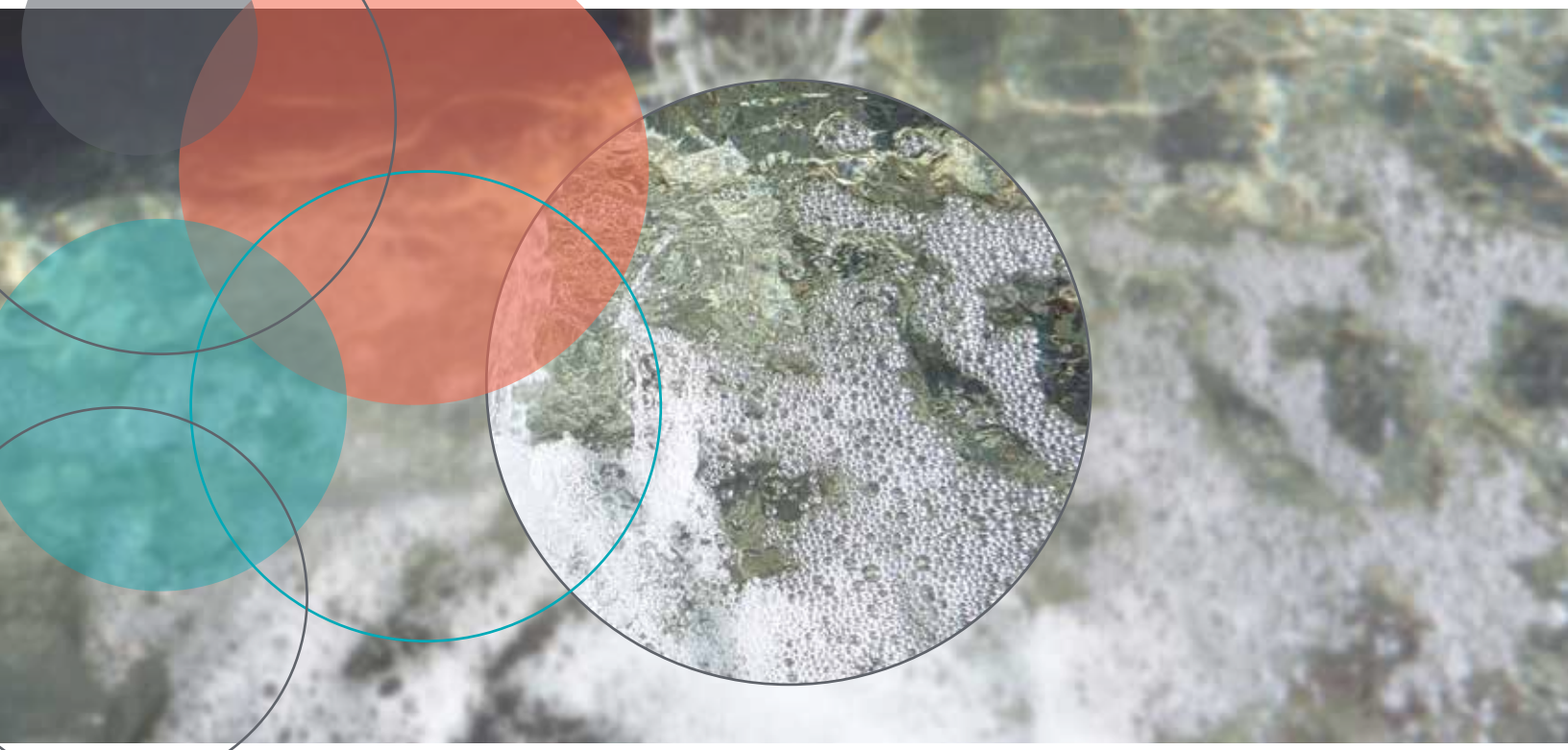

Water Quality and Regulations: Frequently Asked Questions

October 2008

This document was prepared as part of the Nutrient Removal Challenge, which aimed to increase understanding of nitrogen and phosphorus in water and its removal to lower levels. The purpose of this compendium is to answer common questions related to the regulation of nutrients in waterbodies, including water quality standards, the development of criteria, permitting, and water quality trading and offsets.

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FREQUENTLY ASKED QUESTIONS

Why Are Numeric Nutrient Criteria Being Developed and Implemented?

EPA recognized the difficulty in using narrative nutrient standards to develop total maximum daily loads (TMDLs) and National Pollutant Discharge Elimination System (NPDES) permits, assessing monitoring programs, setting measurable objectives, and evaluating effectiveness. In 1995, EPA determined that most states did not have effective nutrient standards and that the narrative nutrient standards were too broad to be effective and too cumbersome to apply to specific waterbodies.

In June 1998, EPA published the National Strategy for Development of Regional Nutrient Criteria. EPA published technical guidance for developing criteria for lakes and reservoirs in May 2000, rivers and streams in June 2000, and estuaries and coastal waters in October 2001, and recommended nutrient criteria for most streams and lakes in January 2001. In November 2001, EPA issued a memorandum to states about planning the development and adoption of nutrient criteria into water quality standards. Most states are still in some stage of starting the process, collecting data, or developing criteria.

For more information, see https://www.epa.gov/nutrient-policy-data/programmatic-information-numeric-nutrient-water-quality-criteria.

What Are Ecoregions?

The concept of ecological regions, or ecoregions, is the grouping of areas of similar climate, hydrology, geology, physiography, soils, land use, vegetation, and wildlife. EPA divided the United States into 14 Level I ecoregions in the continental United States and 104 Level III ecoregions. According to Omernik 2004, states ecoregions are "areas within which there is spatial coincidence in characteristics of geographical phenomena associated with differences in the quality, health, and integrity of ecosystems."

Using ecoregions, EPA has established criteria for total phosphorus and total nitrogen for rivers and streams, lakes and reservoirs, and wetlands. Ecoregion criteria are instream concentrations, as opposed to effluent limits for point source discharges. The ecoregion criteria instream concentrations are very low, ranging from 0.12 to 2.18 mg/L Total Nitrogen and 0.010 to 0.076 mg/L Total Phosphorus.

Ecoregional maps may be found at https://www.epa.gov/eco-research/ecoregions.

What Is a TMDL?

TMDL is an acronym for total maximum daily load. A TMDL is a calculation of the maximum amount of a pollutant that a water body can receive and still safely meet water quality standards, according to EPA's Overview of Impaired Waters and Total Maximum Daily Loads Program (https://www.epa.gov/tmdl).

The TMDL calculation is:

$$TMDL = \Sigma WLA + \Sigma LA + MOS$$

where: WLA is the sum of wasteload allocations (point sources)

LA is the sum of load allocations (nonpoint sources and background)

MOS is the margin of safety

What Is a 303(d) List?

According to EPA's Overview of Impaired Waters and Total Maximum Daily Loads Program (https://www.epa.gov/tmdl), the term "303(d) list" refers to the list of impaired and threatened waters (stream/river segments, lakes) that the Clean Water Act requires all states to submit for EPA approval every two years on even-numbered years. The states identify all waters where required pollution controls are not sufficient to attain or maintain applicable water quality standards, and establish priorities for development of TMDLs based on the severity of the pollution and the sensitivity of the uses to be made of the waters, among other factors (40C.F.R. §130.7(b)(4)). States then provide a long-term plan for completing TMDLs within 8 to 13 years from the first listing.

EPA policy allows states to remove waterbodies from the list after they have developed a TMDL or after other changes to correct water quality problems have been made. Occasionally, a waterbody can be taken off the list as a result of a change in water quality standards or the removal of designated uses; however, designated uses cannot be deemed unattainable and removed until a thorough analysis clearly shows that they cannot be attained.

What Is a Beneficial Use?

Beneficial uses are those uses of water deemed important by a state and commonly include drinking water, cold water fisheries, industrial water supply, recreation, and agricultural water supply.

Recreational uses, the propagation and growth of a balanced, indigenous population of aquatic life, wildlife, and the production of edible and marketable natural resources are generally stated as "fishable and swimmable" uses. Other uses include industrial water supply, irrigation, and navigation. States may define additional beneficial uses, such as aesthetic, salmonid spawning areas, or specific types of aquatic life habitat. For each waterbody, the state designates its uses and may assign one to all of the potential beneficial uses to the waterbody. EPA defines designated uses as those uses specified in water quality standards for each waterbody or segment.

What Are State Water Quality Standards?

State water quality standards are standards that are scientifically defensible and consistent with the Clean Water Act, and are EPA approved. Approved standards must address four elements: designated uses, water quality criteria, antidegredation, and general policies. Each state has adopted a variety of standards to meet the objectives of the Clean Water Act. EPA has compiled these as discussed at https://www.epa.gov/wqs-tech/state-specific-water-quality-standards-effective-under-clean-water-act-cwa.

State standards are the effective requirements as used for waterbody assessments, 303(d) listing, TMDLs, NPDES permitting, and triennial reviews. However, some of the standards are narrative only and require interpretation to be able to apply to specific requirements of TMDLs and NPDES permits. To address this challenge, EPA developed ecoregions and required states to develop numeric nutrient criteria. See Why Are Numeric Nutrient Criteria Being Developed and Implemented?

Thus, state water quality standards are the implementation of the Clean Water Act goals of fishable and swimmable clean water. These standards form the basis for protecting and regulating the quality of all surface waters.

What Is a Water Quality Based Effluent Limit?

A water quality based effluent limit (WQBEL) is a second tier water quality based limit for NPDES permits that is based on the limitations to the specific waterbody, its water quality, a TMDL, and/or the reasonable potential water quality. Water quality based effluent limits are in addition to the treatment technology based effluent limits, such as secondary treatment requirements for biochemical oxygen demand (BOD) and suspended solids.

What Is an Effluent Mixing Zone?

An effluent mixing zone is an area within a waterbody where a point source discharge undergoes initial dilution or mixes with the receiving waters. In theory, the regulatory mixing zone allows for efficient natural pollutant assimilation. In practice, mixing zones can be used as long as the integrity of a water body is not impaired. Water quality standards must be met at the edge of a mixing zone.

A mixing zone may be requested and requires the completion of a mixing zone study but is not always granted. Mixing zone studies evaluate the effectiveness of the mixing of effluent and receiving water under a variety of conditions to ensure compliance with water quality standards. Estimating dilution may be performed using mathematical modeling or through dye studies.

What Is Nonpoint Source Pollution?

Nonpoint source (NPS) pollution, unlike pollution from industrial and sewage treatment plants, comes from many diffuse sources. As the runoff water moves overland or beneath the ground

surface, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters, and even underground sources of drinking water. Examples of nonpoint source pollution include fertilizers from agricultural lands and residential areas, oil, grease, and organic chemicals from urban runoff, sediment from improperly managed construction sites, crop and forest lands, and bacteria and nutrients from livestock, pet wastes, and on-site septic systems.

The combination of point and non-point source pollution may lead to the exceedence of ecoregional criteria and the need for TMDLs. Since point sources are easily identifiable and regulated by NPDES permits, pollutant reductions frequently are inequitably assigned greater reduction goals to point sources than non-point sources.

How May States Address the Exceedence of Nutrient Criteria in Natural Conditions?

If naturally occurring conditions in the receiving water body exceed nutrient criteria, which may or may not include various non-point sources, then states may either change or remove the designated use or adjust the existing criteria. When naturally occurring pollutant concentrations prevent the attainment of a designated use, states may remove a designated use that is not an existing use, provided the state demonstrates the designated use is not attainable. States can also change the designated use by establishing subcategories of a use. A use attainability analysis (UAA) must be performed to change or remove a designated use. An alternative to changing the water body's designated use is for states to establish site-specific numeric aquatic life water quality criteria by setting the criteria value equal to natural background.

What Is a Use Attainability Analysis (UAA)?

A use attainability analysis (UAA) is an analysis to change or remove a designated beneficial use. The Water Environment Research Foundation (WERF) published a study titled *Factors for Success in Developing Use Attainability Analyses*. This study evaluates numerous UAAs, identifying key challenges and providing helpful information about how best to address the challenges. The case studies address three common situations in which UAAs are being considered nationwide: wet-weather impacts, urban settings, and effluent-dependent or dominated streams. (Freedman and Dupuis 2007)

What Are the EPA-recognized Factors for a Water Quality Variance?

A water quality variance provides temporary relief from meeting water quality standards and is specific to the source, discharge, and pollutant. Factors that demonstrate that the designated use is not feasible to attain in the short term and, thus, qualify for a water quality variance are:

1. Naturally Occurring Pollutant Concentrations
2. Dams or Other Hydrologic Modifications
3. Natural, Ephemeral Intermittent Low-flow
4. Natural Physical Conditions That Preclude Attainment of Aquatic Life Uses

5. Human-caused Conditions or Pollutant Sources That Cannot Be Remedied or Would Cause More Environmental Damage to Correct than to Leave in Place
6. Substantial and Widespread Economic and Social Impact

Technological feasibility is not a factor considered for granting a water quality variance. The cost of treatment may be considered only as part of a larger analysis that can show the full economic impact to the region.

What Happens When the Permit Requirements Are Below the Limits of Treatment Technology?

Effluent limits below the limits of treatment technology derived from water quality based effluent limits to protect an impaired waterbody are especially challenging. These situations may limit the ability to discharge to surface waters or require alternative effluent management plans during critical periods in the receiving water. Dischargers may need to consider reducing loadings by other means to offset point sources by diversion through reclaimed water recycling and land application, aquifer recharge, wetlands restoration, conservation and source reduction, and water quality offsets and trading to reduce loadings from other point and nonpoint sources.

What Are Some of the Concerns Raised by the Public Regarding the Implementation of Ecoregional Nutrient Criteria?

Ecoregion criteria have not been met without criticism. Many of the concerns raised by the public about EPA's approach for developing nutrient criteria were previously raised during the development of EPA's Technical Guidance Manuals. Some of these concerns include additional work for states to develop the criteria, the criteria's relation to beneficial uses of the waters, adverse effects of the criteria, and how to approach effluent-dominated streams.

What Methods Are Available to Approach NPDES Permitting Aside from on a Discharger-by-discharger Basis?

Many dischargers have begun to approach NPDES permitting in creative ways to meet more stringent water quality criteria that test the limits of current treatment technology. Dischargers have innovative options to undertake NPDES permitting, including:

- Watershed-based Permitting
- Water Quality Offsets or Water Quality Trading

What Is Watershed-based NPDES Permitting?

Watershed-based NPDES permitting is a process that emphasizes addressing all components within a watershed, rather than addressing individual pollutant sources on a discharge-by-discharge basis. Watershed-based permitting can include a wide range of permits, from synchronization within a basin to the development of water quality-based effluent limits using multiple discharger modeling analyses.

An example of watershed-based NPDES permitting is the Tualatin River Watershed in Oregon. Clean Water Services (CWS) is a public utility that operates four municipal wastewater treatment facilities, each with its own NPDES permit. CWS has two industrial stormwater permits and is a co-permittee on a Municipal Separate Storm Sewer System (MS4) permit. In February 2004, the Oregon Department of Environmental Quality issued a single watershed-based, integrated municipal permit to CWS. This permit incorporates the NPDES requirements for all four of CWS's advanced wastewater treatment facilities, its two industrial stormwater permits, and its MS4 permit. A significant feature of the integrated permit is its inclusion of provisions for water quality credit trading, involving temperature (thermal load), biochemical oxygen demand (BOD), and ammonia, according to EPA.

What Are Water Quality Offsets and Water Quality Trades?

Water quality offsets and trading are innovative approaches to achieving water quality goals more efficiently. Trading programs allow dischargers facing higher pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent (or better) pollution reductions from another source at lower cost.

The Long Island Sound Watershed was one of five watershed studies or demonstrations of trading projects funded by WERF nationwide that resulted in successful outcomes. This study resulted in state legislation in Connecticut that allowed trading in the Long Island Sound watershed. Watershed permits were issued to nearly 80 utilities based on the work of this project, saving over $200 million in capital costs, while also meeting the state goal of reducing nitrogen loads by 70 percent, and establishing a Nitrogen Credit Exchange to administer the trading program (Moore et al. 2000).

The executive summary for this study lists several other references where readers may find guidance in water quality credit trading and enhance their capabilities to begin a trading program (WERF 2000).

REFERENCES

Freedman, P. L. and T. Dupuis. 2007. *Factors for Success in Developing Use Attainability Analyses*. Project 04-WEM-1/1183. Alexandria, VA: Water Environment Research Foundation, and London: IWA Publishing.

Moore, R. E., M. S. Overton, R. J. Norwood, and D. DeRose. 2000. *Nitrogen Credit Trading in the Long Island Sound Watershed*. Project 97-IRM-5B/1268. Alexandria, VA: Water Environment Research Foundation.

Omernik, J. M. 2004. Perspectives on the Nature and Definition of Ecological Regions. *Environmental Management*, 34 Supplement 1, 27-38.

WERF (Water Environment Research Foundation). 2000. *Executive Summary: Nitrogen Credit Trading for Long Island Sound Watershed*. Project 97-IRM-5B/1268. Alexandria, VA: Water Environment Research Foundation.