VIRGINIA WATER RESOURCES RESEARCH CENTER

Lessons from Florida's Experience Developing Numeric Nutrient Standards for Flowing Waters

2014 Report of the Academic Advisory Committee for Virginia Department of Environmental Quality

SPECIAL REPORT

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LESSONS FROM FLORIDA'S EXPERIENCE DEVELOPING NUMERIC NUTRIENT STANDARDS FOR FLOWING WATERS

2014 Report of the Academic Advisory Committee for Virginia Department of Environmental Quality

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Lessons from Florida's Experience Developing Numeric Nutrient Standards for Flowing Waters

Leonard Shabman and Kurt Stephenson[1]

Introduction

The December 2012 report entitled *Technical and Policy Considerations and Options in Assessing Nutrient Stresses on Freshwater Streams in Virginia* argued that the proposed screening process by the Academic Advisory Committee (AAC) to the Virginia Department of Environmental Quality (DEQ) was analogous to the Florida process that was then awaiting approval by the U.S. Environmental Protection Agency (EPA). In turn the report argued, "If EPA accepts the new Florida rule, the Florida approach can be referenced as a justification for the Virginia-specific screening approach." That same 2012 AAC report reviewed a March 16, 2011 memorandum from EPA headquarters (Nancy Stoner) on nutrient criteria development by the states and argued that the memorandum was further justification for proposing the screening approach to EPA.

EPA has since approved the Florida rule for numeric criteria and has proposed rulemaking that follows the Stoner memorandum (see Appendix A). Both of these actions further justify Virginia moving forward with development of the AAC proposed screening approach. This paper updates the 2012 report by expanding upon the explanation of the EPA-approved Florida process. Based on this update, the AAC again makes the argument that DEQ rely on the precedent of the Florida approval, as well as the EPA proposed rulemaking, to promote a Virginia screening approach to EPA. However, because of differences in data availability and other state-specific circumstances, there must be differences in application between Florida and Virginia, and these differences may need to be acknowledged if DEQ approaches EPA for approval of a Virginia process. DEQ might consider continuing to engage the AAC during the next year to make modifications to the draft screening approach that will align it with the Florida model as much as possible given the reality of data limitations.

The process of evaluating the applicability of the EPA-approved Florida process to Virginia's screening approach involved engaging with Frank Nearhoof, a recently retired Florida Department of Environment Protection (FDEP) staff person who was directly involved in the design of the Florida rule. Nearhoof provided two background papers (see appendices A and B) and participated in three phone calls with the authors to review the materials included in this report. For that reason, the authors believe that the description of the Florida process is accurate.

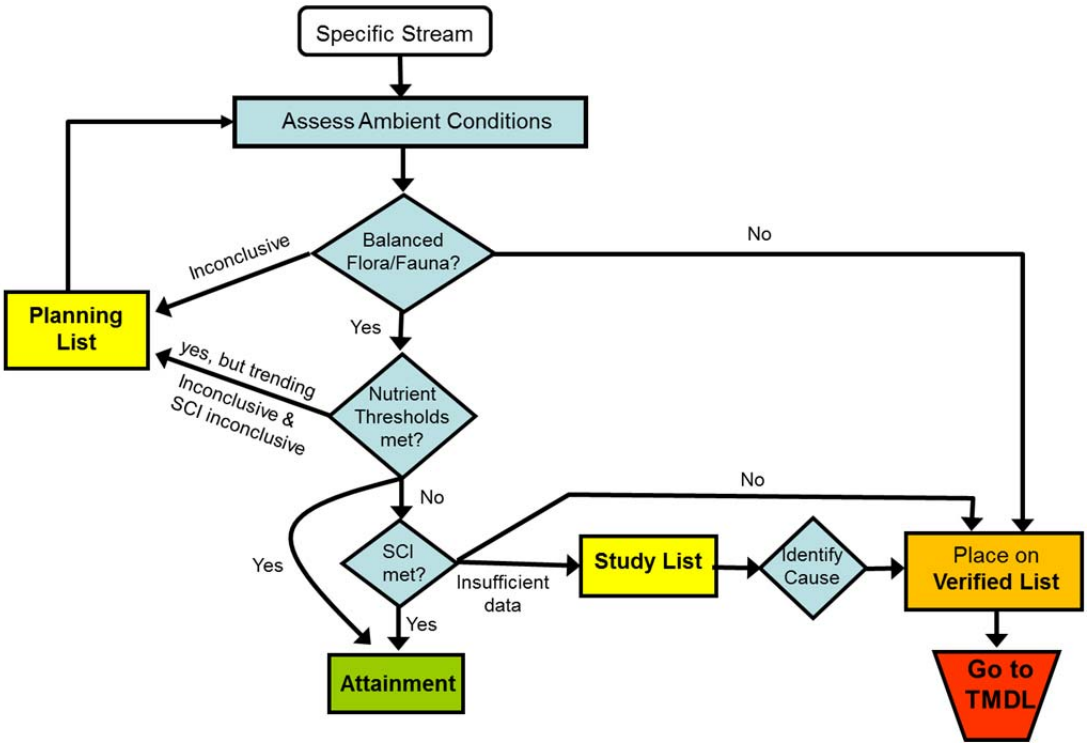
One particular feature of the Florida process needs to be emphasized: If the waterbody is covered by a nutrient TMDL then that TMDL (and any implied nutrient criteria) governs the listing and the load reduction strategy for that water. The Florida process described in the next section is for those places where there is no existing TMDL limit for nutrients.

[1] Authors listed alphabetically. No senior author assigned.

Florida Numeric Nutrient Standard Process

Florida does not utilize a single numeric criterion to identify nutrient impaired waters but instead relies on a process that utilizes multiple lines of evidence to identify nutrient-related water quality impairments. The process is summarized in Figure 1. The process, as described in Figure 1, begins with flowing waters (roughly equivalent to the Virginia concept of wadeable streams) without an existing TMDL or site-specific numeric nutrient criteria (NNC).

Figure 1: Florida's Numeric Nutrient Standards



The first decision step in the Florida assessment process for flowing waters without a site-specific NNC is a floral assessment. At EPA's insistence, Florida included a flora assessment under the assumption that excessive nutrient loads would likely manifest "unbalanced" algae or plant growth. The flora screen includes four different measures: 1) algal mats, 2) changes in algal species, 3) nuisance macrophyte growth, and 4) chlorophyll *a* levels (FDEP 2013). A minimum of two temporally independent samples are required for an assessment of each measure. All four parameters must be measured before moving to the next stage of the assessment. If any of the four flora measures do not meet the designated levels, the water is listed as impaired and placed on the 303d list (verified waters list). If flora measures are "inconclusive" (the waterbody has less than two sampling points), the water is placed on the planning list.

By rule, Florida defines the planning list as: "the list of surface waters or segments for which assessments will be conducted to evaluate whether the water is impaired and a TMDL is needed" (62-303.200-17). The planning list is intended to identify waters where there is insufficient data to make a determination of impairment without placing the waterbody on a 303d impairment list.

Furthermore, "the planning list shall be submitted to EPA for informational purposes only" (62-303.150). This language was inserted to explicitly separate the list of inconclusive waters from the TMDL regulatory framework.

The next stage of the Florida assessment involves either an assessment of the ambient nutrient concentrations in the waterbody or a stream condition index (SCI) value. The state may use only one measure in the second assessment stage. Presumably the nutrient measure would be the threshold most likely used for assessment in the second stage of assessment. Florida developed five sets of thresholds based on separate ecoregions and a rigorous reference-stream approach (FDEP 2013; Appendix B). Thresholds range from 0.67 mg/L to 1.87 mg/L for nitrogen and from 0.06 mg/L to 0.49 mg/L for phosphorus. The rules specify minimum data requirements necessary to make a nutrient-threshold determination. If insufficient data exists to make a determination, Florida rules require that the waterbody be placed on the planning list.

A waterbody that passes the flora screen and falls below the nutrient thresholds for nitrogen and phosphorus is classified as attaining nutrient water quality standards (no SCI measures are required). However, exceedance of the nutrient thresholds does not automatically place the waterbody on the impaired 303d list. If the waterbody exceeds either the nitrogen or phosphorus threshold, the SCI is assessed. The waterbody achieves attainment status if the SCI thresholds are achieved. Florida rules generally require that any water that fails the SCI be placed on the verified list. Waters where the nutrient levels exceed the nutrient thresholds but the SCI is inconclusive are placed on the study list. The study lists includes waters that are thought to be impaired, but the cause of the impairment has not yet been identified and is therefore in need of further study (62-303.150).[2]

The Florida process also includes protocols for identifying waters currently in attainment but where data suggest that the waterbody may become impaired in the future without active intervention. If statistically significant adverse trends in nutrient concentrations and other undesirable indicator measures (chlorophyll *a*) are identified, FDEP will initially place the water body on the planning list for more rigorous analysis (see Figure 1). Additional analysis will then be conducted to control for confounding variables (e.g., flow). If the trends indicate that the waterbody will become impaired within 10 years, then the waterbody will be placed on the study list, and the FDEP "will develop a site specific interpretation of the NNC for the waterbody" (FDEP 2013, p. 30).

Comparisons with the Virginia Screening Process

At a conceptual level, Virginia's proposed nutrient screening approach generally reflects the Florida NNC stream process in that ambient numeric nutrient levels are not the sole basis for determining whether a waterbody is nutrient impaired. The EPA-approved Florida process and the proposed Virginia process share the following features:

- Like Florida's process, the proposed Virginia process acknowledges the complex and uncertain relationship between nutrient levels and impairment of designated uses, and both approaches rely on an iterative process to address this physical reality. Use of

[2] For waterbodies that have inconclusive flora measures and the nutrient threshold is exceeded, the waterbody will be placed on the study list or verified list depending on the status of the SCI index (these situations are not shown in Figure 1).

ambient numeric nutrient concentrations as the sole criteria for judging impairment is problematic because of the physical dimensions of nutrient response. Because nutrient concentrations are not the sole basis for identifying impairments, Florida refers to target nutrient concentrations as "thresholds," not criteria. Virginia's proposed process, like Florida's process, identifies impairments caused by nutrient impairments based on multiple lines of evidence.

- In both state processes, exceedance of an ambient nutrient concentration threshold alone does not trigger an impairment designation. In the proposed Virginia process, exceedance of the no-observed-effect-concentration (NOEC) threshold does not necessarily trigger an impairment designation. The exception occurs for Virginia's observed-effect-concentration (OEC) threshold; if the Virginia OEC is exceeded, the water is identified as impaired. Florida does not have an equivalent measure.
- Both state processes rely on biological indicators to sort out which waters of concern – those where ambient concentrations exceed thresholds – are in fact impaired.

Each state process, however, does exhibit some differences in implementation. The differences include:

- Whereas both Florida and Virginia use flora measures as part of the assessment process, Florida uses four flora measures as the initial screen that all waters must pass. Virginia proposes to use nutrient concentrations as the initial screen. Virginia proposed to use flora thresholds (visual assessment) in its second stage to identify waters that are impaired by nutrients. Technically, not all Virginia streams would be assessed by flora criteria.
- Virginia and Florida used different methods to identify nutrient numeric thresholds. Florida was required to make use of an extensively investigated reference-stream approach (FDEP 2013; Appendix B).
- The Florida process has a specific procedure to identify potential future water quality problems (trend analysis).
- To date, Virginia has not identified what specifically defines the level of data sufficient to make a determination (at every decision point: nutrient thresholds, flora thresholds, SCI, etc.) and what the statistical rule is to make a decision.

Conclusions

The AAC has proposed a screening approach to Virginia DEQ. The proposed AAC approach is consistent with that approved by EPA for Florida in that neither classifies waters based on a single nutrient criterion, and both rely on a weight-of-evidence process. More specific lessons from the Florida experience as well as recent EPA guidance follow:

1. The Stoner 2011 memorandum and the currently proposed EPA rule indicate that EPA may provide additional time to develop ambient nutrient limits for all waters if the state takes nutrient reduction actions that are independent of having nutrient criteria. The following two actions can be offered as evidence for EPA granting more time for development of the screening process.

    a. If a Florida waterbody has a nutrient TMDL then the TMDL limits (and any implied nutrient criteria) govern the listing and the load reduction strategy for that water. The implication for Virginia, if DEQ adapts the Florida process, is that the screening process could initially only be applied where there is no existing TMDL. Therefore, DEQ could

make the case to EPA that many of the state waters already have nutrient criteria backed out of the Chesapeake Bay TMDL, and as such, the state has undertaken nutrient-management actions that are protective of water quality.

b. DEQ can argue that other efforts are already protective of water quality. Specifically, all regulated sources are being aggressively required to limit nutrient sources (municipal point, industrial point, municipal storm water), and there are strong efforts to limit non-point sources in the Bay watershed and elsewhere. While these actions are not based on ambient criteria, the DEQ has demonstrated a commitment to being protective of water quality.

2. DEQ must acknowledge Virginia data limitations relative to Florida if it proposes EPA approval of the screening approach. Three actions for DEQ are suggested. First, there may need to be a DEQ commitment to increased funding for monitoring and assessment or, at a minimum, reallocation of funds for these purposes. Perhaps the criteria implied by the Bay TMDL might suggest that DEQ direct currently limited monitoring and assessment resources, and some share of an increment to those resources, to implementing the screening process for waters outside the Bay watershed. Second, DEQ might redesign some of the data collection processes to become more cost effective for meeting the data requirements of the screening process (see AAC 2012 report for some ideas). Third, these data limitations might require DEQ's screening approach to rely on statistical procedures that result in a higher (than Florida) acceptance of false-positive errors when listing streams as nutrient impaired.

3. DEQ might consider the following AAC contributions to further development of the screening process. The AAC could make an explicit translation of the approved Florida process (to include the Florida flow charts) into the Virginia context. This translation will be essential if DEQ wants to identify the features of the Florida process that need particular attention for use when developing Virginia regulations. For example, Virginia should consider creating a process for evaluating indeterminate or inconclusive water without triggering regulatory actions or listings. Also, the AAC could help design the screening process to make it most acceptable to EPA (examples of needed changes include: kind of floral criteria and their placement in the process and the need for trend analysis). Finally, the AAC could help DEQ estimate how increased or reallocated spending on monitoring and assessment might reduce the number of false-positive decisions.

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Appendix A: Overview and Status of the Florida Numeric Nutrient Criteria

Frank Nearhoof

Timeline of Events

- In 1998, the U.S. Environmental Protection Agency (EPA) issued guidance to the states in the form of a publication entitled *National Strategy for the Development of Regional Nutrient Criteria* (EPA 822-R-98-002). The publication described the approach EPA would use with states and tribes to develop numeric nutrient criteria (NNC) as a part of their water quality standards (WQS).
- In response to the above guidance, Florida formed a technical advisory committee (TAC) in 2001. In 2002, EPA and the Florida Department of Environmental Protection (FDEP) reached mutual consensus on an initial NNC development plan, which was derived through the discussions of the TAC and in consultation with EPA. Between 2001 and 2008, the TAC met 18 times, and the NNC development plan was amended as Florida continued to make progress toward adoption of NNC.
- In 2008, a Clean Water Act (CWA) citizen suit was filed against the EPA, alleging that it had a mandatory duty to adopt NNC in Florida.
- In January 2009, EPA issued a determination under section 303(c)(4)(B) of the CWA that NNC were necessary in Florida (conspicuously, there was no mention that such NNC were necessary in other states). The determination led to EPA settling the lawsuit, and the settlement was memorialized in a consent decree. Florida was not a party to the lawsuit and did not participate in the settlement negotiations that led to the consent decree.
- Pursuant to the consent decree, in January 2010, EPA published draft NNC for Florida's lakes and flowing waters. EPA solicited public comment on its proposed draft and held three public meetings in Florida. The proposed rule did not include NNC for downstream-protection values in streams, South Florida inland waters (including canals), or estuarine and coastal waters. Final NNC were published in December 2010.
- Not long after the publication of the final rule for inland waters, EPA received several legal challenges to its rule. These challenges were resolved in a court ruling on February 18, 2012. While upholding EPA's January 2009 determination and much of its final December 2010 rule, the court invalidated EPA's NNC for Florida's streams and EPA's downstream protection value for lakes that are meeting the lake NNC established in EPA's final December 2010 rule (unimpaired lakes). The court ordered EPA to re-propose criteria for these waters.
- On June 28, 2013, EPA made a revised determination regarding Florida NNC that limited the scope of the fresh waters covered under the previous determination (excluded South Florida flowing waters, marine lakes, tidal creeks, and conveyances). EPA also filed a motion to modify the consent decree in federal court, and the court approved the changes in a January 7, 2014 ruling.

Status of Florida's Adopted Numeric Nutrient Criteria

NNC had already been developed in the Florida Everglades (2003). In an effort to control its own destiny, Florida adopted NNC for a variety of waters starting in December 2011 and continuing through 2013:

- Lakes, streams, spring vents, and Southwest/South Florida estuaries - December 8, 2011 (Note: Non-perennial streams, man-made or physically altered canals/ditches with poor habitat used primarily as water conveyances for flood control, irrigation, etc., and tidal creeks are currently excluded by the stream definition used; however, all streams are presumed covered under the stream NNC until information is provided that it qualifies for an exclusion).
- The majority of Florida's estuaries are covered by NNC. NNC for the estuaries in Southwest/South Florida (Clearwater Harbor, Tampa Bay, Sarasota Bay, Charlotte Harbor, Caloosahatchee Estuary, Southwest Coast, Florida Bay, Florida Keys, and Biscayne Bay) were adopted in 2011, and NNC for the Florida Panhandle (Perdido Bay, Pensacola Bay, Choctawhatchee Bay, St. Andrews Bay, St. Joseph Bay, and Apalachicola Bay) were adopted in 2012. NNC for the Loxahatchee River, Lake Worth Lagoon, Halifax River, Guana River/Tolomato River/Matanzas River, Nassau River, Suwannee River, Waccasassa River, Withlacoochee River, and Springs Coast, as well as satellite-derived chlorophyll *a* criteria for portions of the Florida coast were adopted in June 2013. Interim criteria for the remaining estuaries in the state were established in an August 1, 2013 report to the governor and legislature.

As of September 2013, EPA had approved all of the NNC submitted by FDEP, including the August 1, 2013 report. FDEP is now (June 2014) waiting for EPA to formally rescind their promulgated NNC for lakes and spring vents, which is a required step before Florida's NNC take effect.

Summary of Proposed EPA Rulemaking Related to NNC

The proposed EPA rulemaking amends 40 CFR Part 131 in several programs areas; all of the amendments will have an impact on the WQS programs of states. However, only the proposed amendments regarding the administrator's determination that new or revised WQS are necessary directly relate to the circumstances associated with establishment of NNC in Florida. To address this issue, EPA is proposing to amend paragraph (b) of 40 CFR § 131.22 to add a requirement that an administrator's determination must be signed by the administrator or his or her duly authorized delegate and must include a statement that the document is a determination for purposes of section 303(c)(4)(B) of the CWA.

EPA states in their rationale document that "…the process whereby the Administrator determines that new or revised standards are necessary is not always clearly understood or interpreted by the public and stakeholders." They further state: "In some instances, this lack of understanding has led to a mistaken conclusion that the EPA has made a CWA 303(c)(4)(B) determination when, in fact, the EPA did not make nor intend to make a determination." Although they do not specifically mention Florida, this is precisely the circumstance underlying the Florida lawsuit. EPA initially defended itself in this case, until it decided that the path of lesser resistance would be to explicitly make such a determination and to then enter into a consent decree in the case to allow time to work with Florida and promulgate NNC. This proposal, once adopted, should serve to deter such lawsuits.

Review of comments from several states and the National Association of Clean Water Agencies indicates strong support from the states for this specific component of the EPA proposal.

Comments by Environmental Groups on Proposed EPA Rule

A number of environmental groups provided comments on the EPA proposal. The most extensive comments came from EarthJustice, but there were significant comments from other environmental groups around the U.S., including the Natural Resources Defense Council and Riverkeeper Alliances. The consistency of the theme of the environmental group's comments suggests that the groups made a concerted effort to make them so.

EarthJustice commented that "The Proposed Rule Constraining Administrator's Determinations Is Unnecessary And Contrary To The Intent And Purposes Of The Clean Water Act [CWA]." EarthJustice describes the EPA proposal as an effort "…to very narrowly construe what it means for the Administrator to determine that a new or revised standard is necessary, imposing highly formalized constraints on what constitutes a 'determination' for purposes of invoking EPA's mandatory obligation to promulgate adequate standards." They state that EPA's stated rationale is thin and unsupported by actual experience. EarthJustice further states that the case law supports this conclusion and that EPA's website reveals only three instances in which EPA has actually made a determination, one of which is the Florida instance. Finally, they state: "…EPA has a history of refusing to make determinations even when it should in order to ensure the Clean Water Act is adequately implemented…. The new rule will enable EPA to further insulate itself when states and EPA fail in their obligations to ensure that water quality standard[s] protect designated uses." They go on to cite a number of examples where states and EPA have failed to promulgate adequate WQS.

In closing their comments, EarthJustice states, "In the event that EPA insists on the proposed narrowing of the definition of determination under § 303(c)(4), EPA must take an additional step to create a structure for when those determinations should and will occur." Their suggested structure is to include "…a process whereby once EPA gives a state feedback regarding inadequate or missing water quality standards, EPA is also clear that the state now faces a deadline." They suggest a one-year deadline to give the state adequate time to develop a standard and allow public process. However, at the end of the year if the state's WQS failed to fulfill the purposes of the CWA, EPA must make a determination, and if the state fails to adopt a more protective standard, EPA shall promptly promulgate a standard for the state. They suggest EPA be required to promulgate within 90 days and the promulgated rule be in effect following another 90 days. Finally, they suggest inclusion in the rule of a "requirement that EPA will respond to any petition for a determination within one year of the filing of the petition with EPA."

Comments from the other environmental groups generally follow these suggestions, and some of the groups explicitly incorporate EarthJustice's comments by reference.

Potential Implications of the Proposed EPA Rule

If EPA adopts the rule as proposed, it should have the beneficial effect of allowing interactive communication between the states and EPA regarding the status of their NNC development and adoption without fear of having the array of legal activities that occurred in Florida. Although Florida was able to ultimately develop and adopt NNC, it required a herculean effort, and the resources spent dealing with the legal activities would have been better spent in the state's

restoration efforts. Hopefully, EPA will not include the timelines suggested by the environmental groups in the rule. It can take significant amounts of time to develop scientifically defensible NNC due to the nature and complexity of nutrient effects, and it would be unfortunate if the science had to be rushed to meet arbitrary rule deadlines.

Appendix B: Comparison of Virginia AAC's Approach with Florida's Approach for Stream Nutrient Criteria

Frank Nearhoof

Background

During the development of nutrient criteria, Florida conducted extensive analyses on the significant body of data available from Florida's streams. The intent was to identify a quantifiable cause/effect relationship between a desired biological attribute of the stream and phosphorus (P) and/or nitrogen (N) concentrations in the stream. That relationship could then be used to identify an appropriate N and/or P concentration above which an imbalance of flora or fauna would occur and to establish that concentration as a numeric nutrient criterion (NNC). The results of those analyses are in the report entitled *Technical Support Document: Development of Numeric Nutrient Criteria for Florida Lakes, Spring Vents and Streams* (available at: http://dep.state.fl.us/water/wqssp/nutrients/docs/tsd-nnc-lakes-springs-streams.pdf).

The results of the analyses generally indicated that many of the biological measures evaluated do exhibit a statistically significant adverse response to nutrient enrichment; however, the relationships between the biological response variables and nutrient levels were confounded by numerous other factors such as water color, pH, conductivity, and canopy cover. The confounding effects of these other variables resulted in very weak statistical relationships between measures of the biological communities and nutrient levels. Whereas the effect of nutrients on the biological communities was not clear enough to be used as the sole basis for establishing NNC for streams, the observed relationships between nutrients and the various biological measures did demonstrate the need for NNC. Therefore, Florida chose to pursue the establishment of NNC through a reference approach for streams, consistent with U.S. Environmental Protection Agency (EPA) guidance when the preferred cause/effect approach cannot be used.

Florida's Reference Approach for Streams

Florida's approach, which Florida termed the "Nutrient Benchmark Site Distributional Approach," expanded significantly beyond EPA's best-professional-judgment approach regarding the selection of reference streams. In discussions with EPA, it became apparent that EPA would only be able to approve this approach if Florida developed an extremely rigorous, multi-step process to ensure that the sites eventually selected truly represented minimal human disturbance and full designated use support. This multi-step evaluation included:

- Selection of candidate reference sites by identifying sites with a corridor Landscape Development Intensity (LDI) Index[3] score of ≤ 2 (this step alone eliminated the majority of Florida sites from further consideration). Two additional benchmark exclusions were ultimately based on a whole watershed LDI analysis conducted by Tetra Tech on behalf of EPA, which used a watershed LDI threshold of 3;
- Elimination of sites included on the state's 303(d) list of impaired waters due to nutrients or dissolved oxygen related to nutrients;

[3] Brown, M.T. and M.B. Vivas. 2005. Landscape Development Intensity Index. *Environmental Monitoring and Assessment* 101: 289-309.

- Elimination of sites with nitrate concentrations greater than the 0.35 mg/L proposed nitrate-nitrite criterion, which reduced the possibility of including sites with far-field human disturbance from groundwater inputs;
- Verification of surrounding land use by examining high resolution aerial photographs taken in 2004-2005;
- Obtaining input from FDEP district scientists knowledgeable of the area;
- Performing a statistical outlier analysis of nutrient concentrations to remove potentially erroneous data; and
- Finally, conducting an extensive field-evaluation process, including a watershed assessment with verification of surrounding land-use and biological evaluation, of a large percentage of the remaining waterbodies containing benchmark sites, with the emphasis on sites with nutrient concentrations greater than the mid-range of the distribution.

Through this process, candidate reference sites were subjected to a systematic, comprehensive evaluation process prior to including them as benchmark sites. Whereas this process appears similar to the method used by Virginia to develop the no-observed-effect-concentration (NOEC) values for the Screening Approach, it is likely, based on Florida's experience, that Virginia will need to conduct similar steps to vet the reference sites in order to secure EPA approval.

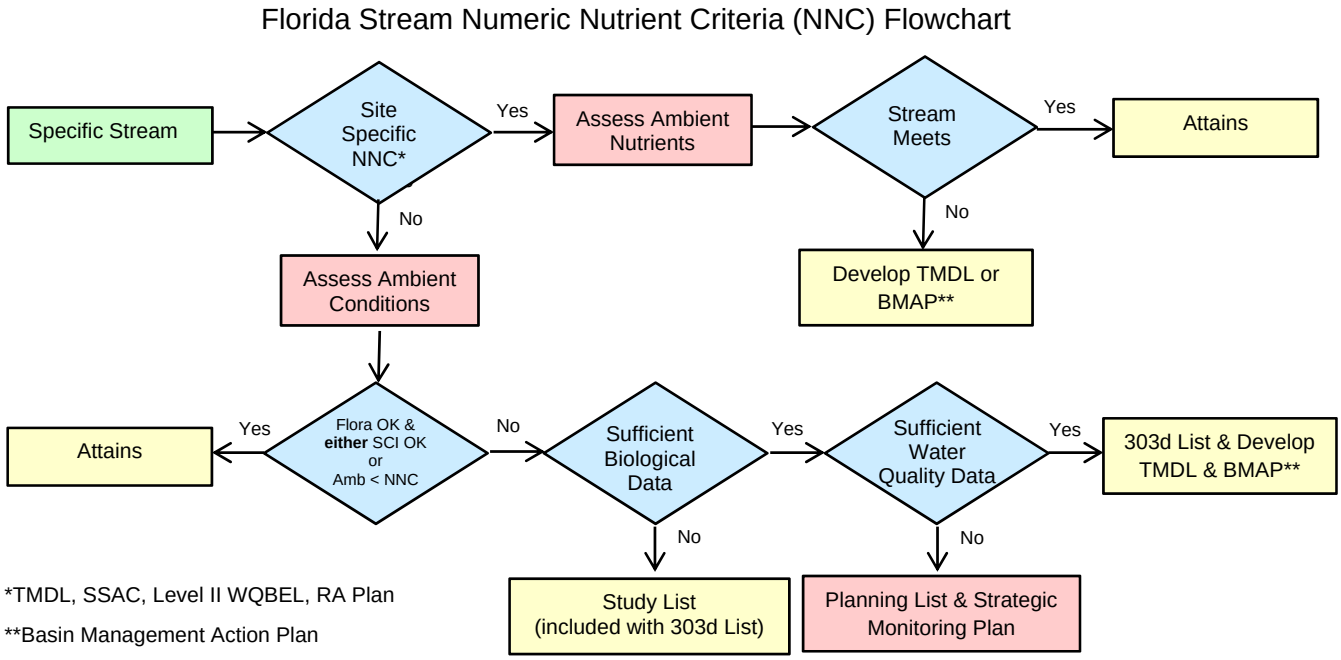
Use of "Thresholds" as NNC

To establish appropriate NNC, Florida used nutrient data associated with stream benchmark sites from various Florida datasets. Data were screened for potential data quality issues (e.g., improper sample preservation, analysis performed outside of hold time, etc.). A number of the benchmark waterbodies were sampled numerous times by different agencies and were often located within several hundred meters of each other. Therefore, to avoid biasing the analyses toward the larger water bodies with multiple sampling sites within close proximity to each other and to take into account spatial variability, the station level data were aggregated by hydrologic units, called Water Body Identifiers (WBIDs), associated with the benchmark sites. To take into account temporal variability, annual geometric mean (AGM) nutrient concentrations were calculated for each WBID. Finally, to take into account inherent regional biological and water quality differences in Florida, AGMs were compiled for five bioregions: Panhandle West, Panhandle East, North Central, Peninsula, and West Central bioregions. Nutrient criteria were derived using the 90^{th} percentile of the AGMs for these bioregions, except for the West Central bioregion where the 75^{th} percentile was used. The lower percentile was used in the latter bioregion owing to less statistical confidence because of a relatively small dataset. Although there is a high degree of confidence that waterbodies with nutrient concentrations below these values will not be impaired, it cannot be said that the converse is true. In fact, uses of these values without additional considerations would inherently determine 10% of the relatively pristine benchmark waterbodies to be impaired. Therefore, Florida termed these values "thresholds" and coupled them with a biological confirmation step in order to use them as NNC.

Florida's Evaluation Process for Streams

The process Florida uses for evaluating NNC in streams, depicted in Figure A-2 from the National Academy of Sciences 2012 report, differs significantly from the Screening Approach, depicted in Figure 1 of the AAC 2012 report. Because Florida was not able to identify effects-

based values, Florida was forced to use the reference-based approach described above. Florida's process is depicted in the figure below.



It should be noted that this approach requires an extensive effort due to the significant reliance on biological monitoring. Florida believes it has the resources to do the monitoring and that doing so is inherently preferable to potentially identifying waters as impaired that are actually not.

Florida's Evaluation Process for Lakes

The Virginia Screening Approach is relatively more analogous to the lake NNC in Florida. Those criteria were developed using cause-effect relationships between nutrients and lake chlorophyll levels. To do that, lakes were separated into three types: colored (> 40 PCU); clear, acidic (< 40 PCU; < 20 mg/L $CaCO_3$); and clear, alkaline (< 40 PCU; > 20 mg/L $CaCO_3$). Relationships between N and P and chlorophyll *a* in each of those categories were used to develop criteria. The criteria were derived using the 50% prediction interval around the relationship using a desired target value to derive an upper and lower limit. For instance, for clear alkaline lakes, using a desired chlorophyll target value of 20 µg/L, a lower total phosphorus (TP) limit of 0.09 mg/L and an upper TP limit of 1.91 mg/L were derived. In applying these values, if there are insufficient data to calculate the annual geometric mean of chlorophyll *a* for a given year or the annual geometric mean of chlorophyll *a* exceeds the appropriate chlorophyll *a* value for the lake type, then the applicable numeric interpretations for total nitrogen (TN) and TP are the minimum values. If there are sufficient data to calculate the annual geometric mean of chlorophyll *a* and the mean does not exceed the appropriate chlorophyll *a* value for the lake type, then the TN and TP NNC for that calendar year are the annual geometric means of ambient TN and TP samples for that lake, subject to the minimum and maximum TN and TP limits (i.e., they

cannot be lower than the minimum or higher than the maximum, but they will "float" between these values in any given year).

Comments on Visual Assessment (Second Stage)

It may take a significant effort to get EPA to approve the visual assessment in the Screening Approach. To approve Florida's NNC, EPA was insistent that a rigorous method be developed to assess stream flora. To gain approval, Florida developed the following methods to assess stream flora for indicators of impairment:

- A rapid periphyton survey (RPS) method to determine the presence and extent of algal mats in the stream.
- Algal species composition change assessment. This assessment evaluates whether the dominant taxa of the stream algal community include taxa known to be nutrient-enrichment indicators.
- A method to evaluate the presence or absence of nuisance macrophyte growth, called the Linear Vegetation Survey.
- A method to determine the presence or absence of algal blooms. An unacceptable phytoplankton bloom would consist of a situation where an algal species, whose noxious characteristics or presence in sufficient number, biomass, or areal extent, may reasonably be expected to prevent, or unreasonably interfere with, the designated use of a waterbody. Florida also assesses trends in algal concentrations as a part of this method.

In order for a stream to be deemed healthy, all floral measures must be within the reference site distribution for the metric. Additional details on these methods and their application are available in FDEP's *Technical Support Document: Development of Numeric Nutrient Criteria for Florida Lakes, Spring Vents and Streams* (2012).

References

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