



Conceptual Framework for DEP's Nutrient Standards

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Background

Nutrient effects on aquatic ecosystems are moderated in their expression by many natural site-specific factors (e.g., light penetration, hydraulic residence time, presence of grazers, habitat considerations), making broad-based numeric criteria development more complicated than for other parameters, such as for toxic substances. This requires a new conceptual model. The Department is exploring a concept that recognizes the site-specific nature of nutrient effects and uses available information to best inform decisions on a case-by-case basis.

Guiding Scientific and Policy Principles for Nutrient Criteria

- 1) Because many natural factors affect the expression of nutrient loadings on a given ecosystem, numeric interpretations are most accurate when determined as a site-specific function. Therefore, nutrient Total Maximum Daily Loads (TMDLs), Site Specific Alternative Criteria (SSAC), and other site specific actions written to achieve the narrative nutrient criteria should be given preference over more broadly applicable interpretations.
- 2) Absent site-specific analyses, criteria based on a quantifiable linkage between anthropogenic nutrient enrichment and a biological response can be used to numerically interpret the narrative nutrient criteria.
- 3) There is value in knowing whether nutrient concentrations are potentially elevated to environmentally harmful levels, but it is important to identify adverse biological effects and determine they are linked to nutrients before deciding that nutrient reductions should be pursued.

- 4) Given the potentially burdensome administrative effects of developing site-specific alternative criteria and high costs of implementing numeric nutrient criteria, care should be taken to avoid any unnecessary and duplicative procedures that do not add value to actual waterbody protection and restoration.

Proposed Concept

The Department, recognizing the role of site-specific factors that affect numeric responses, proposes to base new standards on establishing **a systematic numeric interpretation of the existing narrative criteria**. As was also the case for the Environmental Protection Agency's rule at 40 CFR 131.43(e) [Federal Register, Volume 75, Number 233, Page 75762], this concept is intended to implement Rule 62-302.530 (47)(b), FAC, which states that "in no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna."

Proposed Rule Structure

The narrative nutrient criteria would continue to apply to all waterbodies, and numeric interpretations would be applied based on the scientific information available. The narrative would be implemented using a systematic structure that numerically interprets the narrative nutrient criteria for each waterbody in the following hierarchical manner:

1. Established site specific numeric interpretations of the narrative criteria (including TMDLs, SSACs, and other interpretations embodied in an official Department action) would be the primary interpretation of the narrative nutrient criteria.
2. If "1" (above) is not available for a waterbody, the interpretation of the narrative criteria for a specific waterbody would be based on established, quantifiable nutrient cause and effect relationships where the nutrient concentrations responsible for causing an imbalance of natural populations of aquatic flora or fauna is understood (currently, this is limited to fresh water springs and lakes).
3. If "1" and "2" (above) are not available, a combination of reference-based nutrient thresholds and biological information will be used in the following manner and as described in **Figure 1** (currently, this is limited to fresh flowing waterbodies excluding largely intermittent streams):
 - a. Waters achieving the nutrient thresholds that are also biological healthy (*e.g.*, using SCI and measures of floral health) are deemed to meet the narrative criteria.
 - b. Waters that exceed the nutrient thresholds but also reflect balanced flora and fauna (*e.g.*, using SCI and measures of floral health) are deemed to meet the narrative nutrient criteria.
 - c. Waters that meet the nutrient thresholds but are not biologically healthy are deemed to not attain Aquatic Life Use Support goals. DEP would target these waters for a stressor identification study to determine the causative factor(s).

These waters are initially deemed to attain the narrative nutrient criteria unless the stressor identification study links the adverse biological effects to nutrients.

- d. Waters that exceed the nutrient thresholds that are not biologically healthy would be deemed to not attain the narrative nutrient criteria unless a stressor identification study determines that nutrients are not the causative pollutant.

For “c” and “d”, if nutrients are identified as a causative pollutant, the Department will develop a TMDL or SSAC, at which point the numeric interpretation would default to the provisions of “1” after Department action. During these studies, confounding factors (those other than nutrient effects) will be considered.

		Biology ⁽¹⁾	
		Healthy	Not Healthy
Nutrients	Meet Threshold	Attains narrative nutrient criteria.	Does not attain Aquatic Life Use Support. Attains narrative nutrient criteria unless stressor ID links adverse effects to nutrients.
	Exceed Threshold	Attains narrative nutrient criteria.	Does not attain narrative nutrient criteria unless stressor ID shows nutrients are not causative pollutant.

(1) If biological data are not available, but nutrient thresholds are met, water attains narrative nutrient criteria. If biological data are not available, but nutrient threshold exceeded, water placed on “study list”.

Figure 1. Graphic description of DEP process for determining attainment with narrative nutrient criteria in flowing freshwater streams using a combination of nutrient reference-based thresholds and biological information.

General Discussion on Proposed Rule Structure

- Attainment of the narrative criterion is assessed as a spatial average for the waterbody. If interpreted based on a TMDL or SSAC, the spatial component is as defined in the TMDL or SSAC document. If based on a generally applicable dose-response relationship, it will be as stated in a manner consistent with the derivation of the criterion. For reference-based thresholds, the spatial extent will be determined by site-specific considerations, such as relative system homogeneity, system classification, biological

expectations, or empirically measured responses. Waterbody segments or aggregations of segments may be appropriate in many, but not all cases.

- If there are both a TMDL and a SSAC for a given waterbody, the most recently adopted TMDL or SSAC would take precedence.
- Protection of downstream waters will be provided using a narrative, rather than “downstream protection values”. In no case shall the loading of nitrogen or phosphorus from a Class I or III fresh water stream or lake cause or contribute to an exceedance of water quality standards in a downstream waterbody. Upstream actions taken by the Department would consider downstream standards pursuant to this narrative.

Additional Description of Hierarchical Approach

Discussion on TMDLs as NNC

- Only State adopted nutrient related TMDLs would be eligible as site-specific interpretations of the narrative nutrient criteria.
- To be eligible, the nutrient TMDLs should be based upon prevention of imbalances of flora or fauna [Rule 62-302.530 (47)(b), FAC], but TMDLs for dissolved oxygen (DO) (Rule 62-302.530 (47)(a), FAC) would also be eligible if nutrients were identified as a causative pollutant and the TMDL demonstrated that it would also prevent an imbalance of natural populations of flora and fauna. As an example, surplus anthropogenic nutrients could be shown to be generate excess plant biomass (periphyton, phytoplankton, or vascular plants), which could by themselves constitute an imbalance in flora or result in habitat smothering (e.g., excess periphyton accumulation), food web alteration (e.g., dominance of taxa that thrive in nutrient enriched conditions), or low DO (from decomposition or respiration of excess plant biomass), etc., that results in imbalances in fauna, as reflected by failing SCI scores or other meaningful biological endpoint (e.g., seagrass and transparency, etc.). If the TMDL is written to prevent this cycle and then achieve DO, it could be eligible as the numeric interpretation of Rule 62-302.530 (47)(b), FAC.
- Many TMDLs are expressed as loads instead of concentrations, but the loads do not have to be translated into concentrations to be deemed the numeric interpretation of the narrative nutrient criteria.
- TMDLs may be modified based on new data, new science, or different targeted endpoints (such as DO). When TMDLs are modified and readopted, they become the new interpretation of the narrative.
- Future TMDL rules may include a response target (chlorophyll a, for example) designed to implement the narrative nutrient criterion. Scientific information relating to the response target and the bases for existing TMDLs are presented in the TMDL reports, and this information can be used to establish a site-specific listing threshold for nutrient impairment pursuant to Rule 62-303.450, F.A.C.
- TMDLs may be written to achieve numeric nutrient values established in Chapter 62-303 (lakes or springs), or alternatively, be written to achieve conditions necessary to protect

the narrative nutrient criteria. If written to achieve the narrative nutrient criteria, the site-specific thresholds used for the TMDL would become the numeric interpretation of the narrative pursuant to “1” of the hierarchy.

Discussion on Site Specific Alternative Criteria as NNC

- The current restriction on establishing a SSAC for nutrients pursuant to Rule 62-303.800(2), F.A.C., would be eliminated.
- A structure to allow a predictable approach to developing nutrient SSACs (such as the previously proposed Type III SSAC) would be included as part of the rulemaking. The rule language will provide clear expectations on the water quality and biological data needed to characterize existing nutrient concentrations and aquatic health, but the specific number of stations required for assessment will be determined on a site specific basis.
- Since numeric nutrient criteria are intended to protect healthy, well-balanced natural populations of flora and fauna, if the biology is found to be healthy, then the existing nutrient concentrations are deemed protective. The nutrient SSAC will need to address the natural variability in nutrient concentrations. Any SSAC must demonstrate that the designated use is being protected.
- As part of Type III SSAC development, aquatic life use support must be demonstrated. Waterbodies where the average of two temporally independent Stream Condition Index (SCI) results is greater than 40 and that do not exhibit excess algal growth or nuisance aquatic plants are biologically healthy.
- DEP will consider phytoplankton, periphyton, and vascular plant community responses as additional evidence to demonstrate systems are meeting their designated use. Impaired Waters Rule chlorophyll a metrics may also be used for this demonstration.

Criteria Based on Cause-Effect Relationships

Scope of Approach

For springs and lakes, quantifiable nutrient cause and effect relationships provide the basis for the numeric interpretation of the narrative nutrient criteria:

Springs: Nitrate criterion of 0.35 mg/L, as an annual average.

Lakes: Use the existing chlorophyll/nutrient regression equations, acknowledging the uncertainty in the equations by allowing for “modified” criteria when chlorophyll targets are achieved.

Discussion of Numeric Interpretations Based on Cause and Effect

- The scientific bases for the spring and lake criteria have been previously presented in DEP 2009 document, [“Development of Numeric Nutrient Criteria for Florida Lakes and Streams”](#).

- In highly colored lakes (long term average >140 PCU) where there is no longer a cause and effect relationship, the narrative nutrient criteria should continue to apply.
- DEP is re-examining regionalization and morphoedaphic factors (color, alkalinity) to establish more appropriate lake criteria for some situations.
- Paleolimnological evidence may provide the basis for alternate natural chlorophyll targets in many Florida lakes, which could allow adjustment in the acceptable TP and TN using the regression equations.

Flowing Waters (Streams)

Discussion of NNC Process for Streams

- DEP plans to use referenced-based stream nutrient values, such as EPA's promulgated criteria, as thresholds during the process for numerically interpreting the narrative criteria described in this document.
- Note that the reference-based nutrient values were derived as waterbody geometric means. Spatial application of these values to streams is determined by site-specific considerations, such as relative system homogeneity, system classification, biological expectations, or empirically measured responses. WBIDs or aggregations of WBIDs may be appropriate in many, but not all cases.
- Reference based nutrient values were derived in generally perennial streams. Application of these values to intermittent streams is not appropriate given their derivation and expression.

Waterbody Types and Cases with Insufficient Information

In aquatic systems where insufficient information currently exists to accurately interpret the narrative nutrient criteria, such as Class III wetlands, Class III flowing waters in South Florida, and Class III intermittent streams, the narrative will continue to apply, and the Department will numerically interpret the narrative criteria as the information is developed.

Implementation Considerations

Permitting

- Nutrient effluent limits for facilities discharging to surface waters will be developed through the Water Quality-Based Effluent Limitations (WQBEL) process pursuant to Chapter 62-650, F.A.C. Nutrient WQBELs developed to date were developed to attain the narrative nutrient criteria, and these WQBELs will remain in effect unless a more recent wasteload allocation (WLA) is developed for the facility, the WQBEL is revised pursuant to the WQBEL rule, or the WQBEL is superseded by an agency action. For new or revised WQBELs, the WQBEL process will determine the approach that best interprets the narrative nutrient criteria as outlined in the hierarchical structure. The site

specific analysis performed as part of the WQBEL process can be written to achieve “1”, “2” or “3” of the structure, depending on the available information, or result in a new interpretation of the narrative that could be considered a Department action relevant to “4”.

Assessment

- DEP will revise the IWR to be consistent with the revisions to Chapter 62-302, F.A.C., including provisions to directly implement the NNC for lakes and springs and to directly assess TMDLs.
- For waters with nutrient TMDLs expressed as a load, attainment of the allowable loads will be evaluated as part of the BMAP reporting process, and nonattainment will be assumed until information is provided to prove attainment (a combination of model estimated loads of nonpoint sources and measured loads from point sources). Waters should only be deemed to be in attainment if they meet the loads (or concentrations) and targets (e.g., chlorophyll) and a demonstration that nutrients are no longer causing biological imbalances. If the waterbody attains the allowable loading but there is site-specific information indicating an imbalance in flora or fauna, the TMDL would be revisited and revised as needed.
- As part of these revisions, the Department is contemplating the creation of the study list (in addition to the planning list and verified list) for waters that do not attain water quality standards based on the evidence, but appropriate actions have yet to be identified to rectify the situation. This is common for dissolved oxygen nonattainment, biological nonattainment, and is anticipated for nutrient criteria nonattainment. For example, waters that exceed reference-based nutrient thresholds will be placed on a “study list” unless there are bioassessment data indicating the stream is healthy. Waters on the study list will receive a site-specific physical, chemical, and biological investigation to determine if aquatic life use support goals are attained (if there were no bioassessment data available), and if aquatic life use support is not attained, to determine the causative pollutant(s). This process constitutes a “stressor identification” study. If the stream is determined to be impaired due to nutrients (at least in part), the water will be listed on the verified list for TMDL development, which will determine the reductions needed. This approach places waters on the study list if there is a nonattainment condition based on the current numeric interpretation of the narrative criteria outlined above, and places waters on the IWR verified list for nutrients if they need a reduction in a nutrient loading to attain the narrative nutrient criteria or otherwise restore the waterbody’s designated use.