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Texas Commission on Environmental Quality
Nutrient Criteria Development Plan
DRAFT December 20, 2004

Purpose

This plan is intended to provide a framework for developing nutrient water quality standards for the state of Texas. The staff of the Texas Commission on Environmental Quality (TCEQ) in conjunction with the U.S. Geological Service (USGS) is evaluating options for nutrient criteria for consideration by the United States Environmental Protection Agency (EPA) and the public during the next triennial revision of 30 TAC §307, Texas Surface Water Quality Standards. The plan outlines the work to be performed, status of data analyses, options for criteria development, and time frames for developing and considering nutrient criteria. The information in this plan is subject to change as more information is collected and evaluated and as the information is reviewed by the TCEQ, stakeholders, and the EPA.

Current Status of Nutrient Regulation in Texas

The State of Texas has no numerical criteria for nutrients but does currently consider nutrient controls by 1) applying narrative criteria to address permitted nutrient loadings at sites of concern, 2) developing watershed rules which require nutrient reductions in wastewater discharges in or near specified water bodies, and 3) employing TCEQ's antidegradation policy to increases in discharge loads of nutrients. TCEQ also screens phosphorus and nitrate nitrogen and chlorophyll *a* monitoring data as a preliminary indication of areas of possible concern in the Texas Water Quality Inventory under Section 305(b) of the federal Clean Water Act (CWA).

Scope of Criteria Development

The TCEQ staff will develop and evaluate criteria 1) to maintain water quality in water bodies that are relatively unimpacted and 2) to address excessive nutrients and eutrophication where indicated. The TCEQ staff will also develop procedures to assess compliance with criteria and to apply criteria to wastewater permits and other regulatory actions. Preliminary criteria development will focus on major reservoirs; criteria for streams and rivers, estuaries, and wetlands will subsequently be evaluated. This effort will be staged over several years, and the TCEQ will provide drafts of criteria and implementation procedures for EPA review throughout the process.

TCEQ is exploring several complementary strategies to develop nutrient criteria. Strategies now being investigated include the following: 1) basing criteria on concentrations of nutrients; 2) basing criteria on direct indicators of eutrophication, such as chlorophyll *a*; 3) developing "translator" procedures that relate concentrations of nitrogen and phosphorus to direct indicators of eutrophication; 4) basing criteria on historical "ambient" averages with a statistical allowance for variability; and 5) developing criteria based on the effect of nutrients or indicators of eutrophication

on uses. Work on use-based criteria for reservoirs is being conducted by the Texas Water Conservation Association and other members of the TCEQ nutrient criteria workgroup.

With respect to spatial scales for nutrient criteria, TCEQ has evaluated the procedures for developing criteria as defined in EPA guidance using 1) EPA's aggregate ecoregions and 2) smaller Level III ecoregions within Texas. The TCEQ has found that smaller scales and other ways to group reservoirs are needed to address spatial variability in nutrient concentrations and impacts. TCEQ is therefore evaluating criteria based on 1) data from individual water bodies; 2) grouping water bodies according to geological, chemical, physical, or hydrologic characteristics; and 3) grouping water bodies in smaller geographic regions or watersheds.

Workgroup

The TCEQ has formed a diverse Nutrient Criteria Development Workgroup in order to obtain ongoing stakeholder input from state and federal agencies, Texas river authorities, cities, industry, environmental groups, agriculture representatives, and other interested parties. Three work sessions have been conducted, and additional meetings are planned for 2005.

Schedule

This revised plan is provided to the EPA as a preliminary indication of the TCEQ staff's efforts in accordance with the EPA's notice in the Federal Register dated January 9, 2001: "Nutrient Criteria Development; Notice of Ecoregional Nutrient Criteria." The EPA stated that 1) "by the end of 2001, each State and authorized Tribe should complete a plan for developing and adopting nutrient criteria into State or Tribal water quality standards", and 2) "by the end of 2004, States and authorized Tribes should adopt nutrient criteria (either numeric criteria or as procedures to translate a narrative nutrient criteria into a quantified endpoint) for the water body type and ecoregions associated with the section 304(a) water quality criteria that EPA publishes by the end of 2001."

The TCEQ staff previously drafted a preliminary general work plan to further evaluate the EPA's nutrient criteria and investigate additional options which would lead to criteria development. The initial draft work plan was sent to the EPA Region 6 on November 30, 2001, and a letter providing updated information to the work plan was submitted on December 21, 2002.

In fiscal year 2005, the TCEQ staff expects to produce draft proposals for nutrient criteria for selected major reservoirs in the state for review by TCEQ management, stakeholders, and the EPA. Draft proposed criteria are intended to be available for consideration in the next water quality standards revisions for Texas. The date for the next major standards revisions is yet to be determined, since major provisions of the previous triennial revision of the water quality standards remain under EPA review.

Reservoirs are the TCEQ's staff initial priority, but simultaneous efforts to develop nutrient criteria for streams, rivers, and estuaries are ongoing.

A preliminary schedule of tentative milestones is presented in Appendix D. Major steps and time frames for revisions of TCEQ's water quality standards are noted in Appendix E.

Methods to Develop Nutrient Criteria

Nutrient Data Base Development

There is substantial monitoring data available over the last 30 years for major water bodies in Texas. Historical monitoring data will be used to 1) develop criteria, 2) assess feasibility and effectiveness of the criteria, 3) evaluate impacts of wastewater discharges and other regulatory actions, and 4) establish relationships between nutrients and response variables, such as chlorophyll *a*. The USGS, through EPA funding, is supporting the development of nutrient criteria in Texas. One of the USGS tasks is to create a nutrient data base from data downloaded from the TCEQ Texas Regulatory and Compliance System (TRACS) and from the USGS National Water Information System (NWIS). Data available extends back to the 1970's, and the available parameters include those listed in Appendix A. To facilitate statistical evaluations, the baseline data base for reservoirs has been created from these sources, and additional parameters or data from other sources can be added as needed. Data collected on individual water bodies not contained in the current TCEQ or USGS data bases may also be considered in developing site-specific nutrient criteria. Similar data bases will be constructed for streams and rivers, and estuaries.

USGS completed development of an initial nutrient data base for 1) reservoirs and 2) streams and rivers in October 2001. TCEQ and USGS have periodically updated the data base with newer data as it becomes available. Data used for developing criteria for reservoirs extends from January 1, 1970 to April 30, 2003.

Reservoirs

I. Applying EPA's Methodology to Texas Reservoirs

USGS initially evaluated the potential for using EPA's methodology to develop nutrient criteria. Level III ecoregions in Texas were used as the basis for spatial aggregation rather than EPA's aggregate national ecoregions.

Historical data from the main pools of reservoirs in each of Level III ecoregions were pooled, and criteria for total phosphorus, total nitrogen, and chlorophyll *a* were calculated as the 25th percentiles for each ecoregion in accordance with EPA guidance. The resulting criteria are listed in Appendix A. The resulting criteria for total phosphorus were lower than EPA's national criteria for large aggregate ecoregions in Level III ecoregions 25, 26, 27, and 32; and higher than EPA's criteria in Level III ecoregions 24, 31, 29, 30, 33, and 35. Preliminary analyses indicate that criteria calculated by this method are frequently less than the average ambient concentrations of phosphorus, nitrogen, and chlorophyll *a*; even in relatively unimpacted reservoirs.

II. Criteria Based on Historical Conditions in Individual Reservoirs

Criteria based on historical ambient data on individual reservoirs can be appropriate for those reservoirs that are in good trophic condition. The purpose for nutrient criteria for such reservoirs (termed "least impacted") is to maintain and protect existing conditions. This approach reduces some of the high variability that's inherent in calculations based on aggregated reservoirs. Initial factors used to select "least impacted" reservoirs include the following: 1) availability of historical data, 2) limited urban and agricultural land use in the watershed, 3) absence of major discharges in the nearby watershed 4) no trend of increasing eutrophication, and 5) judgment of experts with firsthand knowledge of a reservoir's watershed and water quality characteristics.

A. Data selection

For continued analysis and investigations, TCEQ/USGS selected 110 reservoirs that had sufficient data to support criteria calculations. These reservoirs are the same as those listed and assessed for trophic state in the 2002 TCEQ Texas Water Quality Inventory [305(b) report]. The main pool stations for each reservoir were selected to perform the calculations and only surface values of a constituent were used. Data from main pool areas was selected because the availability of data from coves, small arms, and transition zones is highly variable; and because peripheral sampling sites are often representative of relatively small areas of a reservoir. Data was restricted to surface samples because of a lack of uniformly available data from deeper samples. Criteria for total phosphorus, total nitrogen, and chlorophyll *a* are included in this evaluation.

B. Identifying least impacted reservoirs

For preliminary analyses, reservoirs are considered to be least impacted if they have the following characteristics:

1. A total of less than 10% of the land use in the surrounding watershed is a combination of urban land use (such as, high intensity residential, low intensity residential, urban / recreational grasses, and commercial, industrial, transportation land uses) or agricultural land use (such as orchards / vineyards, row crops, small grains, and fallow land). The applicable watershed is truncated to exclude the watershed of upstream reservoirs. The TCEQ Source Water Assessment and Protection (SWAP) data base is used to determine land use for approximately 3/4 of the 110 reservoirs. For reservoirs not included in the SWAP data base, USGS acquired land use data from the Nation Land Cover Data set in order to further categorize the remaining reservoirs.

2. There are no major domestic point source discharges directly into the reservoir or within a two-hour water travel time of the reservoir. A major discharge is defined as one which is permitted to discharge more than 1 million gallons per day.

3. There is no apparent historic increase in the trophic condition of the reservoir. USGS has reviewed the historical data to determine if any trends are apparent over time in the 110 candidate reservoirs. They have reviewed the data looking for trends in time using data collected 1) during all times of the year and 2) during warm months from May 1st thru September 30th.

The preliminary list of least impacted reservoirs was presented to the nutrient criteria advisory group, and their firsthand knowledge of these reservoirs was used to adjust the evolving list (Table 1 of Appendix C). TCEQ's initial efforts to develop site-specific nutrient criteria have focused on the reservoirs in this list. Additional screening has been conducted to consider a wider range of least impacted reservoirs – those with combined urban and agricultural land uses of 10-15% and 15-20% of the truncated watershed (Tables 2 and 3of Appendix C).

C. Calculation of criteria

Under this approach, preliminary criteria are calculated as the upper confidence interval of the mean, with the assumption that a sample size of 10 is used to assess a statistically significant departure from the mean. Confidence levels under evaluation include 80th, 90th, 95th, and 99th percent (one-tailed). Other methods to establish criteria based on historical data can also be considered.

III. Criteria Based on Reservoir Groupings

Criteria based on ambient conditions may not be appropriate for all reservoirs, such as reservoirs that have potentially elevated anthropogenic nutrient loadings in comparison to least impacted reservoirs. Other approaches are needed for developing criteria for these reservoirs. TCEQ/USGS are reviewing historical ambient data to determine how reservoirs may be grouped so that reservoirs with sufficient data can be used as references for similar reservoirs that are 1) potentially impacted, or 2) have insufficient data to calculate nutrient criteria based on historical ambient data.

Reference criteria for each group of similar reservoirs would be calculated on pooled data for the least impacted, reference reservoirs in the group. Calculation procedures would be similar to those described above for individual least impacted reservoirs.

TCEQ/USGS are using multivariate analyses to assess similarities among reservoirs based on chemical, physical, and biological characteristics of the reservoirs. Previous and

ongoing work on the classification of Texas reservoirs by other researchers (e.g., Dr. Al Groeger at Texas State University) will also be considered. Options being investigated for grouping reservoirs include the following:

1. Physical/hydrologic characteristics such as reservoir surface area, volume, shoreline complexity, mean depth, detention time.

2. Chemical characteristics such as total dissolved solids, pH, alkalinity, inorganic turbidity.

3. Land use proportions in the watershed such as vegetation type, agriculture, urban, forest etc.

4. Watershed characteristics such as soil types, hydrography and flow variability of tributary streams.

5. Geographic proximity such as ecoregions and major watersheds.

6. Size and number of wastewater discharges in the watershed.

IV. Criteria Based on Protecting Reservoir Uses

Additional ongoing development of reservoir nutrient criteria are based on protecting water quality related uses. Some Texas river authorities and other members of the Texas Water Conservation Association (TWCA) have formed a nutrient criteria committee to conduct use-based evaluations and to coordinate with TCEQ on results and recommendations.

As part of their evaluations, TWCA has conducted data collection to help define the relationship between nutrients and uses; and to develop recommendations for establishing nutrient criteria to protect recreational uses. Water quality sampling and simultaneous user surveys have been collected on nine Texas reservoirs over the past two years during warm months. The goal of the study is to determine how levels of chlorophyll *a* affect recreational use according to users' perceptions. The study will also evaluate the extent to which the results can be applied to groups of reservoirs beyond the nine reservoirs where sampling is being conducted.

This study is similar to a variety of studies conducted elsewhere in the United States. These earlier studies provide supporting information, but the additional data collection effort is needed to better address reservoir conditions in Texas – particularly the relatively high levels of inorganic turbidity that occur in some Texas reservoirs. The results of this study and similar studies in other states can provide an additional option for approaches to establish nutrient criteria in Texas reservoirs.

Adverse eutrophic impacts on recreational uses, and in some cases on water supply uses, can depend in part on the magnitude and frequency of phytoplankton blooms in addition to average conditions. TCEQ is conducting statistical evaluations of the historical ambient database to (1) note the frequency of algal "blooms" above various target concentrations of chlorophyll *a,* and (2) characterize the relationship between measured "bloom" concentrations and long-term average concentrations of chlorophyll *a* during warm months.

V. Predicting Chlorophyll *a* from Concentrations of Phosphorus and Nitrogen

TCEQ/USGS are investigating the correlation between nutrient concentrations and response variables such as chlorophyll *a* and secchi disc depth in Texas. This relationship is particularly important if criteria focus on chlorophyll *a*, so that the potential impacts of loadings of phosphorus and nitrogen on chlorophyll *a* can be predicted.

Data for these evaluations is taken from the historical monitoring data for 110 Texas reservoirs. Correlations are poor when data from single reservoirs is independently evaluated. However, preliminary analysis indicates that the statistical relationship of nutrients to chlorophyll *a* improves when 1) the median concentrations of reservoirs are compared rather than individual sampling dates, 2) annual medians of reservoirs are grouped by ecoregions, and 3) a measure of inorganic turbidity (such as total suspended solids minus volatile suspended solids) is included as a variable in regression equations.

Streams and Rivers

I. Applying EPA's Methodology to Texas Streams and Rivers

In a similar analysis as described above for reservoirs, USGS evaluated the potential for using EPA's methodology to develop nutrient criteria. Level III ecoregions in Texas were used as the basis for spatial aggregation rather than EPA's aggregate national ecoregions.

Historical data from rivers in each of Level III ecoregions were pooled, and criteria for total phosphorus, total nitrogen, and chlorophyll *a* were calculated as the 25th percentiles for each ecoregion in accordance with EPA guidance.

II. Criteria Based on Historical Conditions in Individual Streams and Rivers

As with reservoirs, criteria based on historical ambient data on individual rivers might be appropriate for those rivers that have relatively small potential for anthropogenic nutrient loadings. The purpose for nutrient criteria for least-impacted rivers would be to maintain and protect existing conditions. Potential factors to select least-impacted rivers include the following: 1) availability of historical data, 2) limited urban and agricultural land use

in the watershed, 3) absence of major discharges in the nearby watershed 4) no trend of increasing eutrophication, and 5) judgment of experts with firsthand knowledge of a reservoir's watershed and water quality characteristics.

Under this approach, preliminary criteria would be calculated as the upper confidence interval of the mean. Confidence levels to be considered include 80th, 90th, 95th, and 99th percent (one-tailed). Other methods to establish criteria based on historical data can also be considered.

Criteria can be evaluated for chlorophyll *a*, total phosphorus, and total nitrogen. Preliminary analyses suggest that chlorophyll *a* in water is a useful indicator of eutrophication response in many larger, slower moving Texas rivers.

III. Criteria Based on Grouping Streams and Rivers

As with reservoirs, the use of reference groupings for establishing criteria might be useful where ambient conditions in a stream or river are inappropriate to use as base criteria. TCEQ/USGS will review historical ambient data to determine how rivers and streams may be grouped so that those with sufficient data can be used as references for similar rivers and streams that are 1) potentially impacted, or 2) have insufficient data to calculate nutrient criteria based on historical ambient data. Calculation procedures would be similar to those described above for individual least impacted reservoirs.

Examples of characteristics to consider for grouping rivers and streams include river basins, ecoregions, average depth, wadeable versus nonwadeable, average and dry-weather flows, flow variability, extent of spring-fed flow, occurrence of tidal influence, water chemistry, land use, substrate type (e.g., gravel, incised sand/clay bottom, sand, bedrock), extent of tree canopy, percent of flow from wastewater discharges.

IV. Predicting Chlorophyll *a* in Rivers from Concentrations of Phosphorus and Nitrogen

For larger rivers, the statistical relationship between nutrient concentrations and water-column chlorophyll *a* will be evaluated. Measures of inorganic turbidity (such as total suspended solids minus volatile suspended solids) are again expected to be an important variable in regression equations.

V. Data Needs for Smaller Rivers and Streams

In smaller streams and rivers, (and in some shallow, larger rivers with macrophyte dominance), chlorophyll *a* in water is not useful as an indicator of nutrient enrichment. Measures of the extent of attached vegetation will be needed as a response variable, and the available historical data for Texas is sparse.

To address this data gap, the USGS, under contract with TCEQ/EPA, is collecting data on nutrient concentrations and the extent of attached vegetation in wadeable streams. The initial work focused on 33 streams in East Texas, and it was conducted over the past two years in coordination with a study of dissolved oxygen dynamics in these streams. The study is to increase our biological data set on the presence and quantities of attached algae in wadeable streams in comparison to available nutrients. Sampling included dissolved oxygen measurements over 24 hours, biomass estimates of attached algae, nutrients and conventional parameters in water, habitat surveys, and collection of fish and benthic organisms. Similar sampling is planned in 20-30 Central Texas streams during 2005. The additional stream data will be incorporated into the stream nutrient data base for evaluation of nutrient criteria.

The goal of the study is to provide data that can be used to develop preliminary options for nutrient criteria that are analogous to those options under consideration for reservoirs. In addition, the effectiveness of sampling procedures will be evaluated to determine if estimates of the extent of attached vegetation can be incorporated in routine, periodic statewide monitoring efforts.

Estuaries

TCEQ is following similar steps to develop preliminary nutrient criteria options for estuaries as for reservoirs and rivers. USGS has contracted with EPA to create a data base with historical data for estuaries in Texas. TCEQ/USGS will 1) evaluate EPA's approach and national criteria, and 2) consider preliminary criteria based on historical ambient nutrient and chlorophyll *a* concentrations. Groupings of reference estuaries in Texas will be considered, but the relatively smaller number of estuary systems will limit this approach; and more extensive analyses of individual estuary systems is anticipated to be needed to evaluate a sufficient range of options. Subsequent updates of the nutrient development plan can consider more detailed approaches towards nutrient criteria for estuaries. There have been a variety of studies of Texas estuaries to evaluate the effect of freshwater inflows on estuarine productivity, and these studies will be relevant in considering nutrient criteria.

Boundary Waters

Texas shares boundary waters with New Mexico, Oklahoma, Arkansas, Louisiana, and Mexico. TCEQ recognizes that any eventual criteria for shared boundary waters need to be developed in close coordination with adjacent states, EPA, and the International Boundary and Water Commission (for reaches and reservoirs on the Rio Grande). The Regional Technical and Assistance Group for nutrient development will be utilized as a preliminary point of coordination for any criteria developed for boundary waters. TCEQ also anticipates that separate interstate workgroups may be needed to establish nutrient criteria for shared waters.

Appendix A: Nutrient Database Constituents

Table 1: Nutrient Data Base Constituents	
Parameter	**Notes**
Nitrogen	ammonia, nitrate, nitrite, total N, total Kjeldahl N, nitrite + nitrate, organic N
Phosphorus	orthophosphorus, total phosphorus
Solids	filterable and nonfilterable total suspended solids, volatile suspended solids, tds
Dissolved oxygen	membrane, daytime grabs plus 24-hour means for last 3 years
Chlorophyll *a*	spectrophotometric
Pheophytin *a*	spectrophotometric
Alkalinity	bicarbonate, total, filtered, carbonate
Hardness	as dissolved CaCO3
Stream flow	instantaneous cubic feet per second
Conductivity	
Turbidity	Hach Turbidimeter, lab ntu's
Temperature	
Secchi depth	

Table 2: Base Line Nutrient Data Base Constituents for Reservoirs	
Parameter	**Notes**
Nitrogen	total nitrogen
Phosphorus	orthophosphorus, total phosphorus
Solids	filterable and nonfilterable total suspended solids, volatile suspended solids
Chlorophyll *a*	spectrophotometric
Turbidity	Hach Turbidimeter, lab ntu's
Secchi depth	

Appendix B: Examples of Reservoir Criteria for Level III Ecoregions Using EPA's Methodology for Reservoirs

Ecoregion Name	Ecoregion No.	TP mg/L	TN mg/L	Chlorophyll *a* µg/L
Chihuahuan Deserts	24	0.021	0.951	1.250
Western High Plains	25	0.020	3.120	2.621
Southwestern Tablelands	26	0.012	0.399	1.256
Central Great Plains	27	0.026	0.456	1.408
Southern Texas Plains	31	0.050	0.054	4.130
Central Oklahoma/Texas Plains	29	0.040	0.430	1.688
Edwards Plateau	30	0.016	0.995	7.515
~~Texas Blackland Prairies~~	~~32~~	~~0.034~~	~~0.728~~	~~3.690~~
East Central Texas Plains	33	0.060	0.858	9.165
South Central Plains	35	0.040	1.195	4.371
Western Gulf Coastal Plain	34	0.147	0.566	2.646

Appendix C: Least Impacted Reservoirs

Table 1: Reservoirs with 0-10% Urban plus Agriculture Land Use in the Watershed	
Reservoir	**% Land Use as Urban plus Agriculture**
Amistad Reservoir	0.9
B. A. Steinhagen Reservoir	3.6
Caddo Lake	6.1
Canyon Lake	11.1
Choke Canyon Reservoir	10.8
Diversion Lake	3.3
Farmers Creek (Nocona Lake)	8.6
Houston County Lake	4.2
Hubbard Creek Reservoir	6.5
Inks Lake	3.8
Lake Amon G. Carter	5.3
Lake Bob Sandlin	2.8
Lake Bridgeport	4.2
Lake Buchanan	9.2
Lake Cisco	5.8
Lake Corpus Christi	6
Lake Cypress Springs	3.2
Lake Georgetown	3.3
Lake Jacksonville	11
Lake Limestone	5
Lake Marble Falls	6.6
Lake Murvaul	1.8
Lake Palo Pinto	3.9
Lake Travis	5.9

Lake Tyler	8.1
Medina Lake	4.9
O.C. Fisher Reservoir	4.8
Red Bluff Reservoir	0.02
Stillhouse Hollow Lake	4.4

Table 2: Reservoirs with 10-15% Urban plus Agriculture Land Use in the Watershed

Reservoir	% Land Use as Urban plus Agriculture
Buffalo Springs Lake	13
Cedar Creek Reservoir	12
Cox Lake	12
Lake Arrowhead	12
Lake Brownwood	11
Lake Crook	14
Lake Kickapoo	13
Lake Lyndon B. Johnson	11
Lake Ray Roberts	13
Lake Sweetwater	14
Lake Texana	15
Lake Theo	14
Lake Weatherford	14
Leon Reservoir	14
Palo Duro Reservoir	10
Pat Cleburne Reservoir	14
Twin Buttes Reservoir	13

Table 3: Reservoirs with 15-20% Urban plus Agriculture Land Use in the Watershed	
Reservoir	**% Land Use as Urban plus Agriculture**
E.V. Spence Reservoir	17
Eagle Mountain Reservoir	18
Lake Austin	16
Lake Coleman	20
Lake Granbury	17
Lake Kemp	19
Lake Livingston	17
Lake Mackenzie	17
Lake Worth	19
Millers Creek Reservoir	17
Oak Creek Reservoir	17
Pat Mayse Reservoir	16

Appendix D: Draft Schedule for Developing Nutrient Criteria

Nutrient Criteria Development Plan

Task	Date	Done?
Send initial nutrient criteria development plan to EPA	11/30/01	✔
Send revised draft Plan to EPA	1/31/05	✔
Draft plan mutually agreed upon by TCEQ and EPA	3/31/05	
Revise draft plan as needed	12/31/06	

Criteria Development

Reservoirs

Task	Date	Done?
Complete initial reservoir data base	10/31/01	✔
Advisory workgroup meeting 1	5/08/02	✔
Advisory workgroup meeting 2	2/24/03	✔
Advisory workgroup meeting 3	1/29/04	✔
Advisory workgroup meeting 4	~3/15/05	
Establish final nutrient data base: 110 reservoirs; Jan 1970 - Apr 2003; main pool stations	12/19/03	✔
Incorporate additional parameters into data base	Ongoing	
Incorporate additional supporting information on individual reservoirs	Ongoing	
Review scientific literature that links levels of algae and vegetation with impacts on water quality uses	12/31/03	✔
Develop draft list of least-impacted reservoirs	4/1/04	✔
Evaluate trends over time of nutrients and chlorophyll *a*	4/21/04	✔
Calculate preliminary draft criteria for selected least impacted reservoirs, based on confidence intervals for the means of chl *a*, TN, TP (80, 90, 95, and 99th confidence levels)	8/1/04	✔
Conduct analyses to relate levels of nutrients to chlorophyll *a*	2/28/05	
Present current status of draft criteria to workgroup	~ 3/15/05	

Evaluate results of use-based criteria study	06/30/05	
Send EPA preliminary staff draft of reservoir criteria	08/31/05	
Consider nutrient criteria during next triennial standards revision	[2006]	

Rivers and Streams

Task	Date	Done?
Compile initial nutrient database for rivers and streams	10/31/01	✔
Finish data collection on dissolved oxygen, biota, nutrients, and attached algae for 33 East Texas streams	9/30/04	✔
Update workgroup on status of stream studies	~ ~~3/15/05~~	4/13/05
Incorporate additional information on individual streams and rivers	Ongoing	
Conduct preliminary evaluation of criteria for selected rivers based on historical average conditions	8/31/05	
Finish data collection on dissolved oxygen, biota, nutrients, and attached algae for Central Texas streams	9/30/05	
Evaluate stream data on East and Central Texas streams, and apply results to consideration of nutrient criteria for streams	9/30/06	
Expand/revise nutrient development plan and schedule for rivers and streams as needed	12/31/06	
During next triennial standards revision, consider expanded narrative criterion and new implementation procedures to address nutrient impacts in rivers and streams	[2006]	
Consider proposals for numerical nutrient criteria for streams and rivers during triennial standards revisions	[2010]	

Estuaries

Task	Date	Done?
Compile initial nutrient database for estuaries	9/30/05	
Update workgroup on status of estuary database	~ 3/15/05	

Incorporate additional information on individual estuaries	Ongoing	
Conduct preliminary evaluation of criteria for selected estuaries based on historical average conditions	9/30/06	
Expand/revise nutrient development plan and schedule for estuaries as needed	12/31/06	
Consider proposals for numerical nutrient criteria for estuaries during triennial standards revisions	[2010]	

Appendix E: Time line for Revising the Texas Water Quality Standards (Title 30, Chapter 307, Texas Administrative Code)

[illegible]	[illegible]
0	TCEQ initiates rulemaking
30	Request for preliminary public comments
100	TCEQ convenes stakeholders workgroup
190	Preliminary draft of revisions for informal review
260	Revised draft revisions, preamble, and fiscal note
290	Draft revisions publicly approved by TCEQ Commissioners
330	Notice of hearing in Texas Register and mailout
380	Public hearing
470	Draft of final revisions and responses to comments
530	Standards revisions adopted as state rule at TCEQ Agenda.
550	Standards revisions effective as state administrative rule
610	Adopted standards published in Texas Register
640	TCEQ sends adopted revisions to EPA for review and approval