Nutrient Assessments and TMDLs Using Narrative Criteria in New Mexico
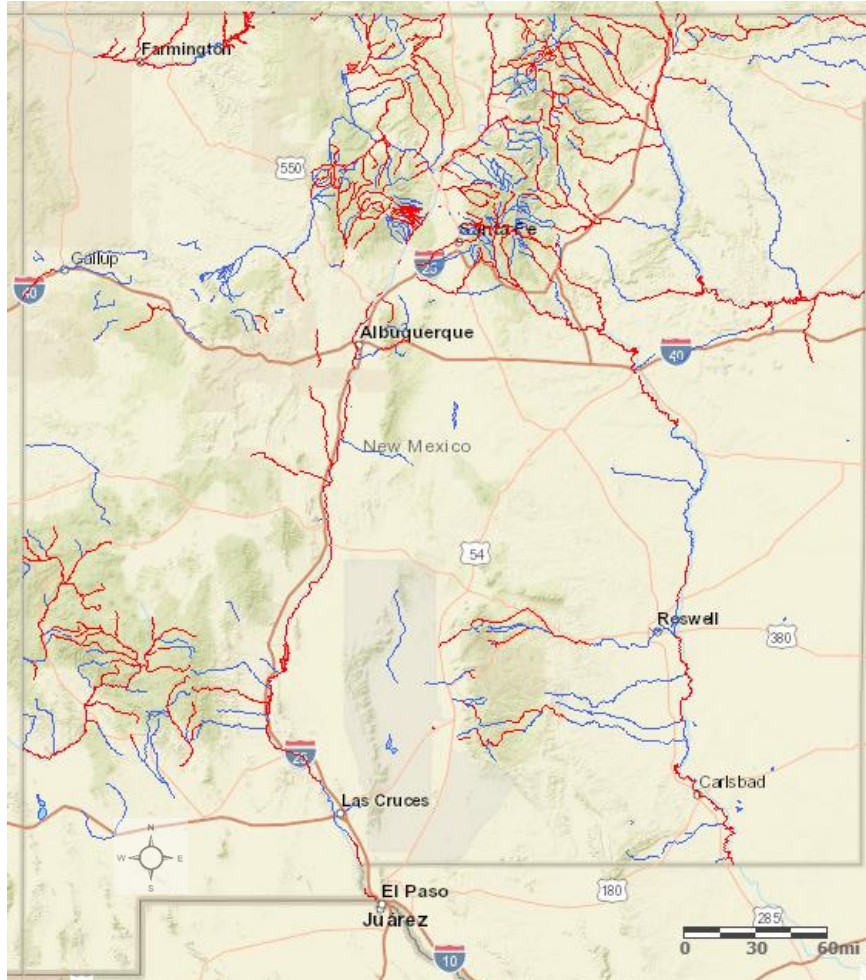
June 21, 2023

Meredith Zeigler, Assessment Coordinator
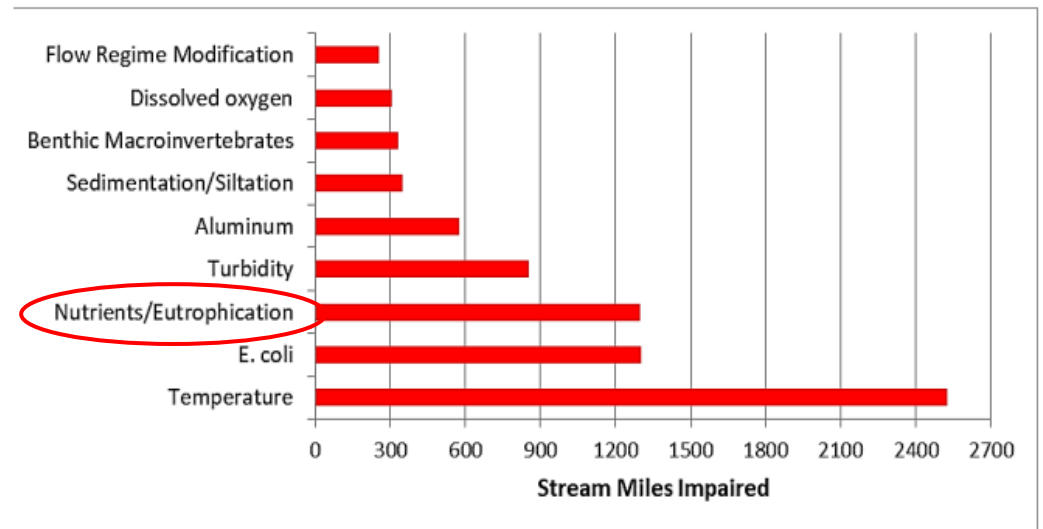Surface Water Quality Bureau
New Mexico Environment Department

Photo credit Rhett Zyla #IamNMED

Nutrient Impairments in New Mexico

- Nutrients are 3rd leading cause of impairment in NM streams and rivers (2022- 2024 Integrated Report)

Top Causes of Surface Water Impairment for Rivers and Streams

— Impaired Streams
— Assessed Waters

https://www.env.nm.gov/surface-water-quality/303d-305b/

New Mexico's Narrative Nutrient Standard

"Plant nutrients from other than natural causes shall not be present in concentrations that will produce undesirable aquatic life or result in a dominance of nuisance species in surface waters of the state."

How to assess for attainment of this standard and define *quantifiable endpoints?*

https://www.env.nm.gov/surface-water-quality/wqs/

Deriving Numeric Criteria from NM's Narrative Nutrients Standard (2004)

(Jemez River, June 2021)

- In 2004 NM developed a weight of evidence nutrient assessment protocol for wadeable, perennial streams using threshold values for both cause (TP & TN) and response (Chlorophyll and DO) variables.

- The thresholds used were the 50th quantiles of all sites grouped by ecoregion and aquatic life use with no link to use impairment or definition of "natural" conditions.

- The TN and TP thresholds were frequently exceeded at sites with little human activities in the watershed and therefore did not provide an effective filter for identifying 'true' impairments.

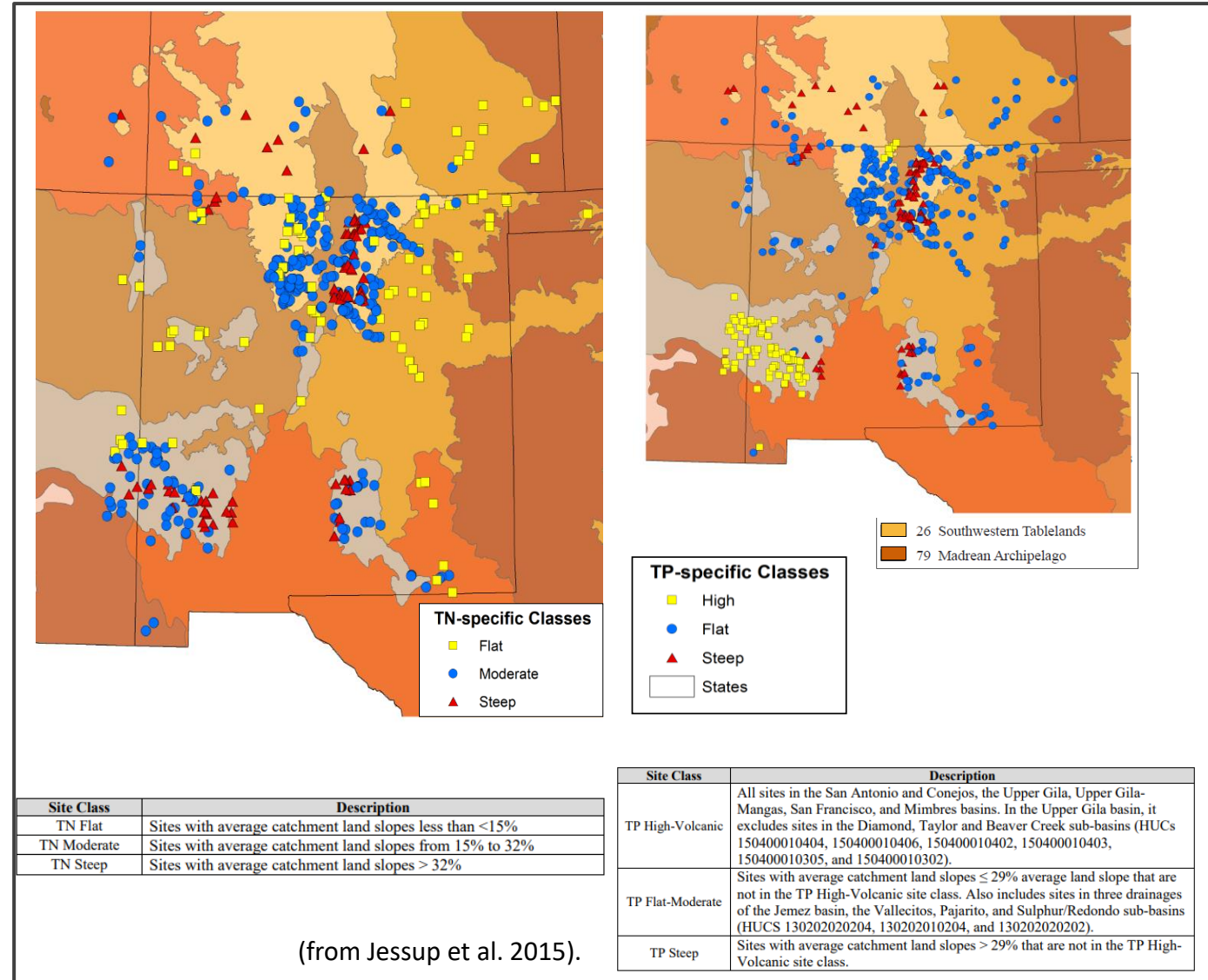# Refinement of Nutrient Thresholds (2016)

(Jemez River, June 2021)

- To address these issues, NMED collaborated with EPA and TetraTech to revise thresholds as part of a N-STEPS partnership.

- The goal was to refine NM's nutrient thresholds using stressor-response analyses, defined reference conditions and site classes to link excessive plant nutrients "from other than natural causes" to aquatic life use impairment.

  - Statistical analyses of available (state and regional) data

  - Reference condition approach to derive candidate thresholds from nutrient concentrations at least disturbed sites which are the best estimate of "natural" conditions.

  - Stressor-response analyses derived candidate thresholds by defining the relationships between TN and TP concentrations (i.e., causal variables) and response variables (Diatom and benthic macroinvertebrate metrics, and dissolved oxygen (DO) and chlorophyll a (chl-a) concentrations)

  - Implemented in 2017 CALM (2018-2020 Integrated Reporting cycle)

Nutrient-Scientific Technical Exchange Partnership System https://www.epa.gov/nutrient-policy-data/n-steps-program

Nutrient Site Classes

- Classification and Regression Tree (CART) models resulted in the following nutrient site classes for total Nitrogen (TN) and total Phosphorus (TP):

  - Land slope partitioned TN values best, so TN classes were based on land slope alone (flat, moderate, steep)
  - For TP, volcanic geology and the concentration of TP in soil were important in addition to average catchment land slope (resulting in three classes, (high-volcanic, flat-moderate, steep)

- * Separate classes for TN and TP were more precise and appropriate for application of numeric nutrient thresholds *
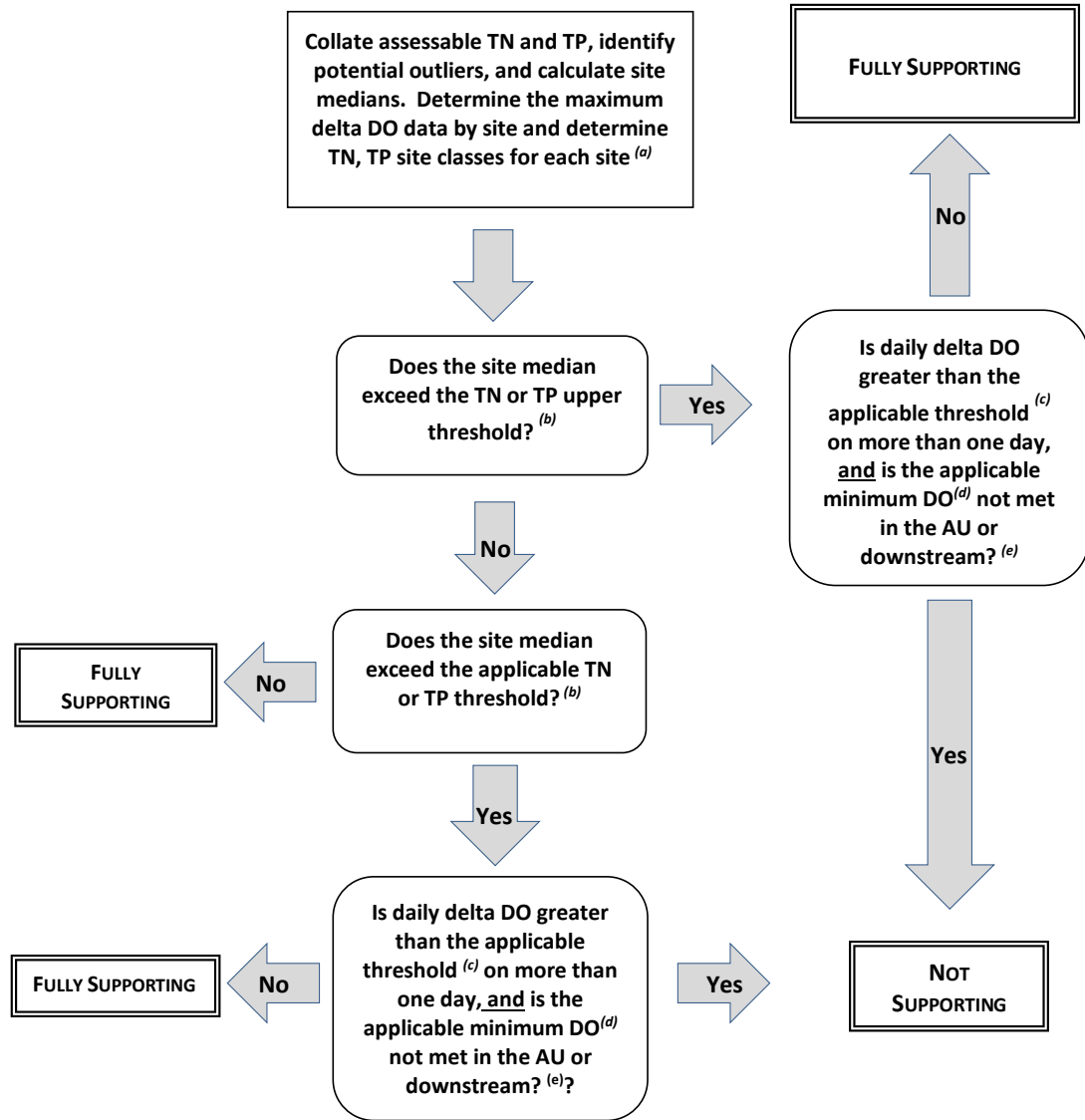

(from Jessup et al. 2015).

Site Class	Description
TN Flat	Sites with average catchment land slopes less than <15%
TN Moderate	Sites with average catchment land slopes from 15% to 32%
TN Steep	Sites with average catchment land slopes > 32%

Site Class	Description
TP High-Volcanic	All sites in the San Antonio and Conejos, the Upper Gila, Upper Gila-Mangas, San Francisco, and Mimbres basins. In the Upper Gila basin, it excludes sites in the Diamond, Taylor and Beaver Creek sub-basins (HUCs 150400010404, 150400010406, 150400010402, 150400010403, 150400010305, and 150400010302).
TP Flat-Moderate	Sites with average catchment land slopes ≤ 29% average land slope that are not in the TP High-Volcanic site class. Also includes sites in three drainages of the Jemez basin, the Vallecitos, Pajarito, and Sulphur/Redondo sub-basins (HUCS 130202020204, 130202010204, and 130202020202).
TP Steep	Sites with average catchment land slopes > 29% that are not in the TP High-Volcanic site class.

NM Stressor-Response "Translators"

	TN (mg/L)			TP (mg/L)		
	Flat	Moderate	Steep	High-Volcanic	Flat-Moderate	Steep
Threshold (90th quantile)	0.69	0.42	0.30	0.105	0.061	0.03
Upper 90% CI	0.85	0.51	0.34	0.114	0.069	0.053
Daily delta DO threshold (mg/L)	-	-	-	5.02	4.08	1.79

❏ Thresholds (i.e., "numeric translators") represent nutrient conditions above which, "…*produce undesirable aquatic life or result in a dominance of nuisance species…*"

❏ Protective of stream and scientifically defensible

https://www.env.nm.gov/surface-water-quality/calm/

2017- Present Nutrient Listing Methodology

Collate assessable TN and TP, identify potential outliers, and calculate site medians. Determine the maximum delta DO data by site and determine TN, TP site classes for each site [a]

Does the site median exceed the TN or TP upper threshold? [b] — Yes →

No ↓

Does the site median exceed the applicable TN or TP threshold? [b] — No → **FULLY SUPPORTING**

Yes ↓

Is daily delta DO greater than the applicable threshold [c] on more than one day, and is the applicable minimum DO[d] not met in the AU or downstream? [e]? — No → **FULLY SUPPORTING** — Yes → **NOT SUPPORTING**

Is daily delta DO greater than the applicable threshold [c] on more than one day, and is the applicable minimum DO[d] not met in the AU or downstream? [e] — No (↑) → **FULLY SUPPORTING** / Yes ↓

- Utilizes robust and scientifically defensible thresholds and verified stressor-response variables
- Uses bioconfirmation approach (i.e., nutrient enrichment with a concurrent response) with DO variable.

TYPE OF DATA	DOES NOT INDICATE ENRICHMENT	INDICATES ENRICHMENT	DELISTING	NOTES
• Nutrients (total nitrogen or total phosphorus[a]) A) 0 to 3 samples B) >3 samples[b]	A) Not assessed. B) Site median does not exceed threshold value.	A) Not assessed. B) Site median exceeds threshold value.	A) Cannot delist with only grab data. B) Site median does not exceed threshold value and delisting criteria in Table 7 are met.	Applicable thresholds are found in Table 3.

https://www.env.nm.gov/surface-water-quality/calm/

Three Integrated Reporting Cycles In...

- **2018-2020** CWA 303(d) List primarily focused on Canadian River and Dry Cimarron River watersheds
  - Seven new nutrient listings for Canadian and Dry Cimarron watersheds using 2017 CALM.

- **2020-2022** CWA 303(d) List primarily focused on the Upper Rio Grande and San Juan River watersheds.
  - Two new nutrient listings; TP and TN both exceeded in respective watersheds
  - Minor changes to CALM, including adding a minimum DO threshold

- **2022-2024** CWA 303(d) List primarily focused on the Upper Pecos River and Gila/San Francisco/Mimbres River watersheds.
  - Two new stream nutrient listings, including one DO impairment that was removed and replaced with nutrient impairment to clarify cause of impairment. TP exceedances only.
  - Minor changes to CALM, including clarifying delisting process
  - No nutrient CALM for large rivers yet.
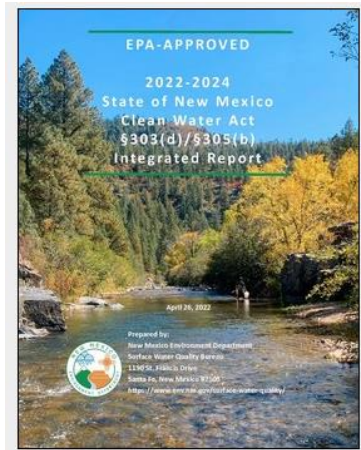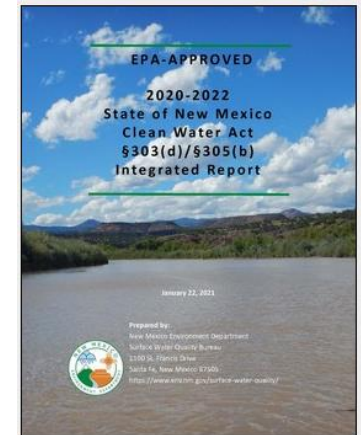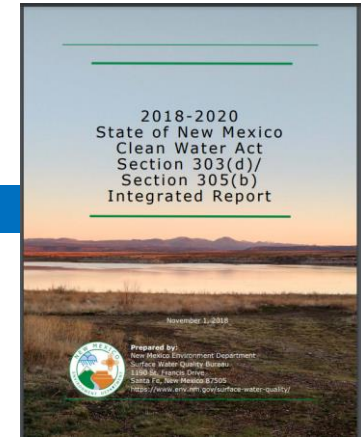
Nutrient Thresholds and TMDLs

- To date, New Mexico has developed 53 plant nutrient TMDLs and assigned Waste Load Allocations (WLAs) to 12 NPDES permitted facilities.

- First TMDL that implemented narrative nutrients standard was in 2005 (Rio Hondo watershed)

- TN and TP are co-limiting in New Mexico streams and TMDLs are developed with both TN and TP limits.

- TMDLs are written to nutrient threshold targets that are protective of the stream and scientifically defensible.
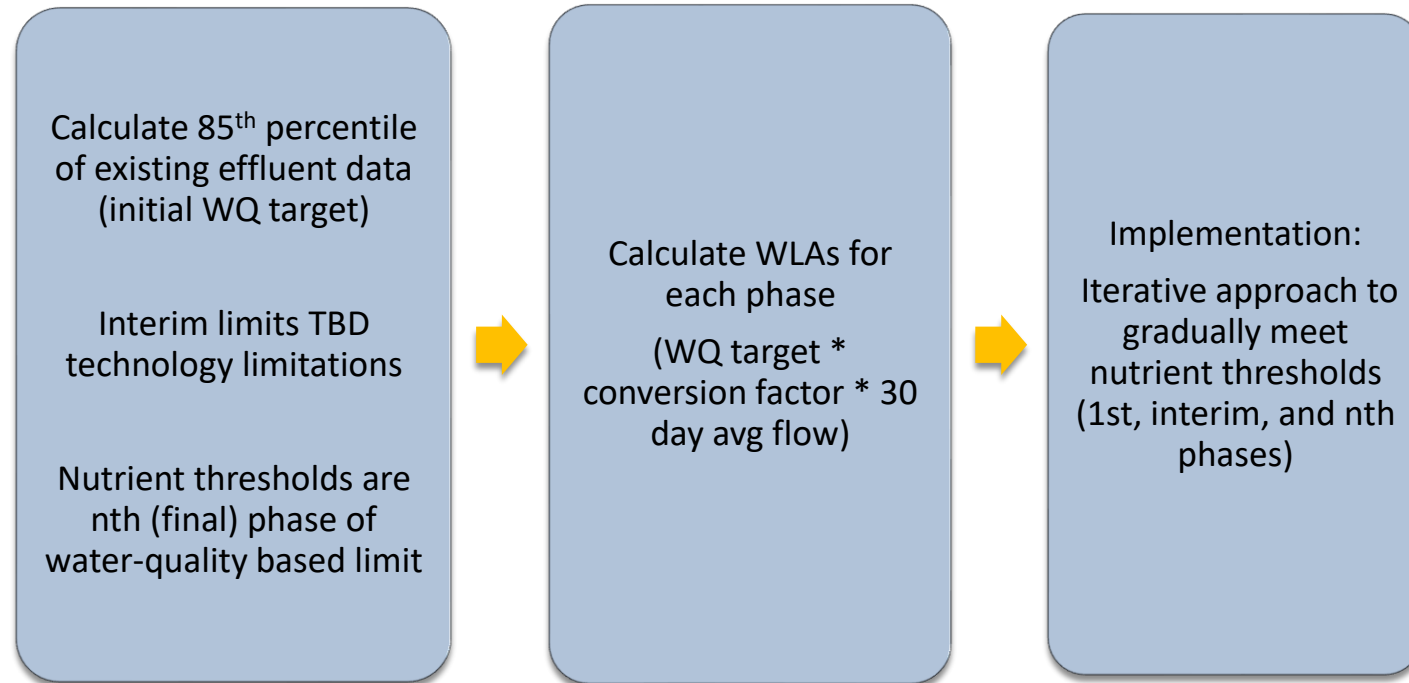

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Total Maximum Daily Loads

MENU

Under Section 303(d)(1) of the federal Clean Water Act, each state is required to develop a list of waters within that state which are not supporting their designated uses established in the state Water Quality Standards and establish a total maximum daily load (TMDL), or prepare an TMDL Alternative.

A TMDL is defined as the *"calculation of the maximum amount of a pollutant allowed to enter a waterbody so that the waterbody will meet and continue to meet water quality standards for that particular pollutant. A TMDL determines a pollutant reduction target and allocates load reductions necessary to the source(s) of the pollutant."*

https://www.env.nm.gov/surface-water-quality/tmdl/

# Implementation of Narrative Nutrient Standard using WLA

- Recently successfully implemented nutrient effluent limits in a NPDES permit using *draft* TMDL Waste Load Allocation (WLA) in a nutrient impaired waterbody

  - Antidegradation policy and WQMP/CPP effluent limitation language as the regulatory basis

  - EPA-finalized permit limits (New Mexico does not have primacy)

- "When an impairment exists in the waterbody without a TMDL and there are available effluent data, SWQB will analyze the effluent data to determine an effluent limit that will be protective of the receiving waterbody based on the frequency of collection and confidence of the data. This approach is consistent with Tier One protection of SWQB's antidegradation policy, which states that no further degradation of existing water quality is permitted in a surface water where the existing water quality does not meet applicable WQS." (NM WQMP-CPP 2020)

Calculate 85th percentile of existing effluent data (initial WQ target)

Interim limits TBD technology limitations

Nutrient thresholds are nth (final) phase of water-quality based limit

➡

Calculate WLAs for each phase

(WQ target * conversion factor * 30 day avg flow)

➡

Implementation:

Iterative approach to gradually meet nutrient thresholds (1st, interim, and nth phases)

State of New Mexico Water Quality Management Plan and Continuing Planning Process
https://www.env.nm.gov/surface-water-quality/wqmp-cpp/

Nutrients Assessment Methodology work continues…

☐ Ongoing N-STEPS project to revise **lake/reservoir nutrient thresholds** (2023)

☐ Current assessment protocol incorporates both causal (TN and TP) and response (chl-a, % cyanobacteria, dissolved oxygen and pH) variables using a weight-of-evidence approach.

☐ Goal of revision is to incorporate state data into existing zooplankton, microcystin, dissolved oxygen, TN and TP stressor-response models using EPA's recently published revised ambient water quality criteria recommendations for lakes and reservoirs (national lake models)
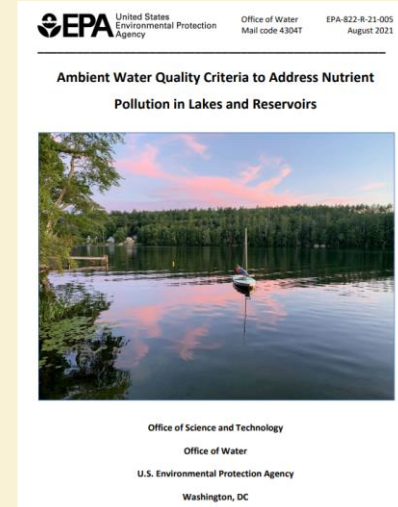
U.S. EPA, 2021. *Ambient Water Quality Criteria to Address Nutrient Pollution in Lakes and Reservoirs*. 822-R-21-005, Office of Water.

Questions/Contact

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https://www.env.nm.gov/surface-water-quality/303d-305b/

Canadian River, 2016