

PROPOSED WATER QUALITY STANDARDS: JUST ANOTHER REGULATORY CHANGE?

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On January 26, 2010, the EPA published their proposed water quality criteria for Florida lakes and streams. In 52-pages of the Federal Register, the EPA states that excess loading of nitrogen and phosphorous are significant factors of water quality impairment for surface waters of the United States. Over-enrichment of the country's surface water significantly impacts aquatic life and the long-term ecosystem health, diversity and balance. This manifests itself through Harmful Algae Blooms (HAB), reduced spawning grounds, fish kills, and hypoxic (dead) zones; HABs can also diminish the aesthetic and recreational utilization of surface waters. In addition, potential public health concerns are raised for some situations.

Florida water quality standards were selected for EPA review following establishment of a consent decree with five environmental organizations. This consent decree was related to the development of numeric nutrient criteria as a means of compliance with Section 303(c)(4)(B) of the Clean Water Act (CWA). The EPA noted that the State has documented approximately 1,000 miles of river/streams, 350,000 acres of lakes, and 900 square miles of estuaries that are known to have nutrient contamination and they note that many other water bodies are currently listed as "unassessed." The two key objectives of the proposed standards are to: (1) develop criteria to protect the immediate water body to which they apply; and (2) ensure the criteria also provide adequate protection for downstream water bodies.

As a "tip of the hat" to the Florida Department of Environmental Protection (FDEP), the EPA acknowledges that Florida is a leader among other states in addressing nutrient reductions to its surface waters. The EPA praises the FDEP array of data collection programs, technology-based standards, and point and non-point source control authority. However, the EPA also believes that the complexity, time and cost of setting water quality standards on a case-by-case basis are an inefficient and insufficient system to protect the State's waters per their interpretation of the CWA. Consequently, the EPA is proposing numeric nutrient criteria for different water body categories. The proposed rule classifies Florida waters as *lakes, rivers and streams, springs and clear streams, and canals*. It should be noted that this rulemaking activity does not apply to wetlands.

Some Definitions

In order to understand the rule, it is necessary to grasp the distinction between the different water categories. The Federal Register proposes the following definitions. **Surface water** means water upon the surface of the earth whether contained in bounds created naturally, artificially, or diffused. **Lakes and flowing waters** are inland surface waters that have been classified as Class I or Class III water bodies pursuant to Rule 62-302.400 F.A.C. A **stream** is a free-flowing, predominantly fresh surface water in a defined channel. **Predominantly fresh water** is defined to be surface waters in which the chloride concentration at the surface is less than 1500 mg/L. A **clear stream** is a free-flowing water whose color is less than 40 platinum cobalt units (PCU). A **lake** is a freshwater body that is not a stream or other watercourse and has some open contiguous water free from emergent vegetation. A **spring** means the point where underground water emerges onto the earth's surface.

Criteria Categories

As might be expected, the theoretical approach and analysis of data to arrive at reasonable numeric criteria to cover all the different waters in the State is somewhat involved. The challenge is to strike a balance between protecting the State's surface waters per the CWA and yet not be overly stringent, which would result in misallocation of economic and technical resources. Whether the proposed rule strikes the appropriate balance will be vigorously debated.

To begin with, the EPA proposed rule applies only to Class I and Class III waters as defined in 62-302 F.A.C. Those classifications, however, cover the vast majority of Florida's surface waters. As mentioned above, the surface waters are broken into four categories: *lakes, rivers and streams, springs and clear streams, and canals in south Florida*. Estuaries are a separate category scheduled for review next year.

Because there is variability in *lakes* throughout the State, the EPA further divided *lakes* into three groups: Colored Lakes, Clear Alkaline Lakes and Clear Acidic Lakes. Clear Lakes are defined as *lakes* having a color level of 40 PCU or less while Colored Lakes have color levels greater than 40 PCU. Clear Alkaline Lakes have an alkalinity

greater than 50 mg/L as CaCO₃ while the alkalinity of Clear Acidic Lakes is less than or equal to 50 mg/L as CaCO₃. The two classification criteria (40 PCU for color and 50 mg/L as CaCO₃ for alkalinity) were the result of separate scientific and statistical studies and somewhat follow those proposed by the FDEP. At the time of this writing, these criteria are available for public comment through the published comment period ending April 28, 2010.

In the same way, *rivers and streams* that exist in Florida have fundamental variances in their characteristics. The EPA has elected to stratify the water bodies by geographical location in the State. This reflects their belief that the *rivers and streams* are most efficiently distinguished by the watersheds that feed them. The watershed classification system is also deemed useful when evaluating the effects of Total Nitrogen (TN) and Total Phosphorous (TP) from streams to downstream lakes and estuaries in the same watershed region. The four nutrient regions used for classifying the State's *rivers and streams* are: Panhandle, Bone Valley, Peninsula and North Central. It should be noted that the south Florida region is omitted from this category because it is included in Section III.E ("South Florida Canals").

The *springs and clear streams* category is handled in a little different fashion. It is estimated that Florida has over 700 *springs* and associated spring runs. The EPA notes that scientists over the past 20 years have identified two significant factors affecting spring water quality. As might be expected, these are groundwater pollution, principally in the form of nitrite/nitrate from land use changes, and increased population density. Somewhat related to that is the reduction in groundwater levels from human withdrawals, which exacerbates the increased nitrite/nitrate load. Consequently, the criteria for *springs* will be based on a primary indicator of human activity and impact on groundwater, which is the Nitrite (NO₂) and Nitrate (NO₃) level. *Clear streams* will have the same criterion, but also carry the TN and TP limits of colored streams in the watershed in which they are located.

Water Quality Criteria

For the purposes of this brief article, the proposed rule is far too involved to delineate the various strategies and analyses that were used to develop the proposed numeric criteria. However, it might be helpful to present the most generally applicable criteria and discuss a few points of interest on each. The first table presents the proposed numeric criteria for the *lake* category. The basic TN and TP for *lakes* are presented in columns C and D. If the *Chlorophyll a* in a particular *lake* is below the level in column B, the FDEP may adjust the TN/TP levels upward to within the limits listed in columns E and F, if certain conditions are met.

Long-term average lake color and alkalinity	Chlorophyll a (µg/L)	Baseline criteria		Modified criteria (within these bounds)	
		TP (mg/L)	TN (mg/L)	TP (mg/L)	TN (mg/L)
A	B	C	D	E	F
Colored Lakes > 40 PCU	20	0.050	1.23	0.050-0.157	1.23-2.25
Clear Lakes, Alkaline ≤ 40 PCU and > 50 mg/L CaCO ₃	20	0.030	1.00	0.030-0.087	1.00-1.81
Clear Lakes, Acidic ≤ 40 PCU and ≤ 50 mg/L CaCO ₃	6	0.010	0.500	0.010-0.030	0.500-0.900

The baseline criteria are developed from a scientific and statistical analysis of the FDEP database of Florida *lake* water quality. Because eutrophication of *lake* systems results from excessive algae growth following nutrient enrichment, a correlation between TN/TP and algae was sought. *Chlorophyll a* levels in the water column have been used in many scientific studies as an indication of algae growth, and the EPA has chosen to adopt it as a surrogate for algae growth. Using the State's water quality database and correlating *chlorophyll a* to various Trophic State Index (TSI) levels, the EPA concluded that a TSI value of 60 and the associated 20 µg/L *Chlorophyll a* represent the boundary between mesotrophy and eutrophy in colored and clear/alkaline *lakes*. In a related analysis, they assert that the division between mesotrophy and eutrophy in clear/acidic *lakes* occurred at a *Chlorophyll a* of 6 µg/L and stipulate that mesotrophic *lake* characteristics constitute an appropriate target level.

Chlorophyll a was then correlated to TN and TP levels using a multi-regression analysis. Using a 50% prediction interval (log scale), the acceptable levels of TN and TP were estimated. Using the prediction interval (as opposed to confidence interval), this procedure categorizes *lake* data into three categories or zones. The EPA asserts that the *lakes* above the 50% prediction interval for TN and TP levels generally exhibit *Chlorophyll a* levels into the eutrophic range, while *lakes* less than the lower limit of the 50% prediction interval generally exhibit *Chlorophyll a* levels associated with high-quality oligotrophic *lakes*. *Lakes* between the 50% prediction limits, tend toward the mesotrophic states. To establish these levels for a particular *lake*, at least three years of data must be collected with a frequency that characterizes seasonal variation (generally quarterly).

Recognizing that the data don't always fit this computational model, the EPA proposes that the TN/TP concentrations can be modified by lake-specific levels if protective *Chlorophyll a* levels exist with slightly higher TN/TP values. The scientific premise for the lake-specific modified values is that if ambient *lake* data show that a lake's *Chlorophyll a* levels are below the established criteria and its TN and/or TP are between the upper and lower prediction limits, then the ambient TN and TP levels represent protective conditions. The modified values in columns E and F represent the flexibility allowed under these conditions.

The proposed numeric limits for *rivers and streams* were developed using a different analytical strategy than that used for *lakes* due to the increased variability in structure and function of *streams*. The EPA chose a 3-step analysis of available *stream* data within the four watershed regions. Using the Stream Condition Index (SCI) scores as a basis for evaluation, *stream* TN and TP were categorized into statistical distributions. The 75% percentile of the log normal distribution of nutrients was deemed to provide reasonable protection for state *rivers and streams*. The following table presents the proposed values segregated into the four regional watersheds (excluding south Florida).

Nutrient watershed region	Instream protection value criteria	
	TP (mg/L)	TN (mg/L)
Panhandle	0.043	0.824
Bone Valley	0.739	1.798
Peninsula	0.107	1.205
North Central	0.359	1.479

Responding to the indications that the degradation of *springs and clear streams* results to a great extent from groundwater contamination, the EPA is establishing a Nitrite/Nitrate maximum level at 0.35 mg/L (annual geometric mean not surpassing long term average of geometric means). In addition, *clear streams* will meet this criterion, plus they must meet TN and TP criteria for *streams* within the watershed that the *clear stream* is located.

The *canals of south Florida* have a target *Chlorophyll a* concentration of 4.0 µg/L, with associated nutrient limitations of TP = 0.042 mg/L and TN = 1.6 mg/L.

Downstream Protective Values

In addition to these "instream" protective values, the EPA is proposing an additional class of regulations that considers the downstream cumulative effect of state waters. While it is beyond the scope of this brief article to outline this process, suffice it to say in many state waters the values listed above could provide only the starting point for the applicable criteria. The analytic and numeric modeling techniques used to develop the values is sure to generate vigorous discussions as to its accuracy, applicability and economic viability.

Just Another Regulatory Change?

Environmental regulations, when developed responsibly, have clearly been shown to be in the public interest in industrialized economies. Also, it can be demonstrated that nutrient enrichment of many lakes and waters of the State should be addressed to allow them to recover. That being said, the impact of these proposed criteria, if enacted and enforced, have the potential to so thoroughly dominate compliance efforts as to distort and disrupt public and private expenditures on other needed environmental projects. The ability to consistently meet these criteria in many urbanized and agricultural areas is doubtful due to technological or space limitations. In addition, passive systems will begin to yield to active treatment which will exacerbate energy and residual disposal difficulties. Thus the compliance implications of these proposed criteria are staggering in terms of cost, land use, and impact on the financial viability of other needed environmental and infrastructure improvements. Clearly this is not just another incremental regulatory adjustment...it is a tectonic shift that will have implications far beyond its stated goal and should be monitored as such. Again, public comment will be received by the EPA until April 28, 2010 if anyone wants to weigh in on the debate...pro or con.

References: <http://www.epa.gov/waterscience/standards/rules/florida/>

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