

Nutrient Benchmark Development



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Nutrient Criteria - Background

- *Clean Water Action Plan: Restoring and Protecting America's Waters*
(February, 1998)
- *National Strategy for the Development of Regional Nutrient Criteria* (USEPA OW/OST; June, 1998)



Turkey Creek in Overland Park, KS

Key Elements of the National Nutrient Strategy

1. Ecoregional and waterbody-type specific.
2. Technical guidance by waterbody-type.
3. Regional Technical Advisory Groups (RTAG) and National Nutrient Team.
4. Ecoregional nutrient criteria for *nitrogen, phosphorus, chlorophyll a and turbidity* (i.e. causal & response variables).
5. Nutrient criteria development plans submitted by States/Tribes.

‘Need to Protect the Use’

- ‘Waters in which naturally occurring water quality and habitat conditions allow the maintenance of a wide variety of warm-water biota...’



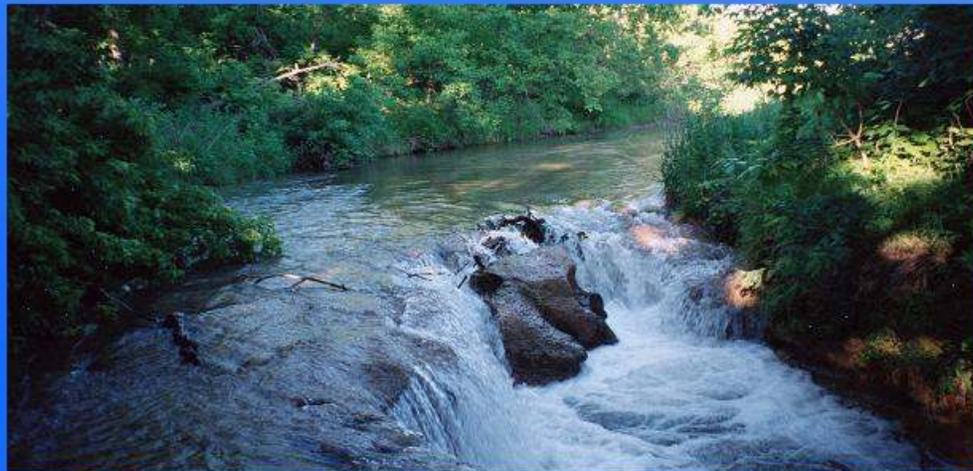
Howe Creek (Santee Sioux Reservation)

Regional Technical Advisory Group (RTAG) - Region 7 -

- **Iowa Department of Natural Resources**
- **Missouri Department of Natural Resources**
- **Kansas Department of Health & Environment**
- **Nebraska Department of Environmental Quality**
- **Prairie Band of Potawatomi Indians**
- **Iowa State University**
- **University of Missouri**
- **University of Kansas**
- **Kansas State University**
- **University of Nebraska**
- **US Geological Survey**
- **US Environmental Protection Agency**
- **Central Plains Center for BioAssessment**

RTAG Mission Statement

- The mission of the Region 7 Nutrient Workgroup is to develop **scientifically defensible** numeric nutrient **benchmarks** for lakes/reservoirs, streams/rivers and wetlands in the Central Great Plains (Iowa, Kansas, Missouri & Nebraska).



RTAG Ground Rules

- Nutrient benchmarks are to protect Streams & Rivers and down stream receiving waters against adverse impacts of **cultural eutrophication** (excess nutrient levels above natural or minimally impaired conditions).
- Nutrient benchmarks are to be protective of aquatic life - **Economics, technology, attainability, social values are not part of the benchmark development process.**
- Benchmarks developed by the RTAG are by **group consensus** and are developed for the purpose of assisting and providing guidance to States and Tribes in the development of their own nutrient criteria.

Lake & Reservoir Benchmarks

Lake & Reservoir Nutrient Values & RTAG Benchmarks

	Reference Lakes	Trisection Method	Literature Values	RTAG Benchmarks
Chl-a (ug/l)	7.4	6.8	8	8
TP (ug/l)	31.5	35	35	35
TN (ug/l)	755	610	650	700

Lake & Reservoir Document

- *Nutrient Reference Condition Identification and Ambient Water Quality Criteria Development Process – Freshwater Lakes and Reservoirs within USEPA Region 7;*
Huggins, Baker, Welker, Smith & Smith;
September 2008 (Peer Review).

USEPA Ambient Water Quality Recommendations for Lakes and Reservoirs (Ecoregions that overlap Region 7)

	ER IV	ER V	ER VI	ER VII	ER IX	ER X	ER XI	RTAG Benchmark
Chl-a (ug/l)	3.4	2.3	8.6	2.6	4.9	NA	2.8	8
TP (ug/l)	20	33	37.5	14.8	20	NA	8	35
TN (ug/l)	400	560	780	660	360	NA	460	700

ER IV = Great Plains Grass & Shrublands (Sand Hills & Flint Hills)

ER V = South Central Cultivated Great Plains (Western KS & NE)

ER VI = Corn Belt & Northern Great Plains (IA; Eastern NE; Northeast KS; Northwest MO)

ER VII = Glacial Dairy (Northeastern IA)

ER IX = SE Temperate Forested Plains & Hills (Northern MO & Eastern KS)

ER X = Texas-Louisiana Coastal & Miss. Alluvial Plains (Southeastern Missouri)

ER XI = Central & Eastern Forested Uplands (Ozarks)

Streams & Rivers Benchmarks

Nutrient Benchmarks: Streams & Rivers

Parameter	Literature ¹ (range)	Nutrient Regions ⁴ (range)	Reference Streams (median)	Tri-section ⁵ (median)	25% (percentile)	MEANS (all methods)	Benchmarks
Total nitrogen (mg/L)	0.7 – 1.5 ¹ 0.15 – 1.10 ² 0.51 – 0.54 ³	0.54 – 2.18	1.08	0.81	0.82	0.964	0.9
Total phosphorus (mg/L)	0.025 – 0.075 ¹ 0.023 – 0.060 ² 0.027 – 0.043 ³	0.01 – 0.128	0.08	0.07	0.07	0.052	0.75
Sestonic chl- <i>a</i> (µg/L)	10 – 30 ¹	0.9 – 3.0	3.3	2.8	2.0	6.0	8.0
Benthic chl- <i>a</i> (mg/m ²)	20 – 70 ¹	NA	24.2	20.3	11.9	25.4	40.0

1. Dodds WK, Jones JR, Welch EB (1998) Suggested classification of stream trophic state: Distributions of temperate stream types by chlorophyll, total nitrogen, and phosphorus. *Water Res.* 32, 1455-1462. These values are for streams in the mesotrophic range.

2. Dodds, W.K. and R.M. Oakes 2004. A technique for establishing reference nutrient concentrations across watersheds affected by humans. *Limnology and Oceanography Methods* 2: 333-341.

3. Dodds, W.K., V.H. Smith, and K. Lohman 2002. Nitrogen and phosphorus relationships to benthic algal biomass in temperate streams. *Canadian Journal of Fisheries and Aquatic Sciences* 59: 865-874.

4. From EPA 822-B-00-017, -18, -019, -020; EPA 822-B-01-013, -014, -016

5. Tri-section values are for upper one-third streams in US EPA Region 7 having highest total richness for macroinvertebrates.

Ambient Water Quality Criteria Recommendations for Rivers & Streams

Parameter	Nutrient Region II	Nutrient Region IV	Nutrient Region V	Nutrient Region VI	Nutrient Region IX	Nutrient Region XI	Mean	RTAG Benchmarks
TP (ug/l)	10.0	23.0	67.0	76.3	36.6	10	37.2	75
TN (ug/l)	120	560	880	2180	690	310	790	900
Chl-a (ug/l)	1.1	2.4	3.0	2.7	0.9	1.6	2.0	8

Ambient Water Quality Criteria Recommendations: Rivers and Streams in Nutrient Ecoregions II, IV, V, VI, IX and XI (USEPA, 2000).

Nutrient Regions:

- II - Western Forested Mountains
- IV - Great Plains Grass and Shrublands
- V - South Central Cultivated Great Plains
- VI - Corn Belt and Northern Great Plains
- IX - Southeastern Temperate Forested Plains and Hills
- XI - The Central and Eastern Forested Uplands

Rivers & Streams Document

- *Nutrient Reference Condition Identification and Ambient Water Quality Criteria Development Process – Rivers and Streams within EPA Region 7*; Dodds, Huggins, Baker, Welker; Draft March 2009.