of nutrient from non-nutrient impairment. High-end critical values (i.e., values above which all sites had SCI<60) were evident (Table 7).

Table 7. Potential critical values suggested by the results of the pilot program.

Parameter	Critical Value (CV)	# sites > CV*
Benthic-Algae Chl-a	170 mg/m ²	4
Benthic-Algae AFDM	70 g/m ²	5
TN	2.6 mg/L	6
NO ₃ -N	2.3 mg/L	6
TKN	0.9 mg/L	4
TP	0.4 mg/L	4
TN, TP, NO ₃ , TKN (WQ)	Combined	10
WQ + Benthic Algae	Combined	13
Best Professional Judgment (BPJ)	High (nutrients only)	7 (6 SCI < 60)
WQ + BPJ	Combined	13
WQ + Benthic Algae + BPJ	Combined	14

* Out of 62 total sites and 36 impaired (SCI<60) sites in pilot program. At 32 sites, SCI<57.5; of the 4 remaining sites (“borderline impaired”), 1 was caught by the AFDM screen but none were caught by the WQ or BPJ screens.

Discussion

Potential applications of pilot-program results to DEQ’s overall monitoring program must be considered in light of the characteristics of the sites selected and included in the program: sites were selected to include a higher proportion of high-nutrient sites than occurs generally within the population of monitoring sites in DEQ’s program. The relatively high-nutrient levels at the pilot-program sites were a deliberate result of the site-selection process.

Another essential characteristic of the pilot-program data set is that both nutrient and non-nutrient stressors were affecting aquatic resources. Although the study design was intended to isolate nutrient effects by focusing efforts on sites where non-nutrient stressor effects were not evident, this goal was not met despite the best efforts of regional biologists in selecting sites. Sediments were identified as a non-nutrient stressors at 37% of the sites included in the program (Table 8), but 37% should be considered as a lower-bound estimate of the sites where sediments had an effect. Only the field form for the fall visual assessment requested information on non-nutrient stressors. Sedimentation is ubiquitous as a water pollutant in human-inhabited landscapes. Nutrient pollution is often associated with sedimentation, particularly phosphorus because it binds to soil particles.

Table 8. Sites where sediments were cited as a non-nutrient stressor by the regional biologists in comments on the visual-assessment forms.^a

	Sites where sediments cited as an influential non-nutrient stressor	Total sites	% of total sites where sediments were cited.
Spring	5	29	17%
Fall	17	33	52%
Total	23	62	37%

^a Non-nutrient stressor effects were addressed specifically by the visual-assessment data form during fall only. In spring, sediment effects were noted as general comments.

The pilot-program results indicate that the visual-assessment procedure has the potential for successful identification of some nutrient-impaired sites. Regional biologists were able to successfully identify some sites that were impaired (according to the SCI score) using the visual assessment process. Of the 62 sites included within the study, regional biologists identified seven has having a high probability of being nutrient impaired using the visual assessment; six of these sites were found to have SCI scores of less than 60, indicating impairment. However, regional biologists were not able to classify all sites identified as impaired according to the SCI score by using the visual assessment; of the 36 sites with SCI scores of less than 60, regional biologists visually identified 16% (six) as nutrient impaired.

The pilot-program results provide no indication that a visual assessment will be an adequate mechanism for assessing monitoring sites as “not impaired by nutrients.” Of the 31 sites identified by regional biologists through the visual assessment as having a low probability of being nutrient impaired, 15 were found to have SCI scores of <60, indicating biotic impairment (see Table 5). It may be that the biologists’ success in identifying sites not impaired by nutrients was actually greater than these figures indicate, but these results provide no basis for determining whether impaired sites were primarily affected by nutrients or by non-nutrient stressors.

The pilot program proved to be inadequate as a mechanism for identifying screening values or critical values. Possibly because of the widespread presence of non-nutrient stressor effects (including sediments), no potential screening values were evident. Some impaired sites (SCI<60) had relatively low nutrient concentrations. From a scientific standpoint, the most robust critical values would appear to be TN and TP, since allocation of water-quality N among the TKN and oxidized N forms in Virginia is both seasonally and regionally dependent (Zipper and Holtzman, unpublished). At the upper end of the concentration ranges, nutrient thresholds with a potential to serve as a critical variable were evident (2.6 mg/L TN, 0.4 mg/L TP) (Table 7). However, the TN threshold is very high, relative to the distribution of TN concentrations in Virginia streams and thus would provide little benefit if implemented as a critical value (Figure 12). At first glance, the combination of water-quality data with benthic-algae measurements appears to offer potential; however, benthic-algal biomass is not measured routinely at Virginia DEQ ambient-monitoring sites.

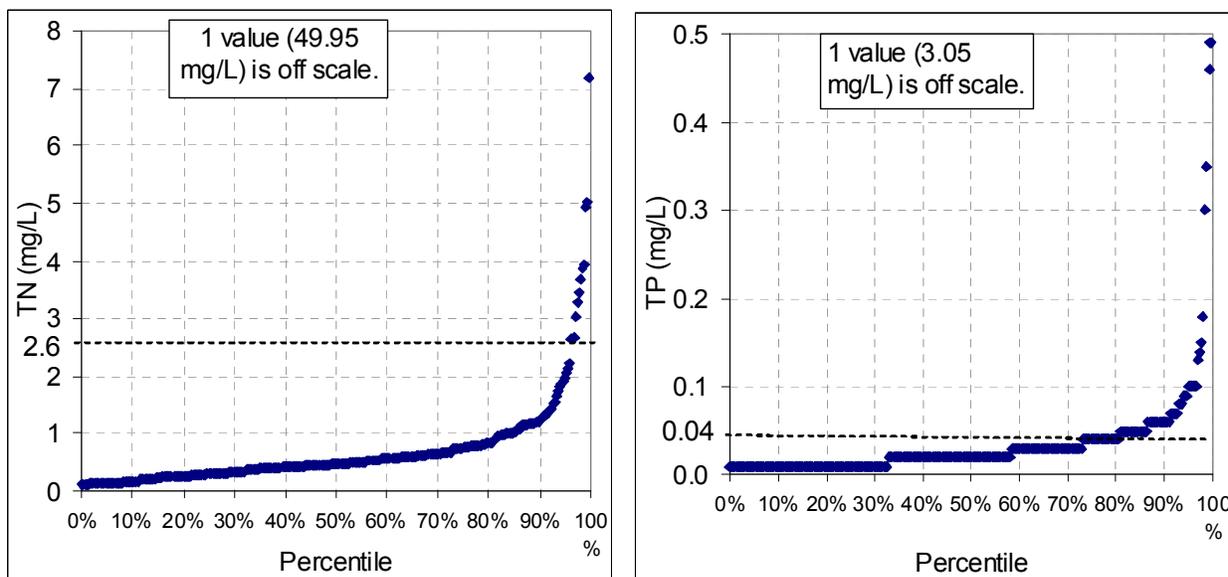


Figure 12. Distributions of TN and TP concentrations at Virginia DEQ probabilistic-monitoring sites in the Mountain and Piedmont regions of Virginia where the freshwater nutrient criteria for rivers and streams that are the focus of this report potentially could be applied. The potential critical values suggested by these results are 2.6 mg/L TN and 0.04 mg/L TP.

Conclusions

Using the visual-assessment procedures, regional biologists were able to successfully identify a subset of sites determined to be impaired ($SCI < 60$). However, efforts to visually identify non-impaired sites were not as successful; a number of the sites identified in the visual assessment as not impaired by nutrients had SCI scores of less than 60, indicating impairment of the benthic-macroinvertebrate community. Although it is possible that many or most of these non-visually evident, but nonetheless, impaired sites were impaired by non-nutrient stressors, the study design did not allow discrimination of impairment sources. Based on this result, we conclude that identification of nutrient-impaired sites has a potential for successful application within a nutrient-criteria program that incorporates a screening-value approach. However, these results do not support the AAC recommendation that a visual-assessment approach be applied to assess sites as non-impaired by nutrients.

Results of the pilot program do not appear as a useful means for identifying nutrient concentrations that can act as critical and screening values. Possibly because non-nutrient stressor effects were evident at a number of the sites selected for study, no potential screening values were evident from these results. Although potential critical values were evident, those suggested by these results are high, relative to the distribution of nutrient concentrations that occur in Virginia streams, especially for TN. A more useful approach in the development of potential critical and screening values would be to analyze water-monitoring data sets that are more representative of the conditions of freshwater rivers and streams in Virginia's Mountain and Piedmont regions. Such an approach could include the probabilistic-monitoring data and a

subset of the ambient-monitoring program sites for which biological-monitoring data are also available.

The pilot-program activity failed to provide the level of support for the screening-value approach to nutrient-criteria development that was anticipated, but the results provided no evidence to suggest that such a program would not be workable. The visual-assessment procedure offers potential to serve as a valid and valuable component of such a program. However, a more in-depth analysis of monitoring data from Virginia's Mountain and Piedmont regions will be required to define and evaluate potential critical values and screening values. Analysis is also needed to evaluate the effect of nutrient criteria developed from the screening-value approach on Virginia DEQ's monitoring resources.

III. Development and Application of Screening and Critical Values: Exploratory Analysis

The AAC's recommended approach to nutrient-criteria development involves the use of critical values and screening values. Nutrient concentrations greater than the set critical values would be defined as "nutrient impaired," while those concentrations less than the screening values would be defined as "not nutrient impaired." Nutrient concentrations in between the critical values and screening values would be assessed using a visual assessment. If the visual-assessment results are not definitive, a benthic-macroinvertebrate assessment would be conducted (see Figure 1).

As a means of illustrating the screening-value approach, we provide the following example. Critical values and screening values in the example are advanced for the purpose of illustrating a possible method for deriving these values from existing data sets. They are intended to stimulate discussion and, as such, should not be considered as actual, suggested, or likely values.

1. Deriving Illustrative Critical Values using a Variant of Paul and McDonald's Conditional-Probability Approach

Using DEQ probabilistic-monitoring (ProbMon) data (2001-2006) for the Mountain and Piedmont regions of Virginia, TN, TP, NO₃-N, and TKN were plotted using a [Prob_{SCI<60}: X>X₀] framework derived from Paul and McDonald (2005). This approach is based on the increasing probability that SCI will be <60 as the nutrient concentration increases. For any given concentration, the probability of impairment at that and higher concentrations is calculated as the ratio of impaired sites to total sites within the range of concentrations extending from the given concentration to the maximum. In the graphics that follow, the probability functions, represented as "Prob SCI<60," are overlaid on plots of SCI vs. TN in Figure 13a and SCI vs. TP in Figure 13b.

Unlike Paul and McDonald, we included only the threshold concentration for P_{SCI<60}=100% (i.e., the lowest concentration at which Prob_{SCI<60}=100%) in the data points used to draw a probability trend line (not represented in the figure). Our reasoning is that the nutrient concentrations above the 100% threshold should not influence the general form of a probability

function that is intended to represent biological condition. Furthermore, our goal is to derive critical values, not numeric criteria.

Plotting a line through the “Prob SCI<60” data points on the TN and TP charts (and including only the lowest concentration for which $\text{Prob}_{\text{SCI}<60} = 100\%$) yielded functions that were used to estimate the illustrative critical values (CVs). For this example and for the purpose of discussion, we selected the 90%-probability TN and TP levels as illustrative critical values. The 90%-probability level was selected considering the overall goals of the AAC approach, which seeks to optimize the trade-off between assessment errors and DEQ resource expenditures for conducting benthic-macroinvertebrate assessments. It would also be possible to select CVs at higher or lower probability levels. Table 9 lists the CVs obtained by this method for TN and TP concentrations that indicate a 90% probability of SCI<60.

It would also be possible to derive comparable values for TKN and $\text{NO}_3\text{-N}$. We have not done so for two reasons (a) the illustrative CV that results from a trial application of that operation for $\text{NO}_3\text{-N}$ was greater than the comparable value for TN, and (b) prior investigations revealed that the distribution of TN between TKN and oxidized forms is seasonally and regionally influenced.

The illustrative CVs in Table 9 were applied independently, i.e., if TN or TP exceeded the corresponding CV, the site was defined as “nutrient impaired.” Applying the illustrative CVs to the ProbMon data set revealed that 12 of 15 sites (or 80%) with TN concentrations above the critical value ($> 1.8 \text{ mg/L}$), assessed as nutrient impaired, were also determined to be impaired according to the SCI score (Table 10). Eight sites were identified as impaired for having TP concentrations above the critical value ($> 0.1 \text{ mg/L}$), and all eight sites (100%) were also considered impaired based on the SCI. The combined application of the two CVs yielded an 81% (13 of 16) correct assessment level in comparison to the SCI score. These assessment levels are less than the targeted 90% because the illustrative CV’s were derived from trend lines, not the individual data points. If the two illustrative CVs had been applied in combination (i.e., if an impairment assessment were to require that both conditions be satisfied), eight monitoring locations would have been assessed as impaired. This example is provided for discussion purposes, recognizing that a superior test would have been to apply the illustrative CVs to an independent data set.

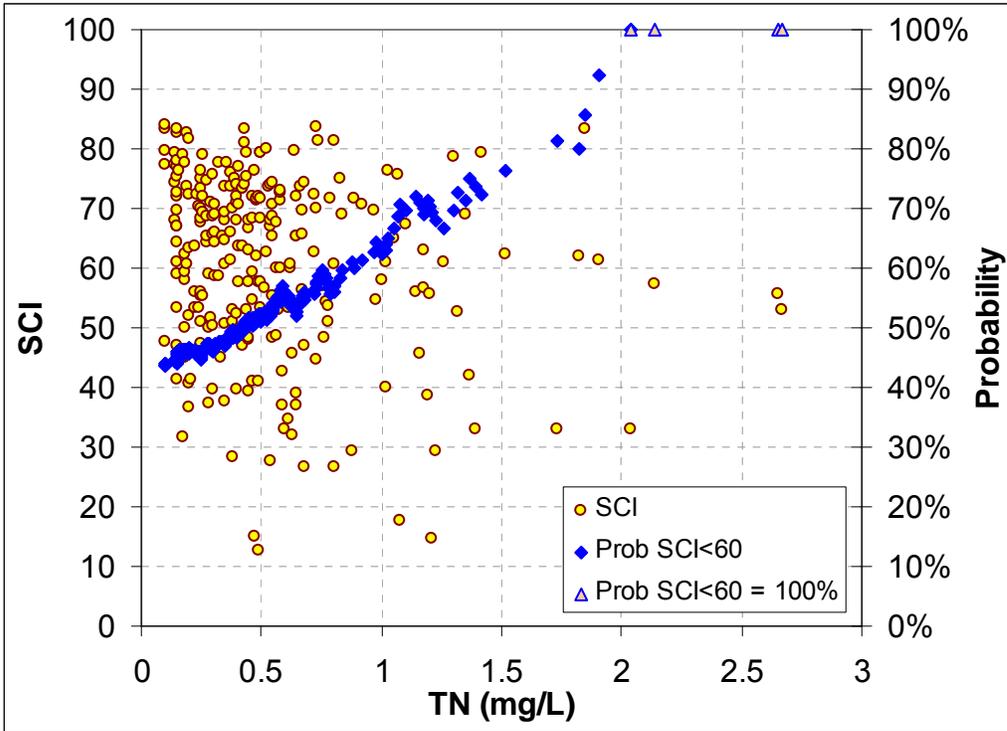


Figure 13a. SCI vs. TN (left axis) and $\text{Prob}_{\text{SCI}<60}$ for TN (right axis) plots based on DEQ probabilistic monitoring data, Mountain and Piedmont regions only, 2001-2006.

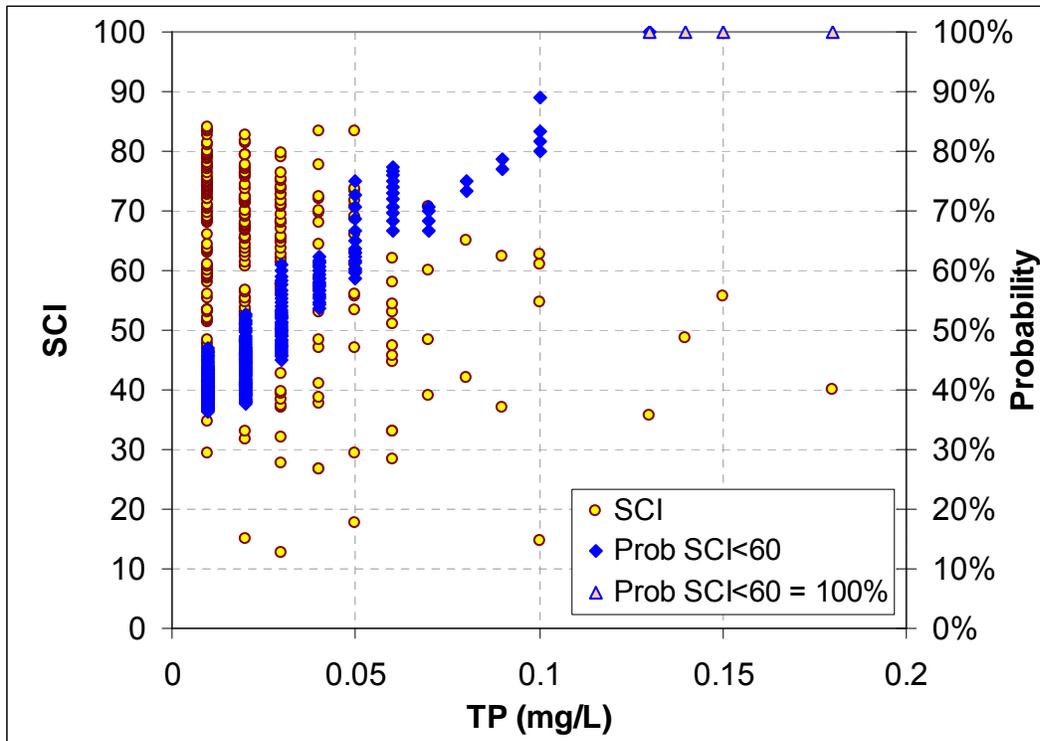


Figure 13b. SCI vs. TP (left axis) and $\text{Prob}_{\text{SCI}<60}$ for TP (right axis) plots based on DEQ probabilistic-monitoring data, Mountain and Piedmont regions only, 2001-2006.

Table 9. Illustrative critical values (CVs) for TN and TP concentrations. These concentrations are for illustrative purposes only and should not be considered as actual, suggested, or likely critical values. TN and TP CVs would be applied independently, i.e., if either TN or TP exceeds the threshold, the site would be assessed as impaired.

Nutrient variable	Critical Value: Concentration where $P_{SCI < 60} \geq 90\%$	Illustrative CV, as Percentile of Probabilistic-monitoring TN Distribution
TN (mg/L)	1.8	94th
TP (mg/L)	0.1	94th

Table 10. Results of illustrative critical-value application to probabilistic-monitoring data set.

	Assessment is Correct Based on SCI	Assessment is Incorrect Based on SCI	Sites Below CV so Not Assessed
TN > 1.8	12	3	252
TP > 0.1	8	0	259
Both	13	3	251

2. Derive Illustrative Screening Values from Reference Conditions

DEQ has used a set of criteria to define reference conditions in various studies. For example, the criteria were used to establish reference conditions in the studies conducted to develop the SCI (Tetra Tech, Inc. 2003), which was approved by EPA. The approach described here uses reference conditions to identify screening values for use in developing nutrient criteria. The following (Table 11) are reference conditions used in the SCI validation study (Virginia DEQ 2006), which were more restrictive than those used by Burton and Gerritsen in the original SCI development.

Table 11. Reference filters applied by DEQ for Mountain and Piedmont regions (Virginia DEQ 2006).

	Mountain	Piedmont
% Urban	< 5%	< 5%
Total Nitrogen	< 1.5 mg/L	< 1.5 mg/L
Total Phosphorus	< 0.05 mg/L	< 0.05 mg/L
Specific Conductance	< 250 μ S/cm	< 250 μ S/cm
Dissolved Oxygen	> 6 mg/L	> 6 mg/L
pH	> 6 and < 9	> 6 and < 9
Channel Alteration	> 11	> 11
Embeddedness	> 11	
Epifaunal Substrate/Cover	> 11	> 11
Riparian Vegetative Zone	> 11	> 11
Total Habitat Score	> 140	> 140

The Virginia DEQ (2006) reference conditions include TN and TP values. We tested the adequacy of those TN and TP reference-condition values as potential screening values by applying the full set of reference-filter conditions to the probabilistic-monitoring data set (2001-2006, Mountain and Piedmont regions only). Results are listed in Figure 14.

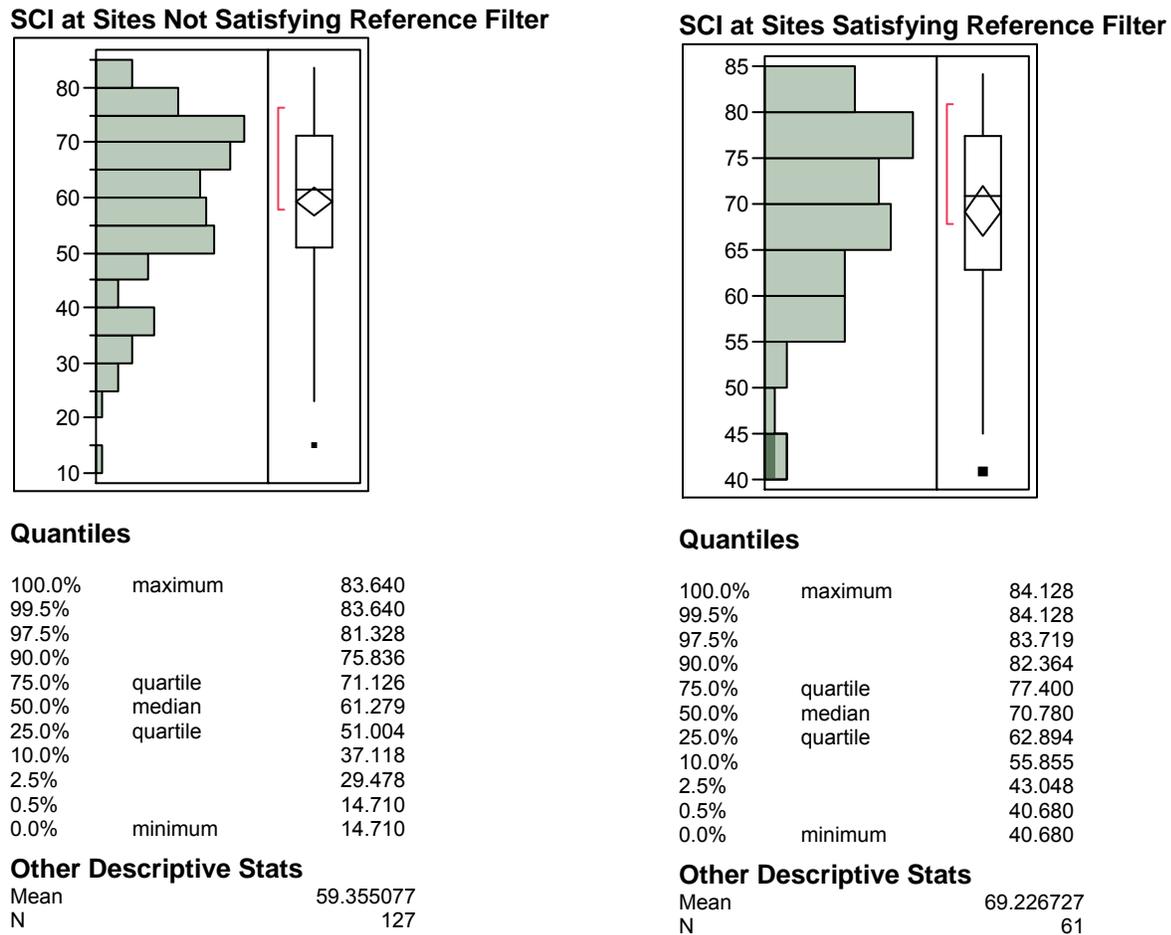


Figure 14. Results of applying the reference filters (Table 11) to DEQ probabilistic-monitoring data set (2001-2006, Mountain and Piedmont regions only).

The 10th percentile of the SCI distribution at sites satisfying the reference-filter conditions is SCI = 56. If DEQ and the AAC were to decide that screening values (SVs) would be developed with the intent of limiting false negative (Type II) assessment errors to 10 percent or less, the result of this exercise would have been more satisfactory if the 10th percentile for the Reference Sites were SCI=60 or above. However, considering that both non-nutrient and nutrient stressors are likely responsible for the observed SCI<60 impairments at the reference-filter sites, we continued the example.

We applied the highest observed TN and TP concentrations derived from the population of sites that satisfied the reference filter as illustrative screening values. The highest observed TN

value within the reference data set was 0.80 mg/L. This value is well below the 1.49 mg/L reference-filter maximum. The highest observed TP value at the reference-filtered sites was 0.04 mg/L, which is the highest possible concentration than can satisfy the reference filter at the analytical precision of these data. Therefore, we describe the screening values in this illustrative example as TN<0.81 mg/L and TP<0.05 mg/L.

Applying these screening values to the probabilistic-monitoring data yields the results in Table 12. These results should be considered while recognizing that both reference and non-reference sites are included within the 267 sites, and that the observed benthic-macroinvertebrate impairments are by both nutrient and non-nutrient stressors.

Table 12. Numbers of sites affected by illustrative screening values (SV). The extent to which impairments (SCI<60) occur when TN and TP are below the screening values cannot be used to determine the adequacy of the screening values because the SCI<60 values can occur due to the effects of non-nutrient stressors.

Illustrative Screening Value	SCI>60	SCI<60	Total	Illustrative SV as Percentile of ProbMon TN/TP Distributions
TN<0.81 mg/L	130	89	219	76 th
TP<0.05 mg/L	133	87	220	77 th
TN<0.81 mg/L and TP<0.05 mg/L	121	78	199	
Total Sites	150	117	267	

Hypothetical Applications of the AAC Recommended Approach

The illustrative CVs and SVs were applied to the probabilistic-monitoring data set and pilot-program data set. Sites were hypothetically considered “not impaired by nutrients” when the TN concentration was below 0.81 mg/L and the TP concentration was below 0.05 mg/L. Sites were listed as “impaired by nutrients” if either the TN concentration was above 1.8 mg/L or TP concentration was above 0.1 mg/L.

When applied to the probabilistic-monitoring data set, the illustrative CVs and SVs were sufficient to assess 81% of the observations (Table 13). The remaining 19% of observations were not classified. Extending this result to a real-world context and assuming the AAC recommended procedure were in place, this would mean that 19% of the total number of sites would need to be assessed visually by regional biologists. Additionally, a percentage of the visually assessed sites would need to be further evaluated using the benthic-macroinvertebrate community.

Table 13. Results of hypothetical combined application of illustrative critical values (CVs) and screening values (SVs) to ProbMon (2001-2006), Mountain and Piedmont regions.

	Number of sites	% of total sites
All sites	267	100%
“Assessed” by SV	199	75%
“Assessed” by CV	16	6%
“Assessed” by either SV or CV	215	81%
Not “Assessed”	52	19%

It is possible to apply the illustrative SVs and CVs to the pilot-program data to generate a second hypothetical example. For this data set, if the status of the site was not determined by the nutrient concentrations, it was evaluated based on the results of the visual assessment. The results were generated assuming a visual assessment that indicated “high probability of nutrient impairment” would result in a designation of “assessed as nutrient impaired.” The results of the visual assessment were only used to determine if a site would be considered “impaired by nutrients” (The visual assessment was not used to define a site as “not impaired by nutrients.”). All sites in the pilot-program that were not assessed using the SV, CV, or visual assessment would need a benthic-macroinvertebrate assessment. Results of this hypothetical application are summarized in Table 14; station-specific results are reviewed in Appendix C.

Table 14. Outcome of hypothetical application of illustrative CVs and SVs, in combination with regional biologists’ visual assessments, to the pilot-program data set.

Outcome	SCI>60	SCI<60	Total
	--- Number of sites ---		
All sites	26	36	62
“Assessed” by SV (Not Impaired by Nutrients)	15	13	28
“Assessed” by CV (Impaired by Nutrients)	6	10	16
“Assessed” Visually as Impaired by Nutrients	-	3	3
Not “Assessed”– Benthic-Macroinvertebrate Assessment Needed	5	10	15

In evaluating the results, readers should consider the limitations of the pilot-program data set as a basis for inferring potential results if these procedures were to be applied more generally. Monitoring locations used in the pilot program were characterized by higher nutrient concentrations than those in the probabilistic-monitoring data set (Figure 15). This high-nutrient-level characteristic was by design because the procedure to select stations for the pilot program was intended to assure that high-nutrient locations (of primary interest in nutrient criteria development) were adequately represented. In contrast, the probabilistic-monitoring locations are selected with the intention of representing the population of Virginia streams. Non-parametric comparisons of the pilot-program and probabilistic-monitoring data sets reveal that both nutrient distributions differ significantly ($p < 0.01$ for TN, $p < 0.0001$ for TP) (Figure 15).

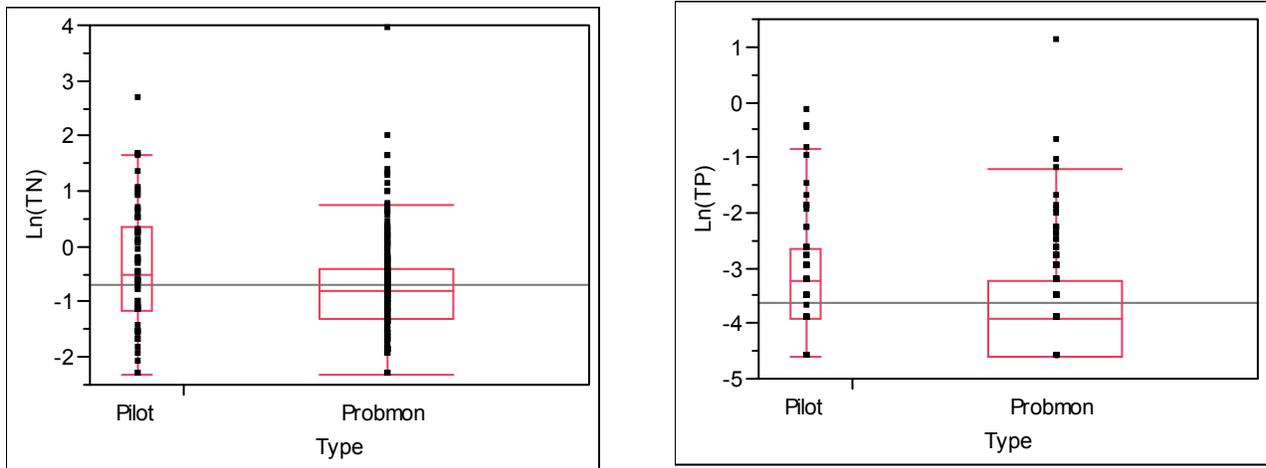


Figure 15. Distributions of Ln-transformed TN (left) and TP (right) concentrations for the pilot-program and probabilistic-monitoring data sets.

IV. Analysis of Nutrient Concentration Stability in Time

An essential question in evaluating how nutrients might be applied by the Virginia DEQ in water-quality assessments concerns the stability in time of measured-nutrient concentrations. Whereas both the pilot-program and probabilistic-monitoring data analyses were conducted using the nutrient concentrations of one water sample per site, Virginia DEQ would be applying nutrient criteria to assess water quality using data containing multiple observations collected over extended periods of time by its ambient water-monitoring program. Thus, it is reasonable to ask how conclusions derived from the pilot-program and probabilistic-monitoring data analyses might be applied within a nutrient-criteria program that is implemented as an assessment of the ambient-monitoring data.

The analysis of the pilot-program data was conducted for the purpose of aiding the process to develop nutrient criteria. Here, we conduct an additional analysis to investigate the effect of using values derived from the pilot program as opposed to values derived from monitoring data collected over prior-time periods. Understanding this relationship is important because monitoring data collected over prior-time periods will likely be used to determine a stream's impairment or non-impairment by nutrients once nutrient criteria are fully developed and implemented.

Methods

The ambient-monitoring database was queried by DEQ's water-monitoring coordinator to extract water-monitoring observations for each of the pilot-program sites over a three-year period extending from 1/1/2006 through 12/31/2008. For each location, the coordinator isolated water-monitoring observations occurring within 183 days, 365 days, and 730 days prior to the sampling period of the pilot program. Median TN and TP were calculated for each of these periods for those locations where >2 observations (i.e., 3 or more) were in the database for the 183-day prior

period, >4 observations were available for the 365-day prior period, and >6 observations were available for the 730-day prior period.

The TN and TP prior-period medians were analyzed for correspondence with observed values obtained from the pilot program. For each prior-period median, the difference from the corresponding pilot-program value was calculated, and the distribution of those differences was tested for equivalence to 0.0 using the non-parametric, Wilcoxon Rank Sum procedure. Ratios of TN and TP pilot-program values to period medians were calculated, and the distribution of those ratios was tested for difference from 1.0 using the Wilcoxon Rank Sum procedure. Log-transformed, prior-period medians were regressed against log-transformed, pilot-program values.

Relationships of prior-period medians to benthic-algae metrics and the SCI were compared to corresponding relationships for the pilot-program observations. Log-transformed TN and TP concentrations – as measured by the pilot program, and prior 183-day, 365-day, and 730-day medians – were regressed against four benthic-algae measures and the SCI. The four algae measures included two algal indices (Algal Index 1234 and Algal Index 13610), benthic chlorophyll-a (Chl-a), and ash-free dry mass (AFDM). The algal indices were constructed for each site by summing the algal color/form combinations that biologists described as being present in the visual analysis procedure, weighting each by visually estimated stream bottom coverage on a scale of 1 – 2 – 3 – 4 to construct the “Algal Index 1234,” and using a weighting of 1 – 3 – 6 – 10 to construct “Algal Index 13610.” Medians were calculated only when the number of prior-period observations exceeded a minimum threshold (> 2 for 183 days, > 4 for 365 days, and > 6 for 730 days) as described above. The monitoring locations included in this analysis were defined separately for TN and TP, and only those locations with sufficient prior-period observations to enable calculation of at least one prior-period median were used.

Critical-value thresholds were derived using the prior-period medians and compared to those derived using the pilot-program observations.

Results

Pilot-Program Results vs. Period Medians

The non-parametric analyses found no pilot-program measured concentrations minus period-median concentrations to be significantly different from zero. Likewise, no ratios of the pilot-program concentrations to the period-median concentrations were significantly different from 1.0. Both measures, however, exhibited substantial variability around measures of central tendency.

As expected, the magnitude of TN and TP differences (pilot-program concentration minus period-median concentration) increased with concentration (Figure 16); larger magnitude differences were mostly positive for both TN and TP. Thus, the highest concentrations observed during the pilot program tended to be unusually high values, suggesting that concentration deviation from the median is primarily on the positive side at such sites. Concentration ratios also increased with pilot-program concentration for both TN and TP, and for all period medians ($p < 0.0001$ for TN; $p < 0.05$ for TP) (Figure 17).

Both measures can be interpreted to indicate that nutrient concentrations in streams with low concentrations tend to remain stable, whereas high-concentration streams exhibit greater variability on both a concentration-magnitude and on a proportionate basis. However, the pilot-program values and all period medians were highly correlated for TN and TP (Figure 18).

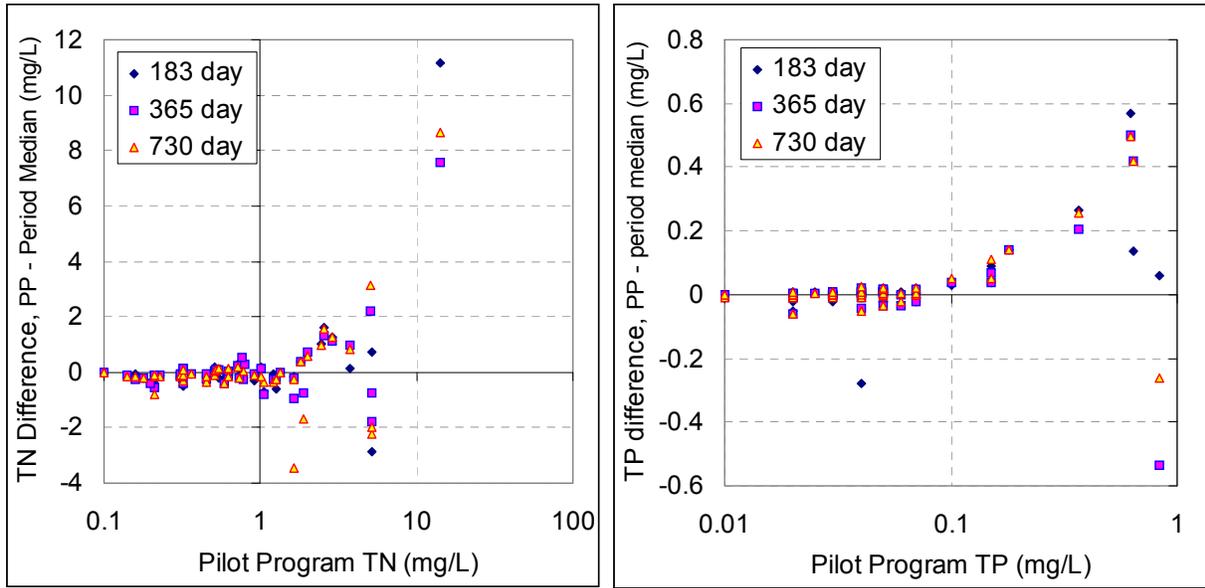


Figure 16. Concentration differences (pilot-program concentrations minus period-median concentration) as a function of pilot-program concentrations.

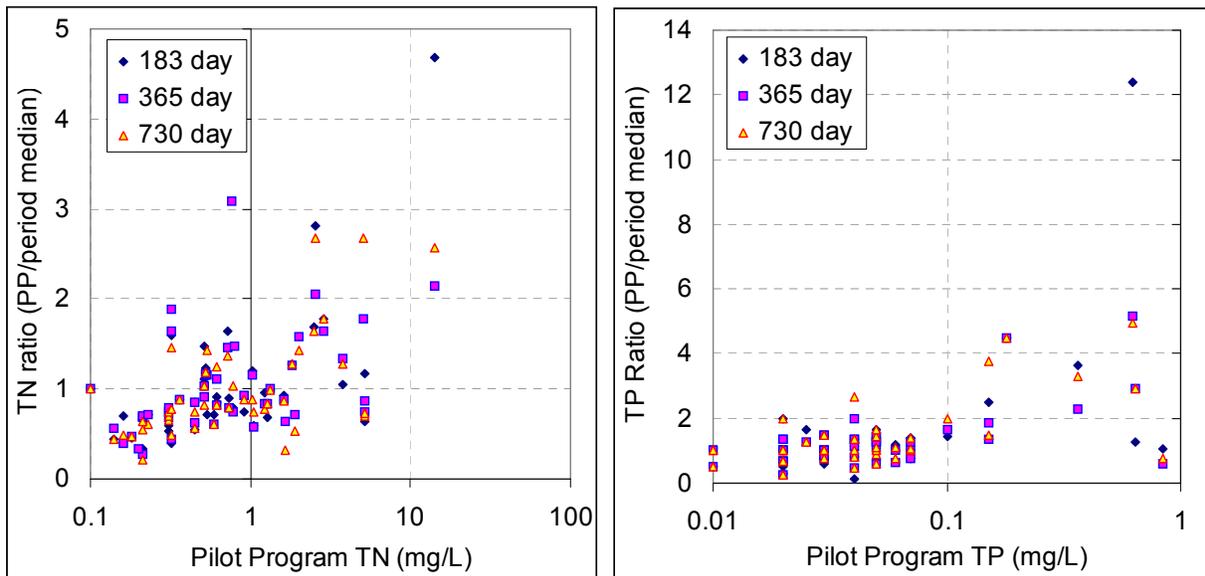


Figure 17. Concentration ratios (pilot-program concentration / period-median concentration) as a function of pilot-program concentration.

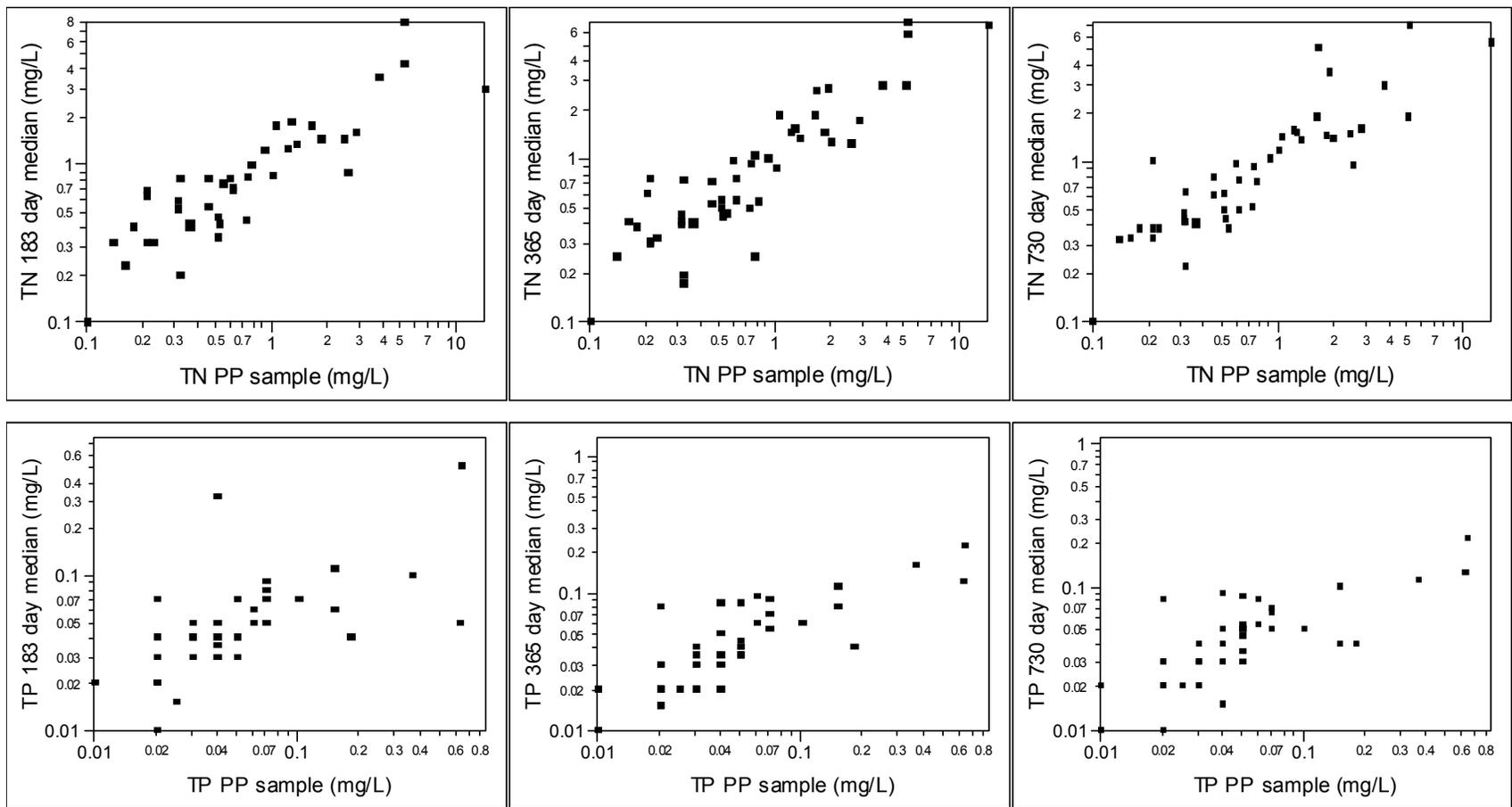


Figure 18. The 183-day, 365-day, and 730-day median TN and TP concentrations as a function of pilot-program (PP) concentrations. All relationships are statistically significant ($p < 0.0001$).

Relationships with Benthic- Algae and Benthic- Macroinvertebrate Measures

Results of the comparative analysis of nutrient concentrations against benthic-algae and benthic-macroinvertebrate measures are listed in Table 15. In general, use of the prior-period medians resulted in tighter regressions (higher R² values, lower p values) for TN relative to pilot-program values. Longer period medians (e.g., 730-day median) were responsible for the highest R² values. The degree of improvement, however, was not sufficient to alter the basic conclusions derived from the pilot-program analysis. For the TP analysis, no systematic change in outcomes was apparent as due to use of the prior-period medians.

Table 15. Results of comparative linear-regression analyses for pilot-program TN and TP concentrations and prior-period median TN and TP concentrations against benthic-algae indices and the Stream Condition Index (SCI). All nutrient concentrations were Ln-transformed.

		Algal Index (1234)	Algal Index (13610)	Ln (Chla)	Ln (AFDM)	SCI
TN	n	50	50	50	50	50
Pilot	R ²	0.014	0.015	0.141	0.071	0.144
Program	p	0.66	0.71	0.0072	0.061	0.0066
TN 183	n	40	40	40	40	40
Day	R ²	0.020	0.009	0.157	0.116	0.295
Median	p	0.6523	0.5541	0.011	0.018	0.0003
TN 365	n	49	49	49	49	49
Day	R ²	0.019	0.016	0.171	0.107	0.144
Median	p	0.3335	0.38	0.0032	0.0212	0.0071
TN 730	n	47	47	47	47	47
Day	R ²	0.023	0.023	0.226	0.133	0.210
Median	p	0.031	0.031	0.0007	0.011	0.0012
TP	n	47	47	47	47	47
Pilot	R ²	0.0000	0.005	0.017	0.0002	0.008
Program	p	0.963	0.615	0.394	0.946	0.544
TP 183	n	41	41	41	41	41
Day	R ²	0.033	0.003	0.003	0.0000	0.034
Median	p	0.247	0.733	0.733	0.956	0.247
TP 365	n	45	45	45	45	45
Day	R ²	0.017	0.032	0.012	0.0000	0.018
Median	p	0.399	0.237	0.477	0.998	0.383
TP 730	n	47	47	47	47	47
Day	R ²	0.019	0.043	0.002	0.0000	0.021
Median	p	0.35	0.056	0.797	0.949	0.331

Potential Screening-Value and Critical-Value Thresholds

As with the analysis of the pilot-program data set, the analysis of the prior-period data set offered little in the way of useful thresholds. Potential screening values derived from the prior-period medians are quite low (0.1 mg/L for the three TN prior-period medians, and 0.01 mg/L for the three TP prior-period medians). Potential critical values derived from the prior-period medians tend to be at very high levels relative to the distribution of TN and TP values from the 2001-2006 probabilistic-monitoring locations (Table 16).

Table 16. Comparison of potential critical values^a (CV) for TN and TP derived from prior-period medians to those derived from the pilot-program observations, and corresponding percentiles within DEQ's probabilistic-monitoring observations (2001-2006, Virginia's Mountain and Piedmont regions).

	CV Concentrations (mg/L)		ProbMon Percentile	
	TN	TP	TN	TP
Pilot-program observations	2.6	0.4	96	99
Prior-period medians:				
183-day medians	1.8	0.2	94	98
365-day medians	2.75	0.2	97	98
730-day medians	4	0.12	99	97

^a Potential critical values are set at approximate midpoint of range between the highest concentration at a non-impaired site and the next-highest concentration.

Conclusions

This analysis should be considered as an initial effort to address questions regarding the operational aspects of applying the screening-value approach within DEQ's water-quality monitoring and assessment framework.

Nutrient concentrations at any given location in a stream are variable in time. The TN and TP concentrations of water samples collected during the pilot program were good estimates, in a statistical sense and on average, of median values for water-monitoring samples collected during 183 days, 365 days, and 730 days prior to the pilot program sampling event (prior-period medians). When comparing the measured concentrations from the pilot program to the concentration medians of the prior-period data, the variability increased in both measured (mg/L) and relative terms at the higher concentrations. Substitution of prior-period-median values for pilot-program-measured values affected results of several analyses, but the differences were minor and inconsequential to the conclusions drawn from the pilot-program data analysis.

One would expect that the additional information in the historical record would provide better results than a single nutrient-concentration measurement obtained during the pilot program. However, questions remain about how the historical data should be analyzed in order to provide an improved result.

Reducing the set of available observations to the median might not be the best way to utilize the historical record. Diminution of the SCI would be caused by a history of high-nutrient concentrations over a period of time, i.e., by an accumulation of high-concentration events over a period of time. If such events were to occur frequently, although less than 50% of the time, they would not be reflected by a median value. Thus, an alternative approach would be to use a mean or a weighted, moving average of the historical record.

V. Summary and Future Plans

The AAC has recommended that Virginia DEQ apply a screening value approach for developing nutrient criteria (Figure 1). The proposed approach employs N and P screening values (nutrient-concentration thresholds below which monitoring sites are determined to be unimpaired by nutrients) and critical values (nutrient-concentration thresholds above which sites are considered impaired by nutrients). Streams with nutrient concentrations that do not allow assessment using the screening or critical values would be visually assessed. If the visual assessment is inconclusive, a benthic-macroinvertebrate assessment would be employed to assess the stream.

During calendar year 2008, Virginia DEQ biologists executed the pilot program, enhanced monitoring activities to test the efficacy of the screening-value approach. Program results did not suggest screening values. In addition, the critical values suggested by the program results would be sufficient to assess only a very small number of monitoring sites because they are at the extreme upper end of the distribution of nutrient concentrations that occur in Virginia streams. Using a visual procedure, regional biologists were able to identify a subset of sites as impaired by nutrients, but they could not apply the visual-assessment method to prove that a stream was not impaired by nutrients.

An exploratory analysis was conducted in an attempt to develop an alternative procedure for identifying screening and critical values. In developing this procedure, we recognized the trade-offs embodied by the screening-value approach and sought to limit assessment errors to 10% or less. We applied “reference conditions” used by DEQ for other analyses (including the development of the Stream Condition Index) to derive screening values. The 2001-2006 probabilistic-monitoring data were used for the exploratory analysis, and its results are considered for illustrative purposes only. The results of the analysis indicate that the technique employed shows promise as a potential mechanism for deriving screening values. However, as with the pilot program, the critical values suggested would be sufficient to assess only a very small number of sites because they are at the extreme upper end of the distribution of nutrient concentrations found in Virginia streams.

The analyses described above utilized data from nutrient concentrations measured from single-point-in-time water samples to characterize each monitoring site’s nutrient status. The Virginia DEQ, however, is expected to assess water-quality nutrient data collected over extended periods of time. A third analysis, therefore, was conducted for the purpose of exploring the stability in time of TN and TP concentrations in Virginia streams. The results indicate that sites

with high concentrations of nutrients had more variability with regard to nutrient concentrations than did sites with low concentrations of nutrients.

Several additional activities are planned for fiscal year 2010 (July 2009-June 2010). These activities include an analysis of the 2001-2008 probabilistic-monitoring data using a more rigorous application of the exploratory data analysis procedure. The planned analysis, which uses an extended data set that includes a larger number of monitoring sites with benthic-algae measurements, is considered desirable and necessary to derive more robust results.

Also during FY2010, the AAC will continue to explore mechanisms for deriving critical values. Downstream-loading issues will be considered in this activity, given the fact that all of the coastal waters that receive Virginia's surface-water streams (Chesapeake Bay, Pamlico Sound, Gulf of Mexico) suffer from nutrient overenrichment. Furthermore, the distribution of nutrient concentrations in Virginia streams is upwardly skewed (see Figure 12), suggesting that a small number of Virginia's surface water streams with excessively high-nutrient concentrations are responsible for a disproportionate share of the nutrients carried by surface waters into the coastal water bodies.

An additional activity planned for FY2010 is an analysis of DEQ's ambient-monitoring data to determine how a screening-value approach would be expected to affect DEQ resource allocations. This analysis would consider regional biologists' time as a critical resource that must be applied to implement a screening-value approach successfully.

Also during FY2010, regional biologists have stated an intent to continue developing the visual-assessment procedure that was employed on a trial and developmental basis during the pilot-program activity. The AAC is willing to continue working with the DEQ's biological-monitoring staff in this activity, as per DEQ and staff preferences.

VI. Acknowledgements

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VII. Disclaimer

The contents of this document are solely the responsibility of the authors and do not necessarily represent the official views of the U.S. EPA Region 3, USGS, Virginia DEQ, or Virginia Water Resources Research Center at Virginia Tech.

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Appendix A: Nutrient Criteria Visual Assessment Field Form (Spring)

Station ID: _____ Field Crew: _____
 Stream Name: _____ Ecoregion: _____
 DEQ Region: _____ **TP Category** _____
 Location: _____ **TN Category** _____

DATE _____ Start Time _____ Finish Time _____

LATITUDE (Decimal degrees) _____ LONGITUDE (Decimal degrees) _____

Stream Physicochemical Measurements

TEMPERATURE: _____ °C CONDUCTIVITY: _____ μS/cm

DISSOLVED OXYGEN: _____ mg/L pH: _____

Benthic Macroinvertebrate Collection

Method used (circle one) **Single habitat** **Multi-habitat**

Riffle quality (circle one) **Good** **Marginal** **Poor** **None**

Habitats sampled **Riffle** **Snags** **Banks** **Vegetation**
 # jabs _____

Algae Community

Algae community growth (% of stream bottom) **Categories; 1-10; 10-40; 40-70; >70**

Type of growth	bright green	dark green	brown	black	other
Film					
Thin mat					
Thick mat					
Filamentous					

Vascular Plant Growth

Vascular plant growth (% of stream bottom) **Categories; 1-10; 10-40; 40-70; >70**

Submerged macrophytes	
Emergent macrophytes	
Other	

Observations

Stream substrate type **Categories; 1-10; 10-40; 40-70; >70**
sand gravel cobble bedrock mud

Estimated average stream width (Meters): _____

Estimated average stream depth (Meters): _____

Stream shading: (circle one)

Categories; 1-10; 10-40; 40-70; >70

Stream flow (circle one)

Low Normal Above Normal

Estimated stream velocity (Meters/sec): _____

Days since last potentially scouring rain: _____

Photo documentation taken? **YES / NO**

BPJ based on observations of algae and macrophyte biomass; probability of impairment to macroinvertebrate community (circle one)

Low Medium High

Provide a brief explanation for rating: _____

Watershed features

Land Use

(Indicate the predominant surrounding land use with a "1". . If applicable, indicate a secondary land use with a "2".)

- | | |
|-------------------|-----------------|
| ___ Forest | ___ Commercial |
| ___ Field/Pasture | ___ Industrial |
| ___ Agricultural | ___ Residential |
| ___ Livestock | ___ Other _____ |

Local Watershed Pollution (circle one)

- No evidence Some potential sources
Obvious sources

Local Watershed Erosion (circle one)

- None Moderate
Low Heavy

Appendix B: Nutrient Criteria Visual Assessment Field Form (Fall)

Station ID: _____ Field Crew: _____
 Stream Name: _____ Ecoregion: _____
 DEQ Region: _____ **TP Category** _____
 Location: _____ **TN Category** _____

DATE _____

Start Time _____ Finish Time _____

LATITUDE
(Decimal degrees) _____

LONGITUDE
(Decimal degrees) _____

Stream Physicochemical Measurements

TEMPERATURE: _____ °C CONDUCTIVITY: _____ μS/cm

DISSOLVED OXYGEN: _____ mg/L pH: _____

Benthic Macroinvertebrate Collection

Method used (circle one) **Single habitat** **Multi-habitat**

Riffle quality (circle one) **Good** **Marginal** **Poor** **None**

Habitats sampled **Riffle** **Snags** **Banks** **Vegetation**
 # jabs _____

Algae Community and Vascular Plant Growth

Algae community growth (% of stream bottom)

Categories; 1-10; 10-40; 40-70; >70

Type of growth	bright green	dark green	brown	black	other
Film					
Thin mat					
Thick mat					
Short Filamentous					
Tall Filamentous					

Vascular plant growth (% of stream bottom)

Categories; 1-10; 10-40; 40-70; >70

Submerged macrophytes	
Emergent macrophytes	
Mosses	
Other	

Total stream bottom coverage by algae and vascular plant growth _____
(Categories; 1-10; 10-40; 40-70; >70)

Appendix C. Pilot Program Data

Hypothetical application to sites in the pilot program for illustrative screening and critical values within AAC recommended approach.

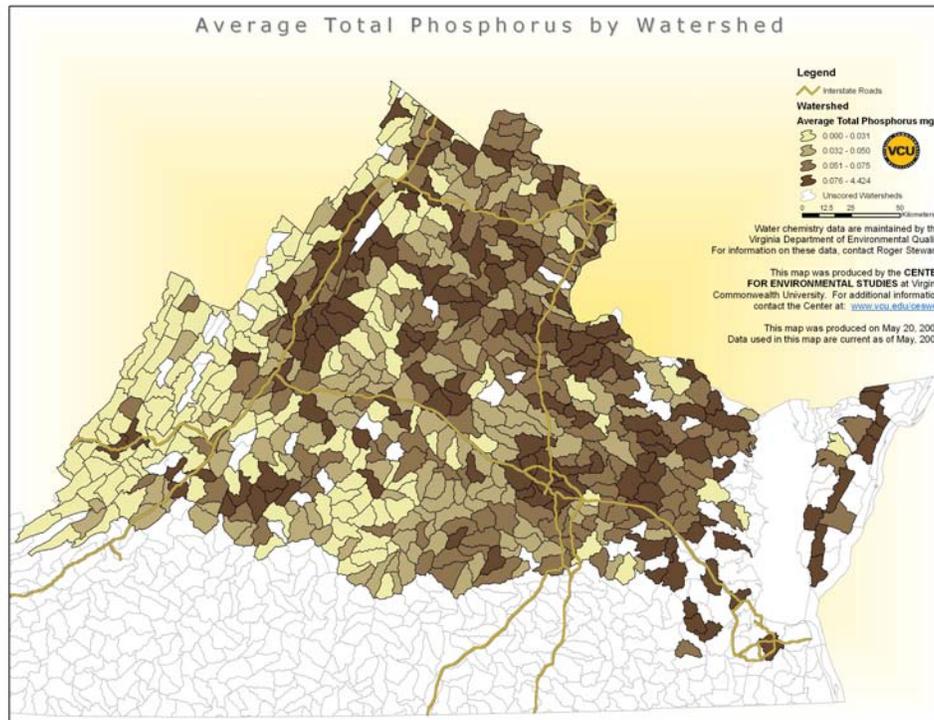
StationID	Sea- son	TN (mg/ L)	TP (mg/L)	BPJ: Prob Nutrient Impair- ment	BPJ: Prob Non- Nutrient Impair- ment	CV: TN>1.8	CV: TP>0.1	SV: TN<0.81 & TP<0.05	BPJ	Outcome	Stream Con- dition Index
6BPLU002.15	Spr	1.27	0.04	MEDIUM	-	-	-	-	-	BenMac Assess	40.94
2-PCT002.46	Spr	0.62	0.10	MEDIUM	-	-	-	-	-	BenMac Assess	42.12
1ANOG005.69	Spr	1.02	0.06	MEDIUM	-	-	-	-	-	BenMac Assess	46.81
1BSSF053.09	Spr	1.22	0.06	LOW	-	-	-	-	-	BenMac Assess	48.28
4ATKR000.69	Fal	1.34	0.05	MEDIUM	MEDIUM	-	-	-	-	BenMac Assess	50.34
6CMFH055.88	Fal	0.59	0.05	MEDIUM	MEDIUM	-	-	-	-	BenMac Assess	50.35
4ASEE003.16	Fal	0.21	0.07	MEDIUM	LOW	-	-	-	-	BenMac Assess	54.37
2-CNE000.96	Spr	1.11	0.05	LOW	-	-	-	-	-	BenMac Assess	55.31
6BIDN000.69	Fal	1.22	0.03	MEDIUM	LOW	-	-	-	-	BenMac Assess	59.81
5AGRV000.08	Spr	0.51	0.05	LOW	-	-	-	-	-	BenMac Assess	68.20
2-NOR000.20	Spr	0.34	0.10	LOW	-	-	-	-	-	BenMac Assess	68.62
3-MTN000.59	Fal	1.05	0.07	MEDIUM	MEDIUM	-	-	-	-	BenMac Assess	69.51
3-RAP006.53 (S1)	Fal	0.78	0.06	LOW	MEDIUM	-	-	-	-	BenMac Assess	70.99
2-HAT000.14	Fal	0.14	0.05	LOW	MEDIUM	-	-	-	-	BenMac Assess	71.86
1ASYL000.02	Spr	3.77	0.02	MEDIUM	-	imp	-	-	-	Impaired	23.01
1AOPE036.13	Spr	5.13	0.84	LOW	-	imp	Imp	-	-	Impaired	29.78
1BMDD005.81	Spr	5.13	0.02	MEDIUM	-	imp	-	-	-	Impaired	36.66
9-STE007.29	Spr	1.63	0.05	HIGH	-	-	-	-	Imp	Impaired	38.18
5ABTR002.80	Spr	0.52	0.05	HIGH	-	-	-	-	Imp	Impaired	39.41
2-CHK079.23	Fal	0.92	0.07	LOW	HIGH	-	-	-	Imp	Impaired	40.62

4AMEY016.00	Spr	2.76	0.43	HIGH	-	imp	Imp	-	Imp	Impaired	42.66
1BCKS001.03	Fal	1.66	0.05	HIGH	HIGH	-	-	-	Imp	Impaired	42.98
3-THM001.40	Fal	2.48	0.07	LOW	MEDIUM	imp	-	-	-	Impaired	47.94
2-JKS018.68	Fal	0.72	0.15	HIGH	LOW	-	Imp	-	Imp	Impaired	50.13
3-GRT001.70	Fal	14.2	0.62	HIGH	LOW	imp	Imp	-	Imp	Impaired	52.43
4ALOR008.64	Fal	5.04	0.64	MEDIUM	MEDIUM	imp	Imp	-	-	Impaired	56.52
1BSTH019.52	Fal	1.62	0.22	LOW	LOW	-	Imp	-	-	Impaired	56.78
2-SOL001.00	Fal	2.86	0.04	LOW	MEDIUM	imp	-	-	-	Impaired	57.11
6BPOW179.20	Fal	0.74	0.02	MEDIUM	HIGH	-	-	NotNI	Imp	Impaired	59.03
9-DEN000.03	Spr	1.99	0.04	MEDIUM	-	imp	-	-	-	Impaired	60.44
1BSTH002.14	Spr	1.28	0.14	MEDIUM	-	-	Imp	-	-	Impaired	61.15
2-APP012.79	Spr	0.45	0.18	MEDIUM	-	-	Imp	-	-	Impaired	61.29
9-MLC005.44	Spr	1.91	0.03	LOW	-	imp	-	-	-	Impaired	62.34
6CMFH033.40	Fal	1.83	0.15	LOW	LOW	imp	Imp	-	-	Impaired	67.39
2-RVN015.97 (S1)*	Fal	2.54	0.37	HIGH	MEDIUM	imp	Imp	-	Imp	Impaired	69.06
1ALIV012.12	Fal	0.45	0.03	LOW	LOW	-	-	NotNI	-	Not Nut Imp	28.56
6ASAT000.26	Spr	0.32	0.01	LOW	-	-	-	NotNI	-	Not Nut Imp	36.70
2-IVC010.20	Spr	0.54	0.02	LOW	-	-	-	NotNI	-	Not Nut Imp	37.37
2-MTC001.24	Fal	0.62	0.04	LOW	MEDIUM	-	-	NotNI	-	Not Nut Imp	47.17
2-LIH005.28	Fal	0.31	0.02	MEDIUM	MEDIUM	-	-	NotNI	-	Not Nut Imp	49.07
8-LTL009.54	Spr	0.36	0.03	LOW	-	-	-	NotNI	-	Not Nut Imp	52.02
3-RAP077.28	Spr	0.32	0.02	LOW	-	-	-	NotNI	-	Not Nut Imp	53.66
9-LTL001.22	Spr	0.20	0.02	LOW	-	-	-	NotNI	-	Not Nut Imp	54.01
2-LIA000.50	Fal	0.31	0.02	MEDIUM	MEDIUM	-	-	NotNI	-	Not Nut Imp	56.40
6BWAL005.97	Spr	0.77	0.03	MEDIUM	-	-	-	NotNI	-	Not Nut Imp	57.56
6AIND000.52	Fal	0.18	0.02	MEDIUM	MEDIUM	-	-	NotNI	-	Not Nut Imp	57.88
8-SAR097.82	Fal	0.32	0.04	LOW	NO	-	-	NotNI	-	Not Nut Imp	59.81
1ACAX004.57	Spr	0.80	0.02	LOW	-	-	-	NotNI	-	Not Nut Imp	61.39
2-MIS000.04	Fal	0.21	0.01	LOW	MEDIUM	-	-	NotNI	-	Not Nut Imp	62.16
9-NBS000.70	Fal	0.16	0.02	MEDIUM	LOW	-	-	NotNI	-	Not Nut Imp	62.93

2-FIN000.81	Spr	0.52	0.03	MEDIUM	-	-	-	NotNI	-	Not Nut Imp	65.18
3-ROB023.06	Spr	0.18	0.02	LOW	-	-	-	NotNI	-	Not Nut Imp	66.98
4ASNA015.30	Fal	0.31	0.03	LOW	-	-	-	NotNI	-	Not Nut Imp	67.42
1AHOC006.23	Fal	0.36	0.01	MEDIUM	MEDIUM	-	-	NotNI	-	Not Nut Imp	68.21
1AGOO022.44	Fal	0.23	0.04	LOW	LOW	-	-	NotNI	-	Not Nut Imp	68.38
5ATRE038.07	Fal	0.54	0.03	MEDIUM	MEDIUM	-	-	NotNI	-	Not Nut Imp	68.91
6CSFH097.42 (S1)	Spr	0.52	0.03	LOW	-	-	-	NotNI	-	Not Nut Imp	71.04
2-JES000.80	Spr	0.10	0.02	LOW	-	-	-	NotNI	-	Not Nut Imp	72.61
8-POR008.97	Fal	0.49	0.04	LOW	LOW	-	-	NotNI	-	Not Nut Imp	73.77
8-NAR005.42 (S1)	Fal	0.21	0.01	MEDIUM	LOW	-	-	NotNI	-	Not Nut Imp	75.48
2-BNF003.52	Spr	0.10	0.01	LOW	-	-	-	NotNI	-	Not Nut Imp	76.91
2-RKI003.40	Fal	0.12	0.02	LOW	LOW	-	-	NotNI	-	Not Nut Imp	83.64

* SCI for 2-RVN015.97 (S2) was 61.22.

Development of Freshwater Nutrient Criteria for Non-wadeable Streams in Virginia: Fish Community Assessment, Phase III



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May 21, 2009

Introduction

The complex ecological and biological relationships among nutrient concentrations and fishes in freshwater systems, including streams, lakes, and reservoirs, are documented by a large and diverse literature. Many such studies focus on the role of nutrients in determining rates of secondary production (and, therefore, potential yields) of higher trophic levels, including fishes (e.g. Dodds, et al. 2002), nutrient cycling and spiraling (e.g. Griffiths 2006), and the effects of nutrient releases from aquaculture facilities (e.g. Dalsgaard and Krause-Jensen 2006). The impact of nutrient enrichment (eutrophication) from anthropogenic sources on aquatic systems has also been widely-studied and is considered a serious threat to aquatic ecosystem health and function (EPA 1998). In response, many U.S. jurisdictions have moved to develop and implement regional nutrient criteria, with the goal of protecting aquatic living resources, including fishes. Frequently, measures (indices) of biotic assemblages (fish and macroinvertebrates) are used to assess stream health, integrity, and, indirectly, water quality. However, only a limited number of published studies (e.g. Wang, et al. 2006) have examined *directly* the putative effects of cultural eutrophication on fish community structure and function in streams, and only a few of these reports (e.g. Morgan, et al. 2007) have focused on the mid-Atlantic region.

At a 2006 meeting of an Academic Advisory Committee working group focused on establishing numeric nutrient criteria for Virginia's streams, participants discussed several potential approaches for linking nutrient concentrations and criteria to aquatic life use standards in larger (i.e., non-wadeable) streams and rivers. Specifically, the subcommittee reasoned that fish community structure may be a useful diagnostic of nutrient-related effects in such systems, which are typically too large for standard benthic macroinvertebrate sampling protocols. The subcommittee proposed a preliminary analysis, using existing data, to determine whether statistically significant relationship(s) exist among a limited suite of variables representing nutrient conditions and fish community structure, and at broad geospatial scales. If such a relationship can be demonstrated, based on analyses with archival data alone, additional future analyses and targeted database development may support the establishment and validation of ecologically-based, and scientifically defensible, numeric nutrient criteria for larger (i.e., non-wadeable) lotic ecosystems.

Previous studies for the AAC (Garman, et al. 2007 & 2008) completed preliminary analyses of archived fish community and nutrient data for streams and rivers in the Virginia Coastal Zone. These analyses were based on an extensive database of fish community metrics for Chesapeake Bay freshwater systems and DEQ's nutrient concentration data (TP, TN) and algal biomass data (Chl-a) from that agency's ambient monitoring program. These earlier studies had the following objectives: 1.) create a working database by combining and distilling large amounts of archival data representing nutrient concentrations and fish community structure from multiple sources, and 2.) conduct simple correlation analyses to test the hypothesis that derived measures of nutrient conditions and stream health (fish communities) may be related statistically and could, therefore, be the basis for future predictive models and nutrient criteria thresholds. Previous reports (Garman, et al. 2007 & 2008) demonstrated that statistical relationships among fish community indices (modified Index of Biotic Integrity, mIBI) and nutrient concentrations (DEQ ambient monitoring) may be useful in developing nutrient criteria related to both localized and downstream effects. Unfortunately, these preliminary analyses were constrained limited by several factors, including the lack of temporally and spatially synoptic data for nutrients and fish

community health, representation by only a few basins, and the inability to separate wadeable and non-wadeable ambient monitoring stations within the DEQ/STORET database. The current (2009) study, described below, expands and improves the earlier analyses and includes specific analyses of putative non-wadeable locations.

2009 Objectives

- 1.) Attempt to document statistically significant relationships among TN, TP, and chlorophyll-*a* concentrations and fish community-based stream health metrics based on an expanded database (*cp.* 2008) that represents all Chesapeake basin watersheds (6th-order hydrologic units) in Virginia.
- 2.) Evaluate differences, if they exist, between responses of coastal *versus* non-coastal stream fish assemblages to nutrients and trophic status.
- 3.) Confirm statistically significant, watershed-based patterns for a subset of paired data representing putative non-wadeable streams.
- 4.) Propose draft nutrient criteria for the identification (and assumed protection) of ecologically healthy, non-wadeable streams, based on fish community assessment.

Approach and Methods

DEQ monitoring data representing ambient nutrient concentrations (total nitrogen, TN; total phosphorus, TP; mg/L) and algal biomass (as chlorophyll-*a*, Chl-*a*; µg/L) at georeferenced stream locations were downloaded to a VCU server for post-processing in April, 2009. These data (provided by Mr. Roger Stewart, Virginia DEQ) were ‘filtered’ by location (Chesapeake Bay drainages), content (availability of all three nutrient parameters and minimum n=10 per station) and other criteria (e.g. stream characteristics, date range), producing a working database of approximately 32,000 records. The final DEQ data were joined to a subset of the fish community database maintained by VCU’s INSTAR stream assessment program (<http://INSTAR.vcu.edu>), which generates stream health (i.e., biotic integrity) scores at stream reach and watershed spatial scales, based on empirical data and established models for fish community structure and function (described below). Data ranges for TN, TP, and Chl-*a* in the final dataset were divided into equal categories based on quartiles, i.e., TN category 1 represents the lowest concentrations of the range, while category 4 represents the highest concentrations. Nutrient data were not distributed normally.

Because no objective criteria exist to identify streams as non-wadeable and quantitative and large-river data for fish communities in Virginia are limited, nutrient data and fish community metrics were combined (pooled) to generate descriptive statistics (means and percentiles) for 6th-order watersheds (hydrologic units, HUCs) in the Chesapeake Bay basin for each selected parameter and all stream reaches. Some HUCs did not have sufficient data (nutrients and/or fish) and were eliminated from further analysis. Preliminary analysis suggested that stream fish assemblages in the Coastal Zone may respond differently to nutrient and trophic status. Coastal HUCs were, therefore, separated from non-coastal regions (i.e., Piedmont and Ridge and Valley) for subsequent, watershed-scale analyses. The fall-zone (inferred from Interstate 95) was used as the line of separation for coastal *versus* non-coastal watersheds. Analyses conducted at the watershed scale included fish community data from wadeable and non-wadeable streams.

We also conducted analyses on a very limited (n=57) *paired* dataset of spatially co-incident nutrient values and fish health metrics for putative *non-wadeable* (> 3rd order) streams and rivers within the Chesapeake basin. This analysis assumed that DEQ ambient monitoring stations

within 500 meters of an INSTAR location represented the same stream reach. The small size of this reach-specific dataset for non-wadeable streams reflects, in part, the lack of relevant, archival data for large streams and rivers in Virginia.

Geospatial analyses were conducted using ESRI's ArcGIS version 9.3. Statistical comparisons across nutrient categories and between 'healthy' and 'compromised' stream fish assemblages were based on nonparametric Chi-square tests ($\alpha=0.05$). More detailed methods and data descriptions are provided below:

Stream Nutrient Concentrations and Trophic Status: The following nutrient parameters were selected from the DEQ ambient monitoring database and developed for further analysis: total nitrogen concentration (TN, mg/L; Figure 1), total phosphorus concentration (TP, mg/L; Figure 2) and chlorophyll-*a* concentration (Chl-*a*, $\mu\text{g/L}$; Figure 3). Chlorophyll-*a* concentration is indicative of the trophic status of a water body and high Chl-*a* values generally indicate eutrophication. A detailed description of DEQ's ambient monitoring program for nutrients is provided at: <http://www.deq.virginia.gov/watermonitoring/aqm.html>.

Stream Fish Community Assessment: The INSTAR application (<http://instar.vcu.edu>) and the extensive aquatic resource database on which it runs, were developed to support a variety of stream assessment and planning activities aimed at restoring and protecting water quality and aquatic living resources throughout the Commonwealth. In addition, regional reference stream models (i.e., *virtual* streams) for both non-tidal and small to medium-sized tidal tributaries are developed as criteria for prioritization of candidate streams and watersheds for protection and restoration, objective and quantitative performance measures, and as a decision support tool for environmental planning and implementation. Currently, INSTAR has compiled information on approximately 2,200 Virginia streams, and INSTAR databases comprise over 245,000 records. Probabilistic study reaches for INSTAR sampling were selected through a statistically powerful, stratified (by stream order) random design.

Although INSTAR compiles data for both aquatic macroinvertebrates and fishes, only fish community data were included in this analysis. Within each geo-referenced reach (150-500 m), fishes are sampled quantitatively using electrofishing equipment (backpacks, tote barge units, boats) and EPA QAPP methods. Backpack and tote barge sampling is performed throughout the entire reach in a single pass. Boat electrofishing may include additional sampling effort depending on stream width and habitat variability. Data are compiled in Access[®] databases and application macros within INSTAR calculate over 50 separate metrics and ecological variables, including those typically generated for the Index of Biotic Integrity (IBI), Rapid Bioassessment Protocol (RBP), and Rapid Habitat Assessment (RHA). Variables and metrics are then subjected to ordination and cluster analysis using unimodal models (e.g. correspondence analysis (CA), detrended correspondence analysis (DCA), and canonical correspondence analysis (CCA)) and linear response models (e.g. principal components analysis (PCA), multiple regression techniques). The site scores (i.e., coefficients from the final response model) are entered as the response variable and significant ($P<0.05$) biotic and abiotic variables and metrics are entered as explanatory variables, and used to develop a series of reference stream models (i.e., *virtual* streams). We used Gower's similarity index to compare empirical scores obtained from sampled stream reaches to the appropriate virtual reference stream, generating an index of stream health (VSA score) as a measure of percent comparability to the appropriate (*virtual*) reference condition model. Fish community data collected as part of DEQ's ProbMon program were included, where appropriate.

Fish assemblages with high percent comparability scores (VSA scores > 71%) were assumed to represent streams with high ecological integrity (i.e., healthy and exceptional categories). Conversely, fish assemblages with low VSA scores (< 57%) were assumed to represent biologically degraded streams (i.e., compromised category). These ‘healthy’ and ‘degraded’ VSA categories generally represented +/- 1 standard error of the mean VSA score from the distribution of all VSA scores in the database. Only those INSTAR stream locations in upper and lower categories were included in 2009 analyses, based on the assumption that streams representing mid-range VSA scores (58-70%) are less likely to be influenced by ambient nutrient concentrations.

Findings

Stream TN concentrations for the 6th-order watersheds averaged 1.57 mg/L and ranged up to 47.22 mg/L, while stream TP concentrations averaged 0.98 mg/L and ranged up to 4.42 mg/L. Chlorophyll-*a* concentrations averaged 2.97 µg/L and ranged up to 52.58 µg/L. These concentrations were strongly associated with coastal zone watersheds classified as ‘degraded’ based on stream fish community assessments (Chi-square test, $p < 0.01$; Table 1). For both TN and Chl-*a*, the relationship was positive, i.e., there were significantly more degraded streams in HUCs with the highest nutrient values (Figure 5). In non-coastal watersheds, only the association between stream health and Chl-*a* values was significant ($p < 0.01$), suggesting that trophic status as inferred from Chl-*a* concentrations is the best predictor of compromised stream health in both coastal and noncoastal regions.

Stream nutrient concentrations and trophic status were also associated statistically (Chi-square test, $p < 0.05$; Table 1) with high ecological integrity (‘healthy’) streams. For example, there were significantly more healthy streams in coastal and noncoastal watersheds with the lowest Chl-*a* values (Figure 6). In contrast, the relationship between TN concentrations and high biotic integrity was unimodal, with the greatest representation of healthy streams at intermediate TN concentrations. These findings suggest that Chl-*a* and TN may be better predictors of stream health than TP; the associations between Chl-*a* and the incidence of healthy or degraded streams in a given HUC were statistically significant for both coastal and noncoastal regions.

Analysis of paired, reach-level data for nonwadeable streams and rivers (Figures 9-11) generally mirrored the statistically significant relationships demonstrated by watershed-scale analyses of wadeable and nonwadeable streams combined (Table 1, Figures 6-8). Specifically, Chl-*a* mean concentrations were strongly and negatively correlated (Figure 11) and no stream reaches classified as biologically healthy were observed at paired Chl-*a* values above 0.25 µg/L. The relationship between fish community healthy and TN concentrations was also negative (Figure 9) but depended on a single observation. No streams classified as healthy were observed at paired TN values above 2.0 mg/L. There was no obvious relationship between stream health and TP concentrations (Figure 10).

The analyses suggest that nutrient criteria for the protection of biologically healthy streams and rivers are supported by simple, but statistically significant, models of relationships among TN, Chl-*a*, and VSA scores. For the watershed scale analysis, the proposed ‘protection’ criteria are as follows: TN < 0.66 mg/L and Chl-*a* < 0.88 µg/L for coastal and noncoastal streams. The paired, reach-level analysis of nonwadeable streams, based on a much smaller sample size, suggests the following criteria for healthy stream protection: TN < 2.0, Chl-*a* < 0.25 µg/L. Criteria based on TP concentrations are not supported by this analysis.

Summary

- 1.) Statistically significant relationships were documented among TN, chlorophyll-*a*, and to a lesser degree TP, and fish community-based (INSTAR) stream health metrics using an expanded database (n=35,000 records, DEQ ambient monitoring) of all Chesapeake basin watersheds (6th-order HUCs) in Virginia. Some of these relationships (e.g. Chl-*a* and VSA score) were relatively strong predictors of both healthy and degraded stream assemblages and might reasonably serve as the basis for establishing biologically valid nutrient criteria. Some of the strong associations between nutrients and trophic status and fish community structure at watershed scales were corroborated by analysis of a much smaller database of paired, nonwadeable streams and rivers. Specifically, fish community metrics were strongly and negatively correlated with TN and Chl-*a* concentrations in 77 putative nonwadeable streams.
- 2.) Proposed, *conservative* criteria for the protection of high quality nonwadeable streams are as follows: TN < 2.0 mg/L and Chl-*a* < 0.88 µg/L. At this time, criteria based on TP may not be warranted.
- 3.) Differences did exist between responses of coastal *versus* non-coastal stream fish assemblages to nutrient and trophic status, but the geographic differentiation may not warrant separate nutrient criteria for streams. However, this issue should be explored in more detail.
- 4.) Chlorophyll-*a* concentration appears to be the most promising predictor of ecological health in nonwadeable streams, and therefore the most likely basis for establishing nutrient criteria based on fish community structure; however, the availability of Chl-*a* data is limited, compared to other parameters including TP and TN.
- 5.) Future efforts should focus on: a.) expanding the paired database for nonwadeable streams and rivers through additional data mining and GIS analysis, b.) refining the proposed nutrient criteria for TN and Chl-*a* based on this expanded coverage, c.) leverage ongoing fieldwork (e.g. DEQ's ProbMon Program) to develop a separate and synoptic database of nutrient and fish community metrics that can be used to formally validate proposed nutrient criteria for nonwadeable streams in Virginia and d.) expand the discussion statewide into non-Bay drainages.

Table 1. Summary of statistical comparisons across nutrient (TN, TP, Chl-a) categories for watersheds classified as ‘healthy’ or ‘degraded’ based on INSTAR assessment of fish communities in coastal and non-coastal streams and rivers (Chesapeake Bay basin). The analyses tested the null hypothesis that classified streams were distributed uniformly or randomly among nutrient categories. Rejection of the null suggests that stream biological health is significantly associated with nutrient or trophic status. All data were pooled by watershed (HUC). Statistically significant relationships are described as ‘positive,’ ‘negative,’ or ‘unimodal.’ Refer to Figures 5-8 for specific comparisons.

	TN		TP		Chl-a	
	Coastal	Noncoastal	Coastal	Noncoastal	Coastal	Noncoastal
Degraded Streams	** positive	n.s.	** unimodal	n.s.	** positive	** positive
Healthy Streams	* unimodal	* unimodal	* positive	n.s.	* negative	* negative

** alpha <0.01, * alpha <0.05, n.s.=not significant

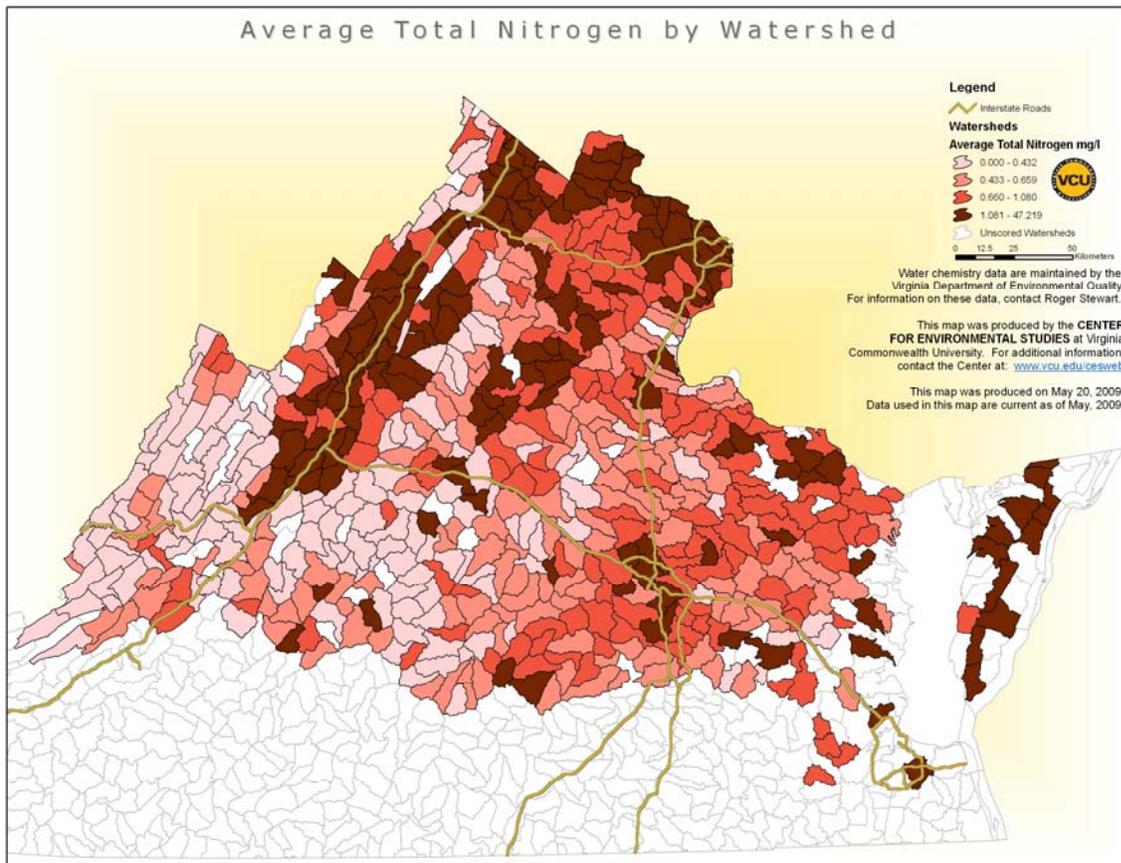


Figure 1. Distribution of total nitrogen concentrations (TN, mg/L) for streams in 6th-order hydrological units in the Chesapeake Bay basin, Virginia. Data provided by DEQ ambient monitoring program.

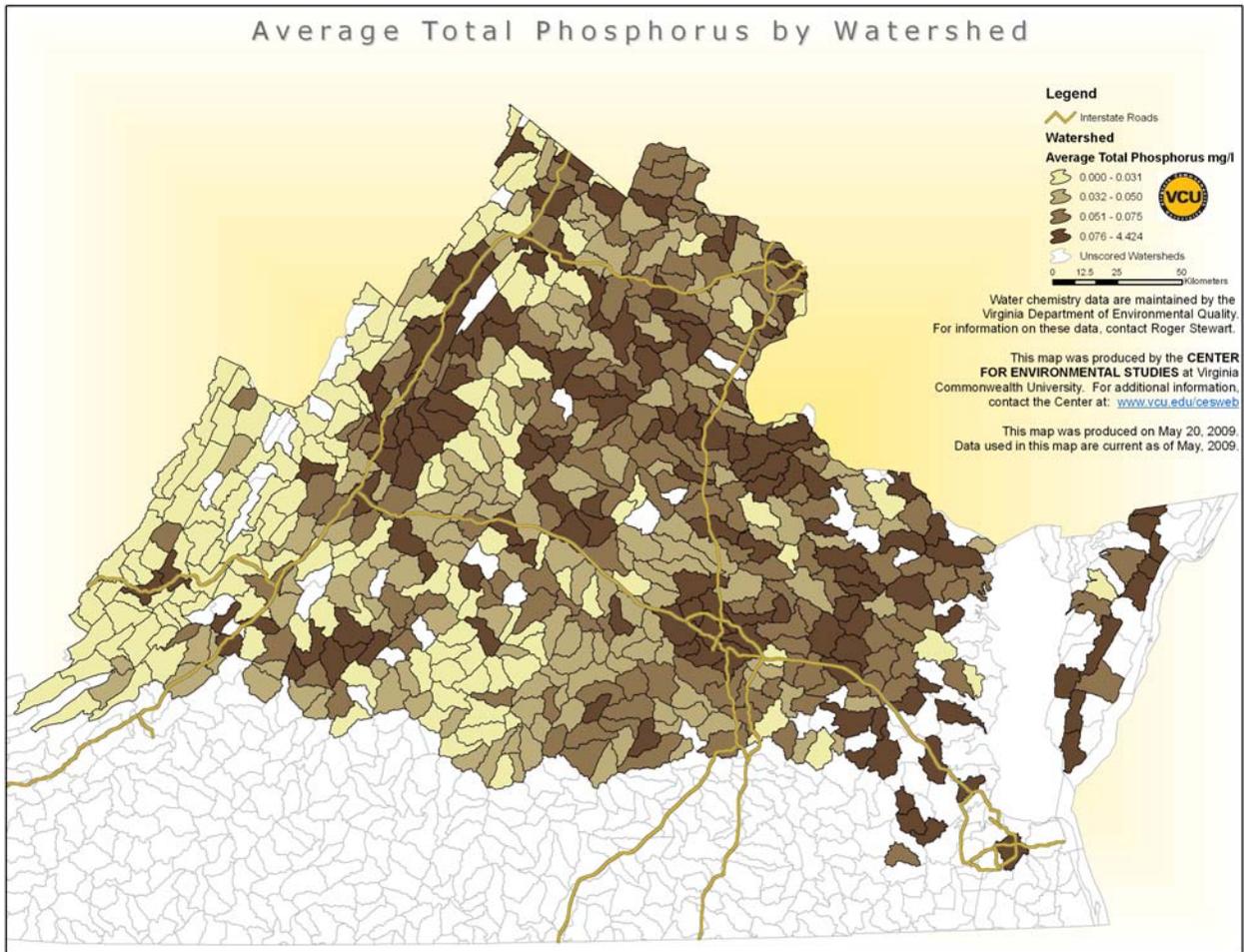


Figure 2. Distribution of total phosphorous concentrations (TP, mg/L) for streams in 6th-order hydrological units in the Chesapeake Bay basin, Virginia. Data provided by DEQ ambient monitoring program.

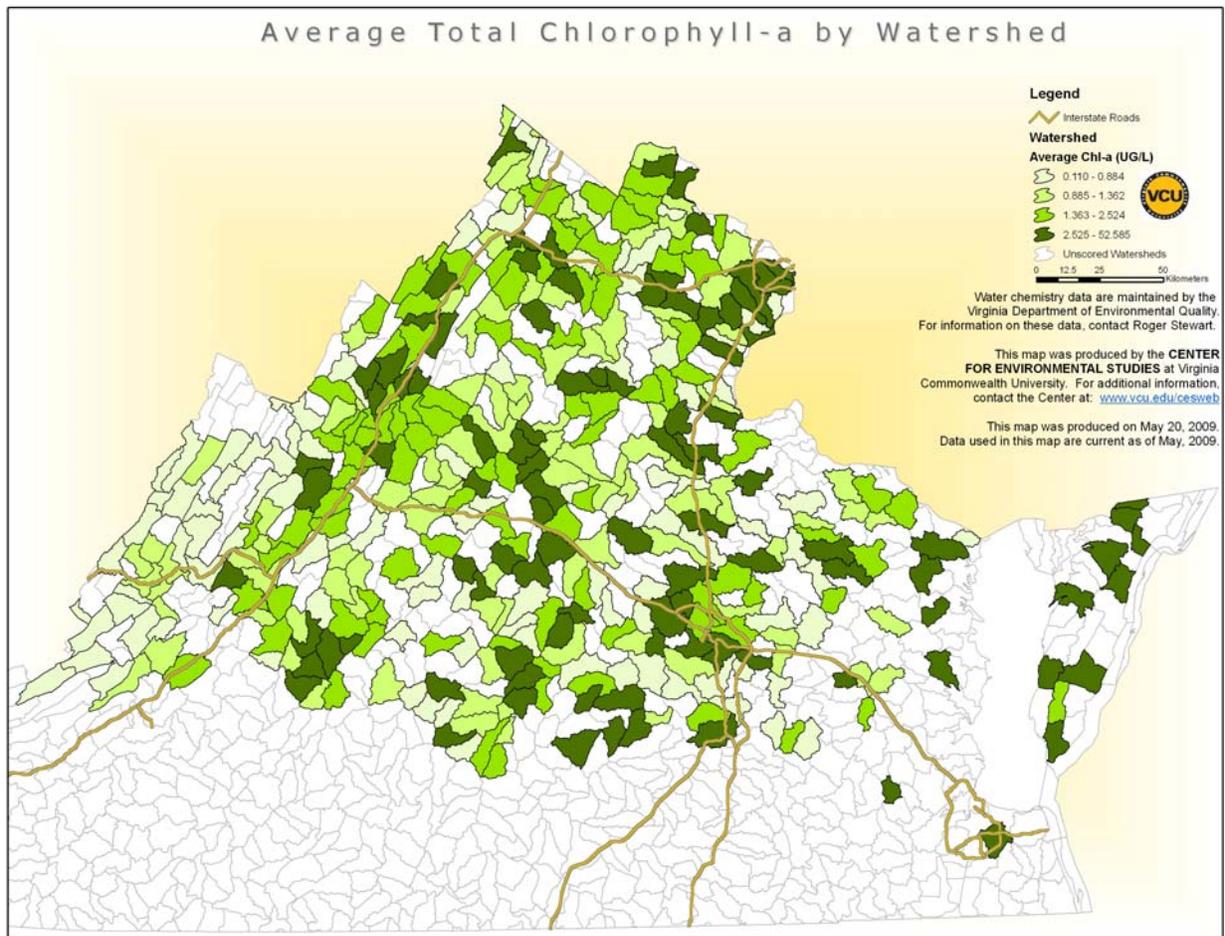


Figure 3. Distribution of chlorophyll-*a* concentrations (Chl-*a*, $\mu\text{g/L}$) for streams in 6th-order hydrological units in the Chesapeake Bay basin, Virginia. Data provided by DEQ ambient monitoring program.

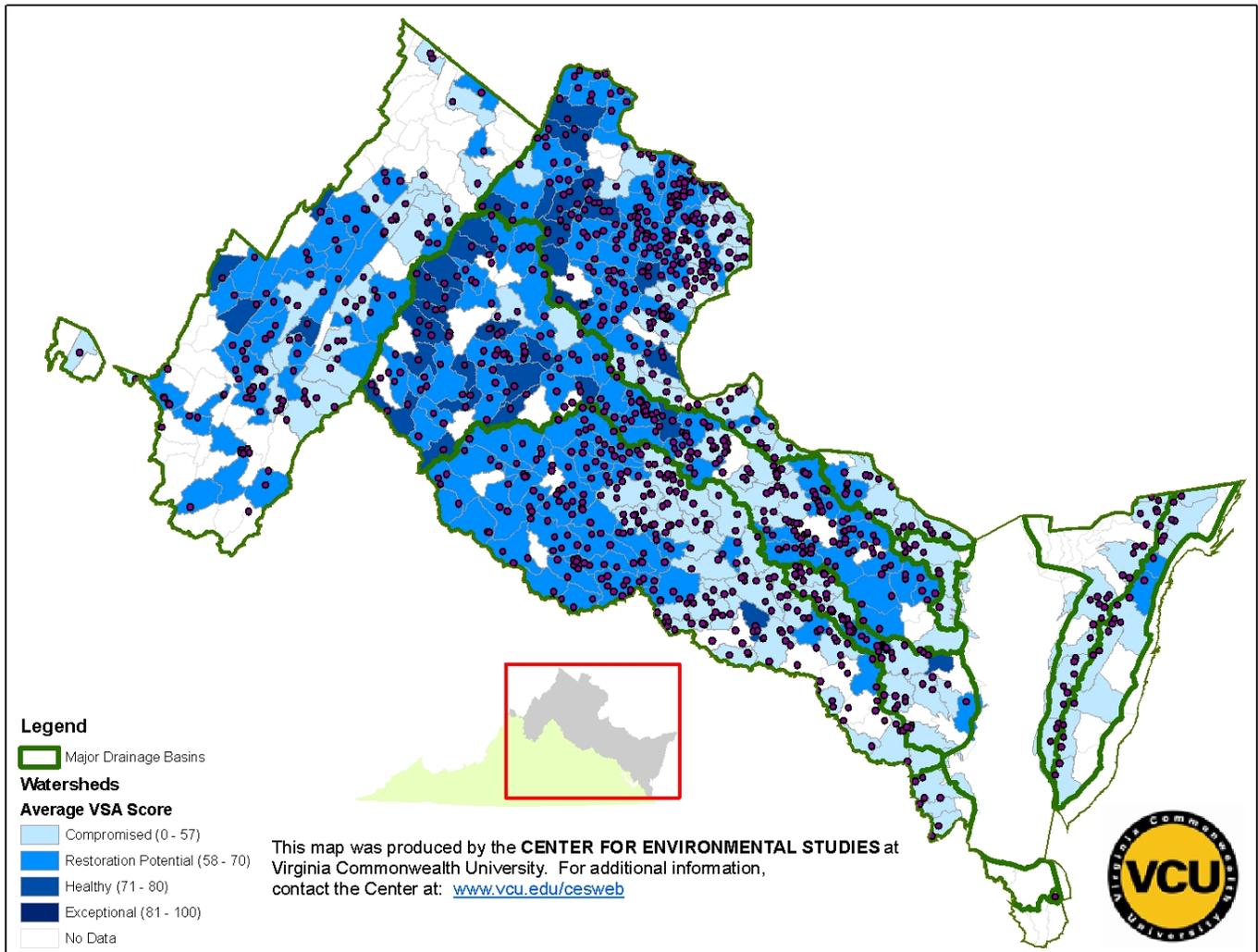


Figure 4. Stream health classification (INSTAR fish assemblage models) for streams in 6th-order hydrologic units in the Chesapeake Bay basin, Virginia. Categories are based on the mean VSA score (percent comparability to appropriate virtual reference condition). Breakpoints for stream health categories are based on the mean, +/-1 standard error, and + 2 standard errors of the distribution of n=1,033 randomly selected VSA scores for INSTAR stream reaches. HUCs in the 'exceptional' and 'healthy' categories are dominated by streams exhibiting high ecological integrity. Points represent individual quantitative (electrofishing) collections for selected HUCs.

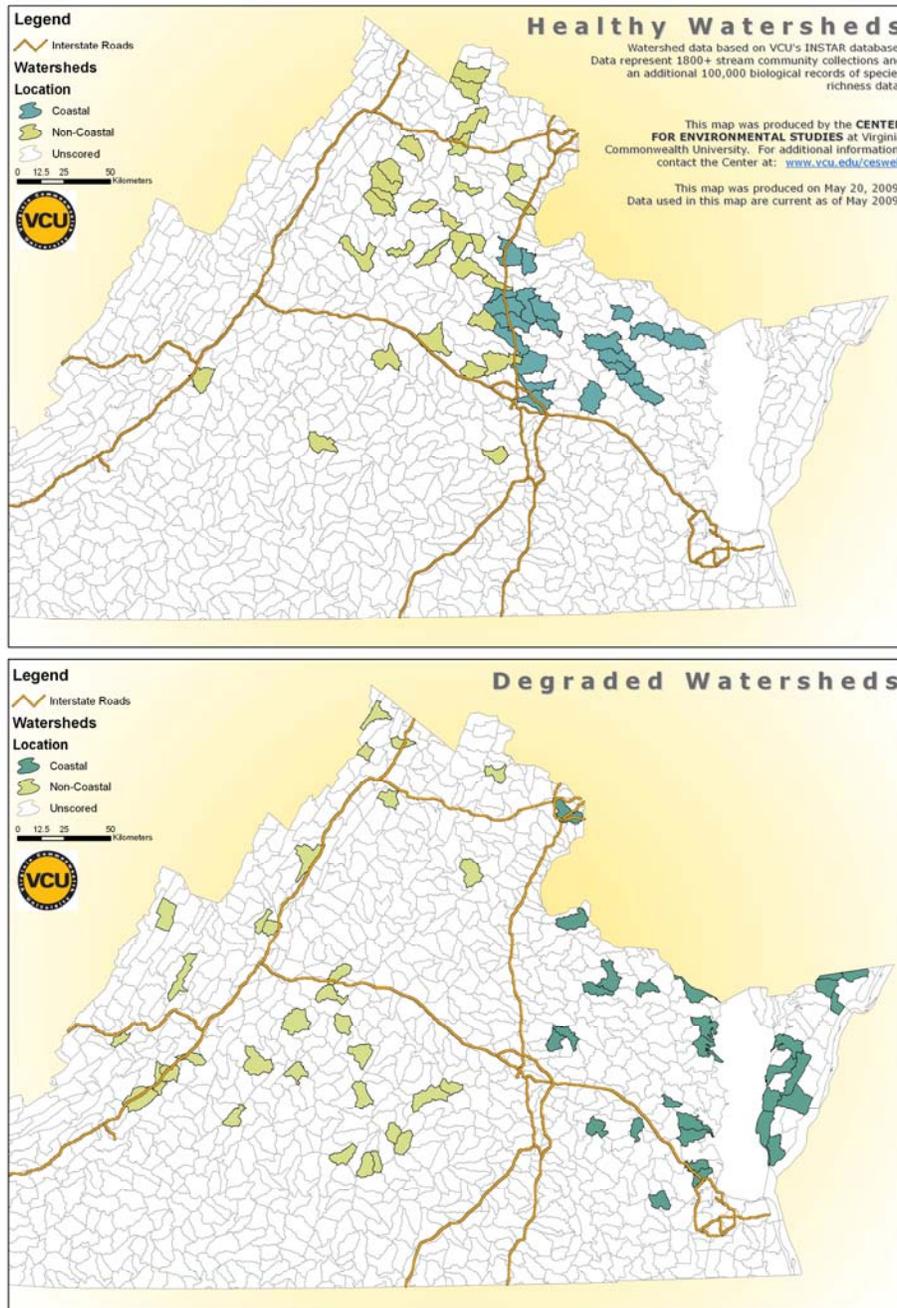


Figure 5. Watersheds (6th-order HUCs) classified as ‘healthy’ or ‘degraded’ based on INSTAR assessment of fish community data. Refer to the text for a more detailed explanation.

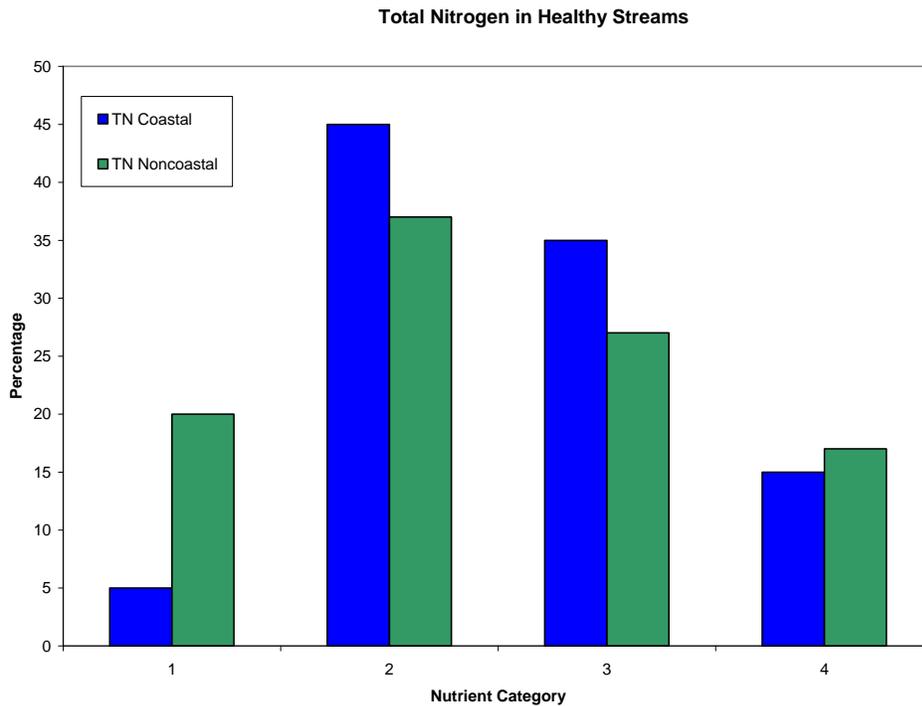
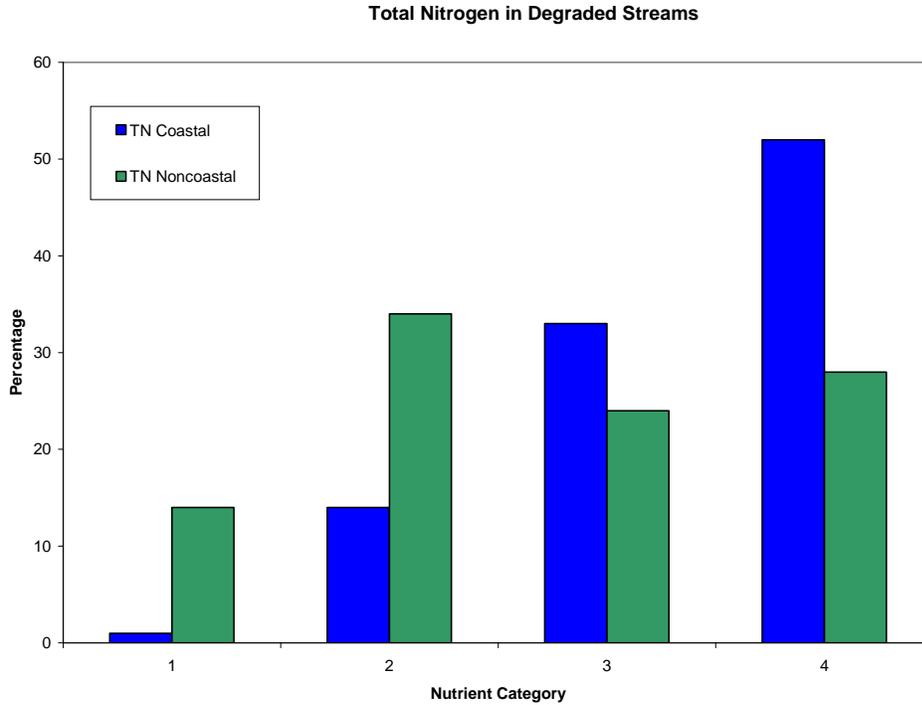


Figure 6. Percent occurrence of biologically degraded (upper plot) and healthy (lower plot) watersheds as a function of TN concentration, where category 1 represents the lowest nutrient concentrations in mg/L. Please refer to Figure 1 for category breakpoints and to Table 1 for results of statistical comparisons.

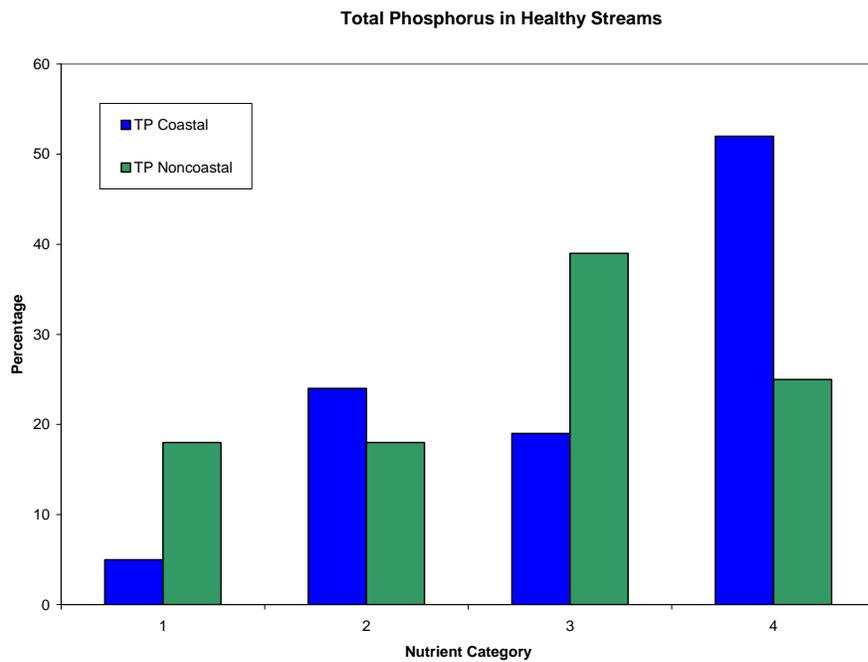
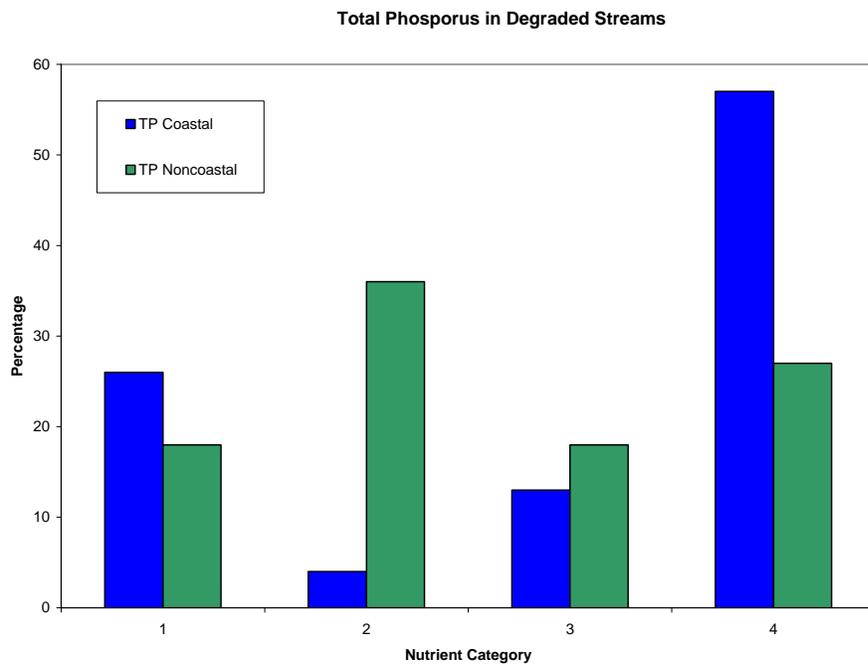


Figure 7. Percent occurrence of biologically degraded (upper plot) and healthy (lower plot) watersheds as a function of TP concentration, where category 1 represents the lowest nutrient concentrations in mg/L. Please refer to Figure 2 for category breakpoints and to Table 1 for results of statistical comparisons.

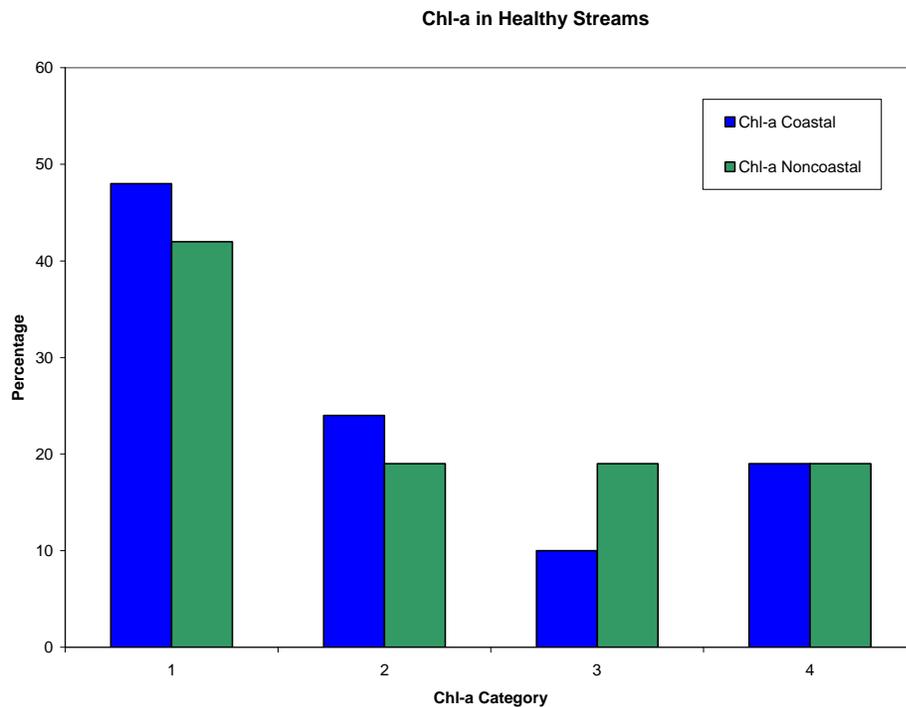
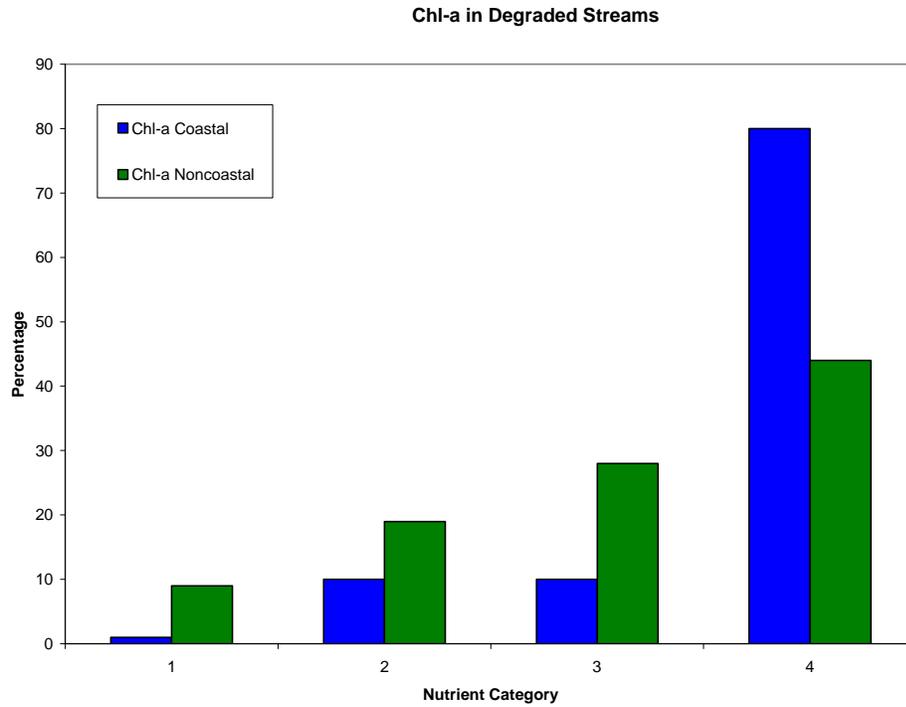


Figure 8. Percent occurrence of biologically degraded (upper plot) and healthy (lower plot) watersheds as a function of Chl-a concentration, where category 1 represents the lowest nutrient concentrations in $\mu\text{g/L}$. Please refer to Figure 3 for category breakpoints and to Table 1 for results of statistical comparisons.

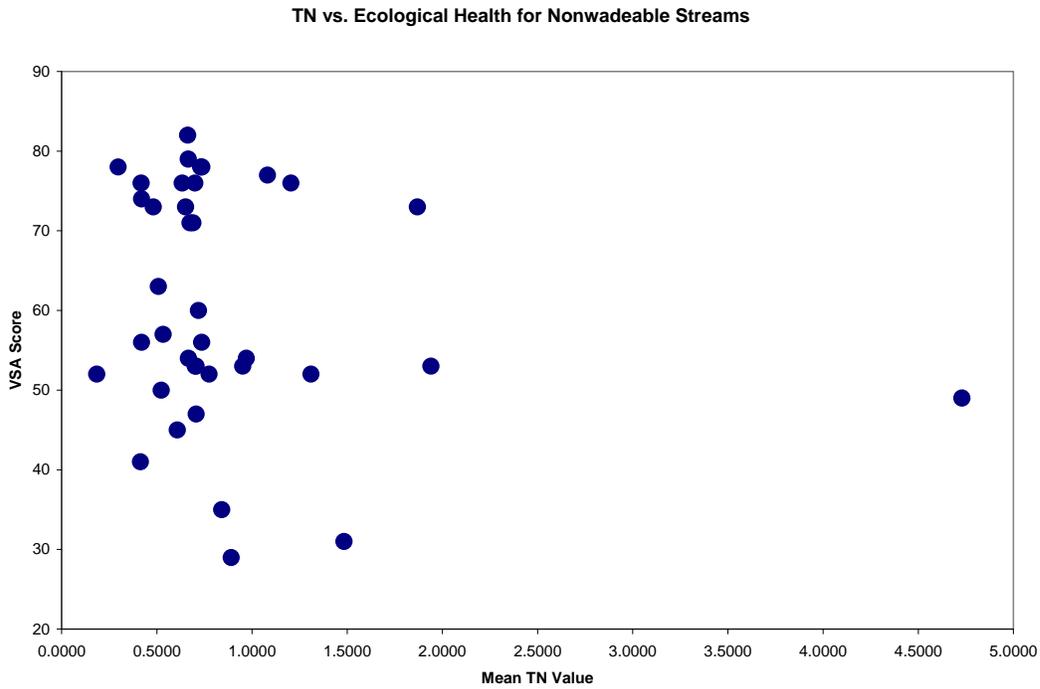


Figure 9. Scatterplot of fish community health score (VSA, % comparability to reference) and TN concentration (mean, mg/L) for paired, non-wadeable stream and river reaches, Chesapeake Bay basin, Virginia.

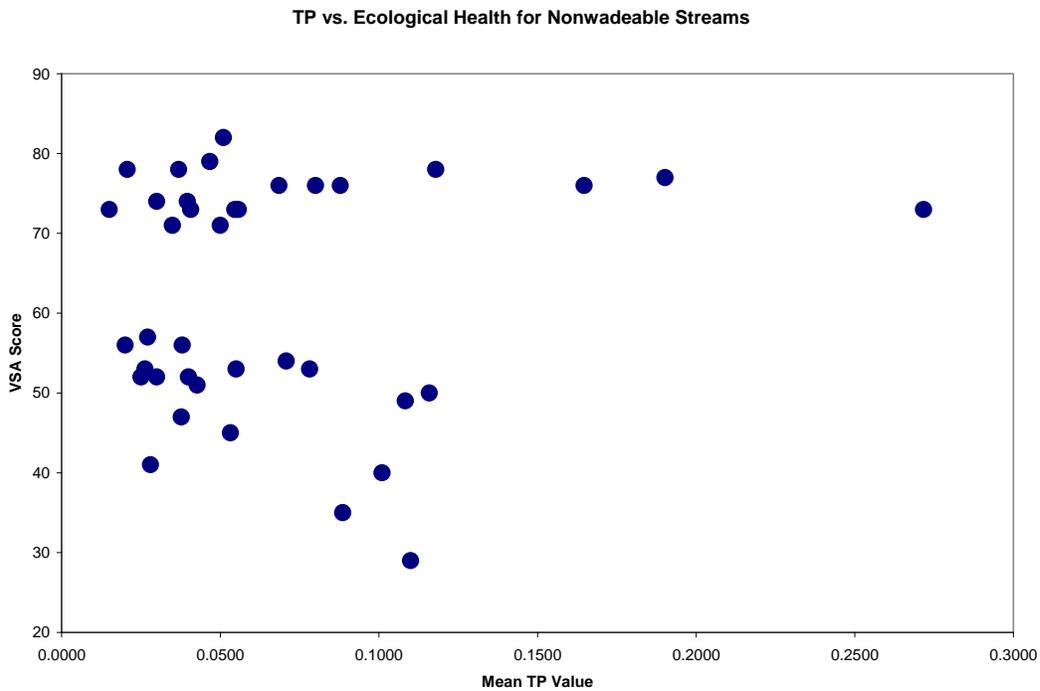


Figure 10. Scatterplot of fish community health score (VSA, % comparability to reference) and TP concentration (mean, mg/L) for paired, non-wadeable stream and river reaches, Chesapeake Bay basin, Virginia.

Paired Chl-a vs. Ecological Health for Non-wadeable Streams

