# Developing Numeric Nutrient Criteria for Mississippi



## Stakeholder Update

MDEQ Amite Street Offices
Jackson, MS
March 19, 2014

# Criteria are required by law



- Water quality standards (WQS) are required by the Clean Water Act for waterbodies in MS
  - A water quality standard = A designated use + **criteria** to protect the use + policy to prevent degradation
  - MDEQ has many criteria to protect designated uses from different pollutants

# Water Quality Criteria



- A concentration, level, or narrative statement
- Represent a level of water quality that supports a particular designated use
- States must adopt criteria that protect the designated use(s)
  - Based on a sound, scientific rationale
  - Sufficient parameters to protect the designated use
  - Must support the most sensitive use

# Nutrient Criteria



- Nutrients are a major pollutant contributing to impairment of waters nationwide
- EPA developed an Action Plan for nutrients in 2001 that included states developing numeric nutrient criteria to protect uses from nutrient pollution
- Early on…MDEQ developed a task force and a plan for developing nutrient criteria
- MDEQ's Mission:

  Develop appropriate and protective numeric nutrient criteria for Mississippi's waters that are scientifically defensible.

# MS Nutrient Task Force



- Initiated criteria planning in 2000
- Decided that criteria should be developed based on water body type
  - Lakes and Reservoirs
  - Streams and Rivers
  - Estuaries and Coastal Waters
- Established different committees to focus on different water body types
- Developed the first Nutrient Criteria Development Plan for Mississippi

# Implementing Our Plan



- Took action on the Task Force's recommendations
- Data and information gaps were identified by the Task Force
- Efforts were initiated to address these gaps
  - Data collection across various water body types
  - Establishing biological indicators
  - Preliminary nutrient criteria analyses

# Data Collection Efforts



- Data collection efforts were developed to fill data and information gaps
- MDEQ-led data collection:
  - Data collection efforts in all water body types across the state
  - EPA GMPO grant for intensive nutrient study of St. Louis Bay watershed
  - Continued sampling of benthic macroinvertebrate communities within wadeable streams throughout the state (M-BISQ)
  - Sampling of benthic communities and DO data within Delta waters
  - 319/BMA Projects

# Tool Development



- MDEQ has developed and continues to develop and evaluate multiple tools in an attempt to make the connection between nutrient concentrations and biological response
  - M-BISQ Recalibration
  - Benthic Index for Coastal Waters
  - Benthic Index for Delta Waters
  - Fish data for Delta waters

# Timeline



- Mutually-agreed upon plan (Oct 2010) with EPA lists June 30, 2013 as our date for non-Delta waters to go to Public Comment
  - Date has been postponed
  - Evaluating the latest science and NNC guidance and efforts
  - Implementation planning
  - Addressing stakeholder questions/concerns
- Non-Delta Waters do not have a revised date for draft at this time
  - Lakes and Reservoirs
  - Wadeable Streams; Non-wadeable Streams
  - Coastal and Estuarine Waters
- Public Comment Period for Delta Waters begins no earlier than November 30, 2014
- Adoption by Commission
- Approval by EPA

# MS Nutrient Technical Advisory Group



- MDEQ is committed to a defensible, science driven process for deriving protective criteria
- At the core of this process is the input, review, and guidance of technical work by a committee of research, state and federal agency scientists with technical expertise relevant to nutrient science
- MDEQ formed the Nutrient TAG to be this committee
- TAG's Mission:

  Provide technical expertise and regional knowledge to MDEQ for the development of scientifically defensible numeric nutrient criteria.

# MS Nutrient Technical Advisory Group

NRCS
Natural Resources Conservation Service

Mississippi Department of Marine Resources

United States Environmental Protection Agency

NGI
Northern Gulf Institute

USGS
science for a changing world

Mississippi Wildlife, Fisheries, & Parks

U.S. Fish & Wildlife Service

Mississippi State University
Extension Service

US Army Corps of Engineers

Gulf of Mexico Program

JSU
Jackson State University

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STATE

Gulf Coast Research Laboratory
The University of Southern Mississippi

USDA ARS
United States Department Of Agriculture
Agricultural Research Service

# Nutrient Criteria Analysis



- Goal: scientifically defensible, protective criteria developed using a transparent, well-documented process

- Methods based on USEPA Nutrient Criteria Guidance
  - Data Compilation
  - Classification of Waters
  - Data Analysis using Multiple Lines of Evidence
  - Criteria Derivation

# Data Analysis: Multiple Lines of Evidence



- Using multiple lines of analysis to define a specific endpoint
- Alternative to single analysis approaches
- Especially useful with complex systems

"A weight of evidence approach that combines any or all of the three approaches above will produce criteria of greater scientific validity"

-USEPA 2000, SAB 2010

# Lines of Evidence



- Distributions of nutrient values in minimally disturbed sites and sites attaining designated uses
- Stressor-response empirical models of nutrients versus biological/chemical responses
- Mechanistic water quality model output
- Scientific literature on nutrient effects

# Status of Technical Efforts
# Inland Waters

# Streams

## Option 1- Single values



Magnitude:
TP: 0.060 - 0.150 mg/l
TN: 0.75 - 1.20 mg/l

Duration: Geometric annual mean
- Based on underlying data

Frequency: Not to be exceeded more than 2 out of 5 years
- Based on variability analysis

# Streams

## Option 2 – Combined criteria with site specific adjustment



Magnitude:
TP: 0.040 - 0.2 mg/l
TN: 0.45 - 1.40 mg/l

Duration: Geometric annual mean

Frequency: Not to be exceeded more than 2 out of 5 years

Implementation: As long as MBISQ/DO/nuisance criteria are met and nutrients are within range or below, nutrient criteria not violated.

And, site specific nutrient numeric adjusted to the long-term 75th percentile seasonal geometric mean within the range for assessment moving forward.

# Streams

## Option 3 – Combined Criteria



Magnitude:
TP: 0.040 - 0.2 mg/l
TN: 0.45 - 1.40 mg/l

Duration: Geometric annual mean

Frequency: Not to be exceeded more than 2 out of 5 years

Implementation: As long as MBISQ/DO/nuisance criteria are met and nutrients are within range or below, nutrient criteria not violated.

# Lakes/Reservoirs

## Option 1- Single values



Magnitude:
TP: 0.090 mg/l
TN: 1.25 mg/l
Chlorophyll a: 20 ug/l

Duration: Seasonal (June-October) Geometric Means
- Consistent with assessment periods for DO
- Acute could be considered

Frequency: Not to be exceeded more than 2 out of 5 years
- Based on stream criteria nutrient variability analysis

# Lakes/Reservoirs

## Option 2 – Combined criteria with site specific adjustment



Magnitude:
TP: 0.050 – 0.160 mg/l
TN: 0.680 – 1.70 mg/l
Chlorophyll a: 20 ug/l

Duration: Seasonal (June-October) Geometric Means
- Consistent with assessment periods for DO
- Acute could be considered

Frequency: Not to be exceeded more than 2 out of 5 years
- Based on stream criteria nutrient variability analysis

Implementation: As long as chl a criterion/DO/nuisance criteria are met and nutrients are within range or below, nutrient criteria not violated.

And, site specific nutrient numeric adjusted to the long-term 75$^{th}$ percentile seasonal geometric mean within the range for assessment moving forward.

# Lakes/Reservoirs

## Option 3 – Combined Criteria



Magnitude:
TP: 0.050 – 0.160 mg/l
TN: 0.680 – 1.70 mg/l
Chlorophyll a: 20 ug/l

Duration: Seasonal (June-October) Geometric Means
- Consistent with assessment periods for DO
- Acute could be considered

Frequency: Not to be exceeded more than 2/5 years
- Based on stream criteria nutrient variability analysis

Implementation: As long as chl a criterion/DO/nuisance criteria are met and nutrients are within range or below, nutrient criteria not violated.

No site specific adjustments made.

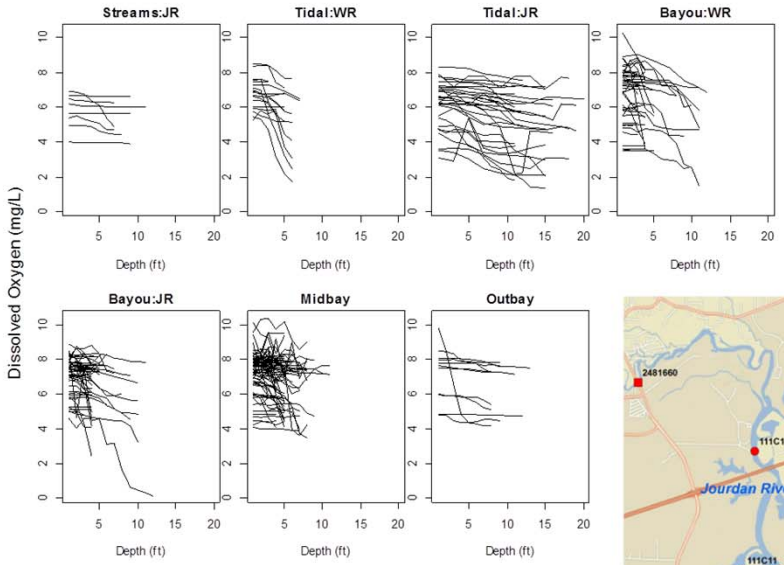
# Coastal Waters

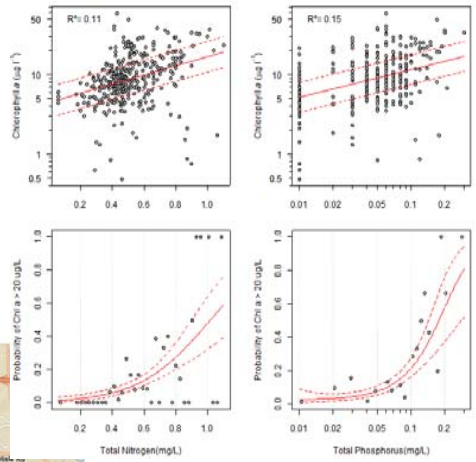
# Coastal Waters Update

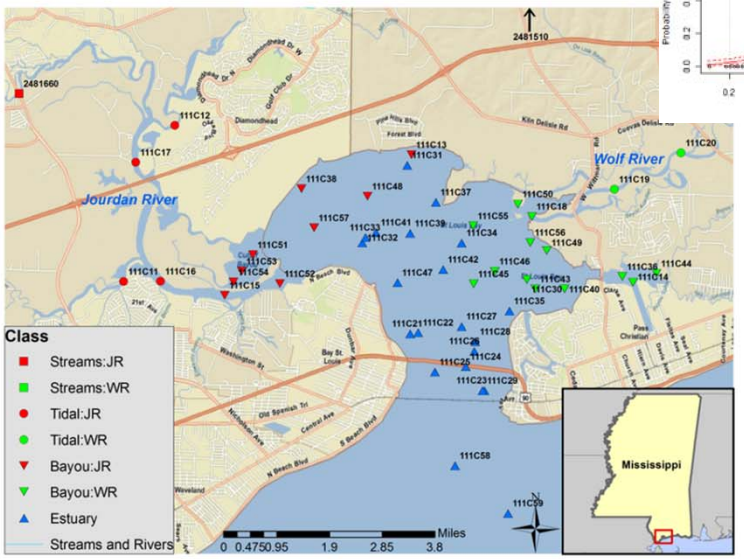
- Bay St. Louis, MS: Nutrient Sources, Fate, Transport, and Effects Study
  - Funded by the USEPA Gulf of Mexico Program
  - Part of several case studies through the Gulf of Mexico Alliance (FL, TX, AL)
  - Comprehensive estuarine water quality model with field calibration/validation

# Modeling Efforts – Bay Saint Louis

- Field sampling – calibration, validation, empirical modeling

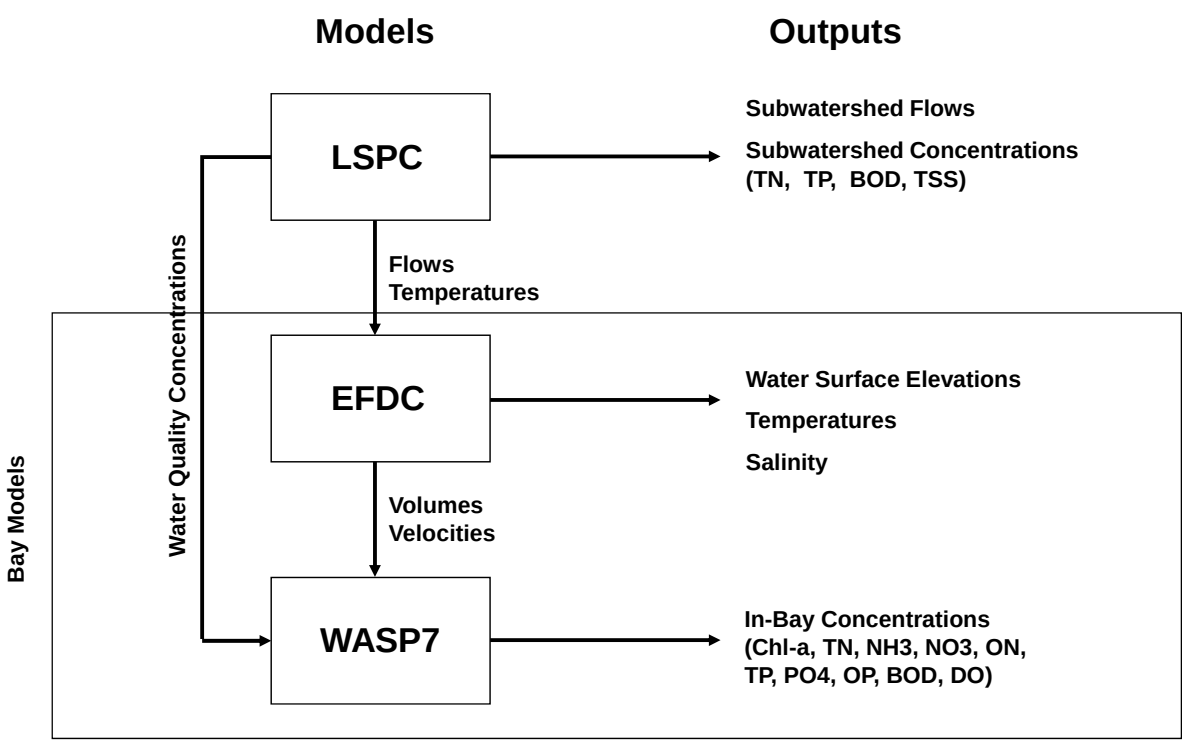


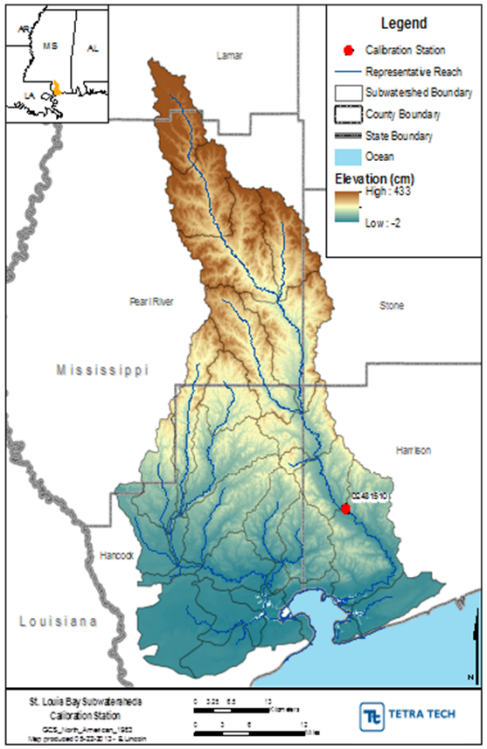



# Modeling Efforts – Bay Saint Louis

- Linked watershed loading (LSPC) - hydrodynamic (EFDC) - water quality (WASP7) models



# Coastal Empirical Analysis

- Using coastal/estuarine/tidal water quality data
- Classification
  - Open sound, estuaries, and tidal waters were defensible
- Literature
  - MS Coastal Region generally medium-low eutrophication
- Reference (Existing Condition)
  - Based on identifying and using existing conditions to set criteria
- Stressor-response modeling
  - Developing nutrient-response models for different classes

# Coastal/Estuarine/Tidal



SLB Study reinforced current numeric ranges

- Magnitude:
  - Ranges from multiple analyses to date (SLB)
    - Chl a: 6 – 15 ug/L (10 – 20 ug/L)
    - TN: 0.60 – 1.0 mg/L (0.6 – 0.8 mg/L)
    - TP: 0.05 – 0.20 mg/L (0.06 – 0.08 mg/L)
- Duration: Seasonal (June-October) Geometric Means
- Frequency: Not to be exceeded more than 2/5 years
- Implementation: Same options as for other waters
  - Single numeric
  - Range with combined criteria/site specific option

# Coastal Efforts

- Completing Revised Technical Reports on Coastal Estuarine Numeric Thresholds
- TAG review
- Will complete range recommendations by June 2014
- NOTE: Potential for some additional coastal modeling – working with EPA R4 and HQ to identify resources

# DECISION AGREEMENT

# WHAT IS DECISION AGREEMENT?

- Looking at agreement in decision-making
- Based on decision theory/receiver operator characteristic analysis.
- Engineering and health diagnostics.

| | | Indicator | |
|---|---|---|---|
| | Is there a response? | No | Yes |
| "Truth" | Yes | False Negative | True Positive |
| | No | True Negative | False Positive |

# WHERE DID IT COME FROM?

- McLaughlin 2011, 2012

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## Estimating the Designated Use Attainment Decision Error Rates of US Environmental Protection Agency's Proposed Numeric Total Phosphorus Criteria for Florida, USA, Colored Lakes

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(Submitted 22 September 2010; Returned for Revision 7 April 2011; Accepted 11 May 2011)

**ABSTRACT**
The utility of numeric nutrient criteria established for certain surface waters is likely to be affected by the uncertainty that exists in the presence of a causal link between nutrient stressor variables and designated use–related biological responses in those waters. This uncertainty can be difficult to characterize, interpret, and communicate to a broad audience of environmental stakeholders. The US Environmental Protection Agency (USEPA) has developed a systematic planning process to support a variety of environmental decisions, but this process is not generally applied to the development of national or state-level numeric nutrient criteria. This article describes a method for implementing such an approach and uses it to evaluate the numeric total P criteria recently proposed by USEPA for colored lakes in Florida, USA. An empirical, log-linear relationship between geometric mean concentrations of total P (a potential stressor variable) and chlorophyll *a* (a nutrient-related response variable) in these lakes—that is assumed to be causal in nature—forms the basis for the analysis. The use of the geometric mean total P concentration of a lake to correctly indicate designated use status, defined in terms of a 20 μg/L geometric mean chlorophyll *a* threshold, is evaluated. Rates of decision errors analogous to the Type I and Type II error rates familiar in hypothesis testing, and a 3rd error rate, $E_{ni}$, referred to as the nutrient criterion–based impairment error rate, are estimated. The results show that USEPA's proposed "baseline" and "modified" nutrient criteria approach, in which data on both total P and chlorophyll *a* may be considered in establishing numeric nutrient criteria for a given lake within a specified range, provides a means for balancing and minimizing designated use attainment decision errors. Integr Environ Assess Manag 2012;8:167–174.
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**Keywords:** Nutrients Water quality criteria Florida lakes Data quality objectives Decision errors

Environmental Management

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## Assessing the Predictive Performance of Risk-Based Water Quality Criteria Using Decision Error Estimates from Receiver Operating Characteristics (ROC) Analysis

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(Submitted 17 November 2011; Returned for Revision 13 January 2012; Accepted 13 February 2012)

**ABSTRACT**
Field data relating aquatic ecosystem responses with water quality constituents that are potential ecosystem stressors are being used increasingly in the United States in the derivation of water quality criteria to protect aquatic life. In light of this trend, there is a need for transparent quantitative methods to assess the performance of models that predict ecological conditions using a stressor–response relationship, a response variable threshold, and a stressor variable criterion. Analysis of receiver operating characteristics (ROC analysis) has a considerable history of successful use in medical diagnostic, industrial, and other fields for similarly structured decision problems, but its use for informing water quality management decisions involving risk-based environmental criteria is less common. In this article, ROC analysis is used to evaluate predictions of ecological response variable status for 3 water quality stressor–response data sets. Information on error rates is emphasized due in part to their common use in environmental studies to describe uncertainty. One data set is comprised of simulated data, and 2 involve field measurements described previously in the literature. These data sets are also analyzed using linear regression and conditional probability analysis for comparison. Results indicate that of the methods studied, ROC analysis provides the most comprehensive characterization of prediction error rates including false positive, false negative, positive predictive, and negative predictive errors. This information may be used along with other data analysis procedures to set quality objectives for and assess the predictive performance of risk-based criteria to support water quality management decisions. Integr Environ Assess Manag 2012;8:674–684. © 2012 SETAC

**Keywords:** Water quality criteria Stressor–response model Criteria assessment Risk-based Receiver operating characteristics

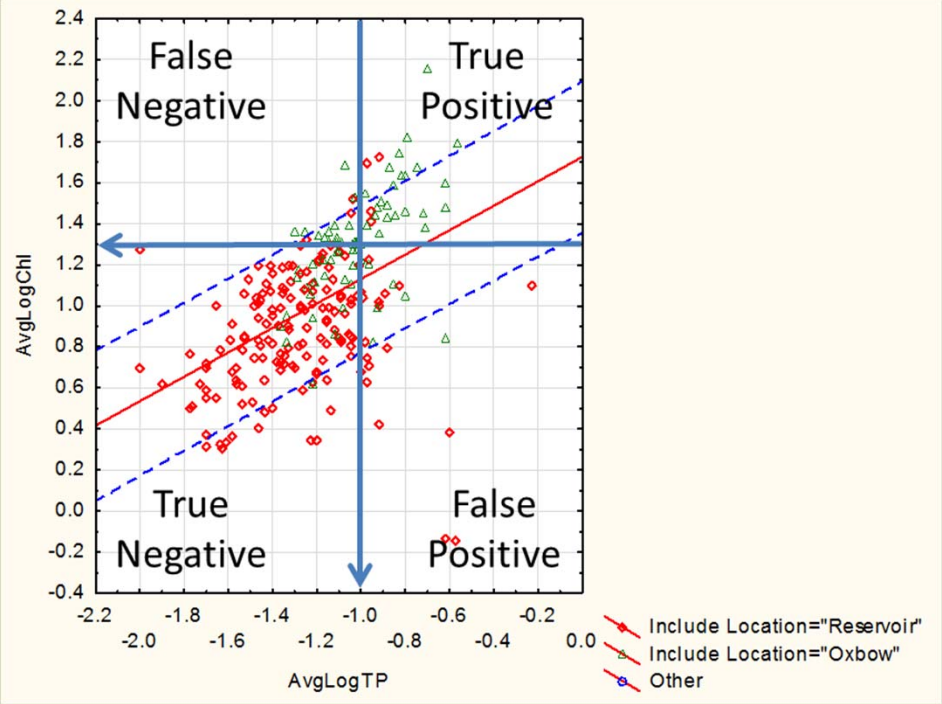
Health & Ecological Risk Assessment

**INTRODUCTION**
Increased attention is being given to the development of water quality benchmarks and criteria using weight of nutrient criteria (USEPA 2010b), and benchmarks for specific conductance in central Appalachian streams (USEPA 2011).
Suter and Cormier (2008) provide a useful risk-based

# WE CAN APPLY IT TO ENVIRONMENTAL INDICATORS

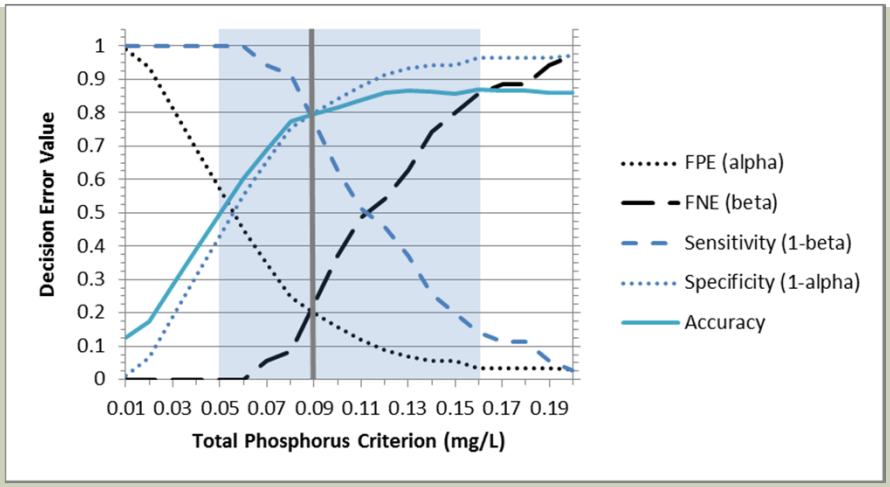
- Assume that the response is “truth”

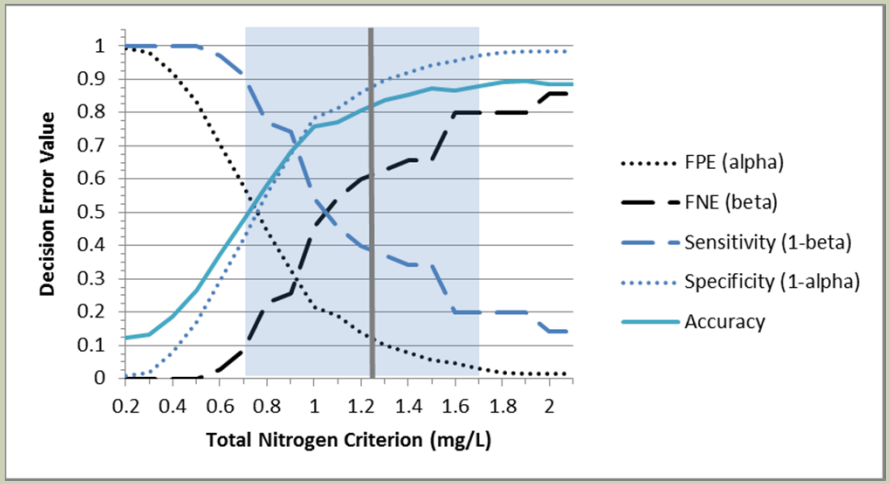
| | | | |
|---|---|---|---|
| Response (Chl a) | Impact (+) | False Negative | True Positive |
| | No-Impact (-) | True Negative | False Positive |
| | | No-Impact (-) | Impact (+) |
| | | Indicator (TN or TP Concentration) | |



# TAKE HOME MESSAGE - LAKES

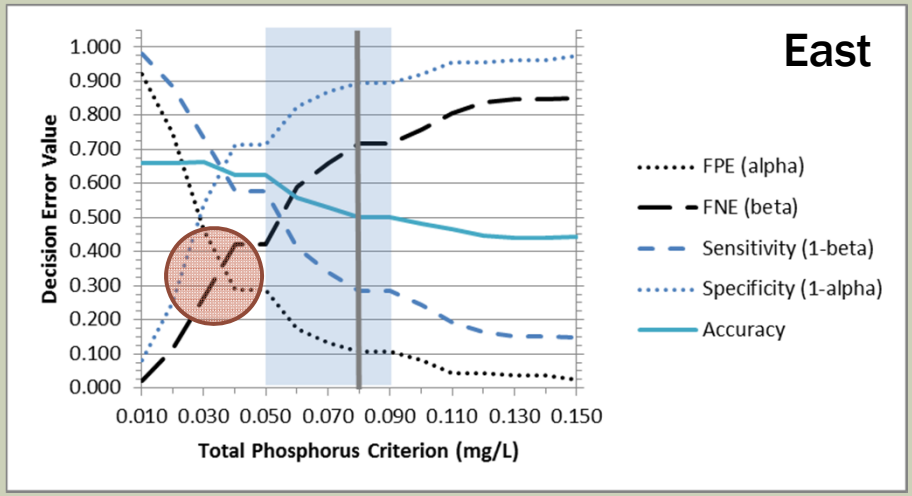
- Chl a is response
- Proposed single criteria balance agreement very well for TP
- For TN, hedge on side of best agreement between TN and Chl targets
- Range approach minimizes both agreement errors

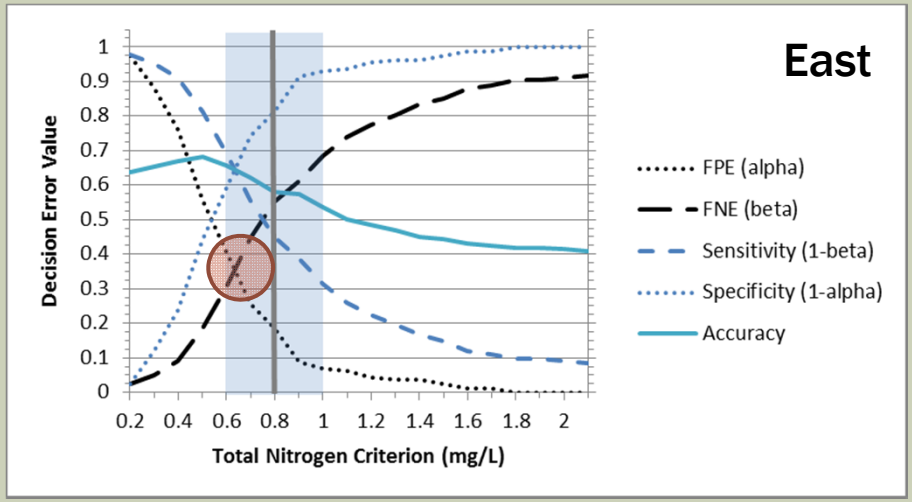


# TAKE HOME MESSAGE - STREAMS

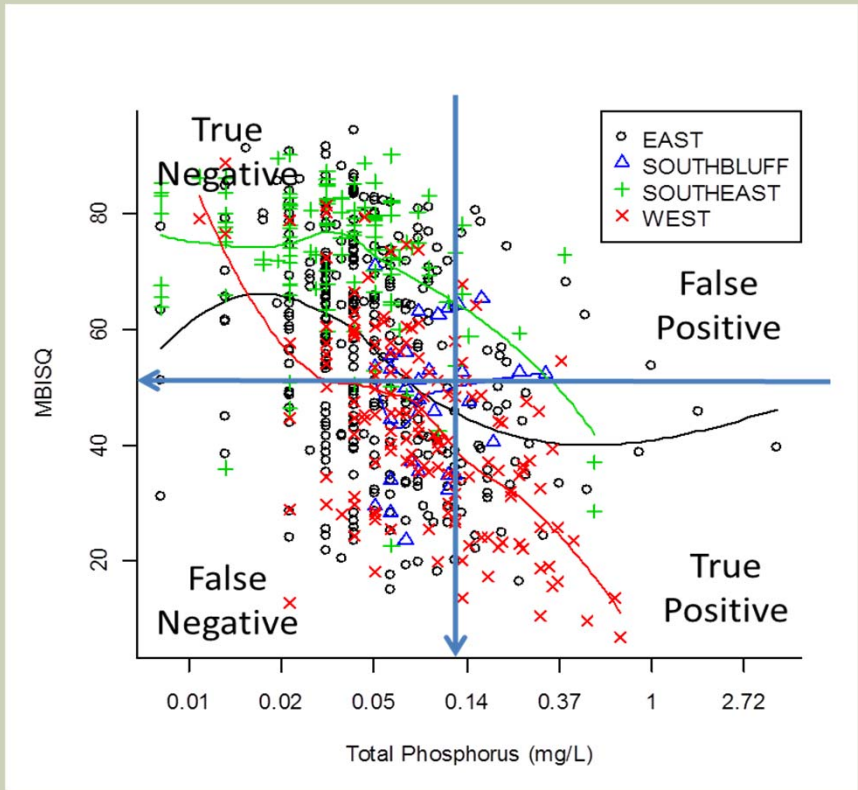
- MBISQ is response
- Tend to hedge on side of lower false positive errors
- High false negative error rate, but there is an explanation for that….



# TAKE HOME MESSAGE - STREAMS

- Stream models are noisier
- High False Negatives
  - Bad Biology and Low Nutrients
  - Is that a real false negative due to nutrients?
  - Lot of stressors in streams affect invertebrates.
- Not many False Positives
  - With single value approach




West region thresholds

# DECISION AGREEMENT

- Decision agreement analysis has largely supported defensibility of thresholds and consistency with responses
- MDEQ using this analysis to reinforce thresholds
- Looking at model results to inform ranges
- A few more tweaks to run

# Implementation Planning

# Beyond the Number: Implementation Planning



- Many questions surround implementation both internally and from our stakeholders
- MDEQ Interdivisional Implementation Workgroup formed to work through issues identified by MDEQ staff, partners, and stakeholders
  - Permitting implications
    - Compliance Schedules
    - Variances/Mixing Zones/Others
  - Assessment implications
  - TMDLs/WLAs
  - Watershed Planning

# Implementation Workgroup



- Workgroup developed a list of implementation questions such as
  - How will the number be written into our standards?
  - How will we monitor/assess for nutrients?
  - How will we incorporate this number into permits?
  - How long will it be before facilities see nutrient limits in their permits?
  - How long will facilities have to comply with new permit limits?
- Survey was sent out to stakeholders asking for feedback on the questions as well as issue prioritization
- Subcommittees will initiate developing responses to these questions
  - MDEQ will work with external stakeholders to get feedback and input as well
- Responses will ultimately be part of an implementation plan

# Stakeholder Survey

- Survey was sent out on January 27, 2014 to stakeholders asking for feedback on the prioritization of implementation issues covering topics within categories including:
  - Nutrient Criteria Development
  - Monitoring and Assessment
  - Permitting
  - Total Maximum Daily Loads, Waste Load Allocations (WLAs), and Modeling
  - Watershed Planning
  - Miscellaneous Issues (other states' efforts, funding sources, etc)

- Additional opportunity at the end of the survey for stakeholders to express other comments and concerns regarding implementation

# Stakeholder Survey Results

- Rate topics in each of the six categories based on the level of importance to them as a Stakeholder
  - 1 being less important, 5 being extremely important
- Answers ranged from 3.40-4.63 indicating at least a moderate interest in all topics
- Out of the 249 people surveyed we received 43 responses for a response rate of 17%

# Stakeholder Survey Results – High Interest

- The consideration of nonpoint sources
  - Permitting category
    - "Discretion or Flexibility Regarding the Required Nutrient Treatment Limits where the Point Sources are a Minor Fraction of the Total Nutrient Load" received a score of 4.51
  - Watershed Planning category
    - "Considering Nonpoint Sources and Point Sources when Implementing Nutrient Criteria" was rated a 4.63
  - Six of the typed responses inquired about the treatment of nonpoint sources

# Stakeholder Survey Results – Less Interest

- "The efforts of other states"received the lowest rating of 3.40

- Additional resources needed for implementation
  - Permitting category
    - "Additional Resources Needed to Implement Nutrient Criteria into Permitting, Compliance, and Enforcement to MDEQ and/or to Permittees" was rated 3.79
  - Modeling category
    - "Additional Training or Other Resources Needed to Implement Nutrient Criteria into TMDLs/WLAs/Modeling" was scored 3.80

# Stakeholder Survey Results – Additional Comments

- Final question allowed stakeholders to voice their comments and concerns regarding implementation
- 16 comments were left
  - MDEQ will take steps to address all of these additional comments

- We appreciate your input
- Thank you for taking the time to provide us with your thoughts
- Would there be a benefit to resending to the group?

# Moving Forward in MS



- MDEQ will continue work through the criteria development process with TAG support and Stakeholder input
- MDEQ will continue to work on Internal/External Implementation Planning
- Stakeholder Outreach an MDEQ Priority
  - MDEQ will continue regular Stakeholder Update Sessions
  - Continue to provide the opportunity for stakeholders to stay informed and also express their comments and/or concerns regarding both the criteria development efforts and plans for implementation of those criteria
    - Technical concerns/suggestions may be relayed back to DEQ
    - Policy concerns can be relayed to MDEQ upper management
- We are not currently in the formal comment period – that will come later
  - The sooner we know about your concerns, questions, suggestions, etc. the better...MDEQ can start looking at those now

# Update on Important Nutrient Criteria Issues

# Combined Criteria

- On September 12, 2013 USEPA published the "Guiding Principles on an Optional Approach for Developing and Implementing a Numeric Nutrient Criterion that Integrates Causal and Response Parameters"
- Only applicable to nitrogen and phosphorus
- Rules for Use
  - Must be protective – numeric values for all parameters must be set to protect uses
  - Sound Science Rationale
    - Criterion process should be thoroughly documented
    - Sensitive Indicators : TN, TP, Productivity measures (chlorophyll-a, percent algal/plant cover), algal assemblage structure, functional measures (pH and DO)
    - Reliance on higher trophic levels alone (invertebrate/fish), may not be adequate, need to be coupled with others
    - Must have sufficient data
    - The use one or more of these ideal response indicators is recommended

# Expression of the Criterion

- Causal and response parameters must be combined into one criterion
- Parameters should be expressed numerically
- Duration and frequency components for all parameters should be included
- Must clearly establish the water quality goal that applies for permitting, assessment, and TMDL decisions
- If using a range, must include transparent decision framework to use in that range.

# Expression of the Criterion

| Criterion | Water Body Condition |
|---|---|
| All causal and response parameters are met | Meeting designated use |
| All response parameters are met, but one or more of causal parameters is exceeded | Meeting designated use |
| A causal parameter is exceeded and any applicable response parameter is exceeded | Not meeting designated use |
| A causal parameter is exceeded and data is unavailable for any applicable response parameters | Not meeting designated use |
| A causal parameter is not exceeded but an applicable response variable is exceeded | Not meeting designated use (further investigation may be needed to determined if nutrient pollution is the cause) |

# What Does this Mean for MS?

- The "Guiding Principles" document describes a more rigorous data requirement for combined criteria than what MDEQ currently has
  - Investigating sufficiency of current algal/plant measures/data
  - Do not have current chlorophyll a/percent cover measure
  - Could lengthen criteria development process if combined criteria are desired

- How does this change MDEQ options?
  - The "Guiding Principles" only loosely addresses a range approach
  - Combined criteria could be very costly
  - A purely numeric criterion is still an option

# Nutrient Criteria Nationally



- Florida
- Mississippi River Petition
- New lawsuits

# Florida



- EPA Necessity Determination and Consent Decree – 2009
- EPA Phase I – Inland Criteria – Jan/Nov 2010
- Lawsuits– 2011
- "Stoner Partnership Memo" – March 2011
- Court Decision – Feb. 2012
- FDEP Inland Criteria Proposed – June 2012
- EPA Inland Remand/Marine Criteria Rules Proposed – Nov 2012
- EPA Approves Florida Inland Rule – Nov 2012
- Agreement in Principle – March 2013
- Court stays rule (DPVs) – April 2013
- FDEP Implementation document approved, EPA amends determination and moves to amend consent decree (DPV and gap waters) – June 2013
- FDEP submits Marine Criteria *mostly – August 2013
- EPA approves Marine Criteria – September 2013
- Judge heard arguments on amended consent decree – September 2013
- Judge decides for EPA and modifies consent decree – January 2014
- Plaintiffs appeal decision – March 2014
- EPA in process of withdrawing their rule

# Florida



- FDEP has approved rules for inland and coastal waters
  - Not in force until EPA withdraws theirs and confirms FDEP rules fulfill consent decree.
  - EPA just approved final set of coastal criteria and plan to finish the rest
  - EPA *has not yet withdrawn their rule*, but has an amended determination
- Plaintiffs appealing court decision to amend the consent decree
- Poison Pill still in play - Approve, remove, and satisfy determination or else "not implement" these rules

# Mississippi River



- July, 2008 -13 NGOs file petition for criteria/TMDLs
- Given known problems and lack of progress; EPA should make a necessity determination to:
  - Impose WQS for Northern Gulf, and all waterbodies in all states without nutrient WQS; or
  - Impose WQS for Northern Gulf, and all waters in MARB; or
  - Mainstem Mississippi River and Northern Gulf of Mexico; or

  <u>and</u>
  - Establish TMDL for N and P in Gulf, Mississippi River, and each tributary that fails to meet numeric N and P criteria; or
  - Establish TMDL for N and P in Gulf and mainstem Mississippi River.

# Mississippi River



- Petitioners threaten litigation - April 2011
- EPA denies petition for determination - July 2011
  - Too resource intensive/Deferring to state efforts
- Petitioners sue under APA - March 2012 (US District Ct. LA)
  - EPA failed to respond to petition properly
  - States and Agricultural Groups intervene
- Judge rules for plaintiffs mostly - September 2013 (US District Ct. LA)
  - EPA's motion to dismiss denied; must make determination in 180 Days (march 19, 2014)
  - Plaintiff summary judgment denied
- EPA appeals ruling – November 2013 (5th Circuit)
- Gets extensions for appeals brief – Feb. 2014 (5th Circuit)
- EPA requests stay pending appeal – Feb. 2014 (US District Ct. LA and 5th Circuit))
- Plaintiffs say EPA should at least start on 6 states – Feb. 2014
- EPA files appeal brief – March 2014 (5th Circuit)
  - Courts erred in requiring determination – determinations are not mandatory
- Judge denies stay – March 14, 2014 (US District Ct. LA)
- Appellate Court grants stay – March 17, 2014 (5th Circuit)

# Other Lawsuits - Kentucky



- CWA Lawsuit on KY WQS Approval
  - Original lawsuit - chronic fish-tissue based Se standards revision.
  - Amended complaint – added EPA's approval of change to eutrophication definition and criteria as unlawful
    - Eutrophication "means the enrichment of a surface water by the discharge or addition of a nutrient" **changed to** "means the enrichment of a surface water with nutrients nitrogen and phosphorus *resulting in adverse effects on water chemistry and the indigenous aquatic community*."
  - Plaintiffs argue that:
    - "such standards were ***reactive*** and ***appeared to allow nutrient pollution*** and even algal blooms ***until the pollution actually had an adverse effect*** on the aquatic community...
    - "...criteria must prevent impairment of uses rather than wait to address impairments that have arisen"
    - "The changes to the eutrophication definition and criteria fail to effectively control nutrient pollution so as to prevent eutrophication from occurring, and are insufficient to avoid adverse effects to existing water uses, including federally-listed species. "

# Other Lawsuits - Chesapeake



- Chesapeake Bay TMDLs
  - American Farm Bureau sued that TMDL was illegal – January 2011
    - Usurped state authority to apportion loads and set timelines
  - AFBF asks for summary judgment, so does EPA – Jan/Mar 2012
  - Court decides for EPA – September 2013
  - AFBF files appeal of decision – October 2013
    - 21 state AGs side file amici briefs for plaintiffs – Feb 2014
    - WV sides with Plaintiffs
    - MD sides with EPA - Feb 2014

Questions?
Comments?
Concerns?

# Improving Tools for the MS Water Quality Standards Program:

Natural Conditions Framework and
Revised Aquatic Life Use Options

# Take Home Message

- Two documents have been developed in a collaborative effort between MDEQ and EPA with recommendations for:
  - *Natural Condition Framework*: Process for establishing where natural conditions provision applies and justify setting site specific criteria
    - A consistent and replicable process for MDEQ to apply its natural conditions narrative provision
  - *Use Revision Options*: An exploration for options to revise aquatic life uses in MS
    - Provide options for exceptional and modified aquatic life use classes
    - Supporting improvement over MS current one size fits all narrative

# History

## Natural Condition

- MDEQ has a narrative natural condition provision
- MDEQ has applied this provision to some previous waters
- Seeing an increasing interest in applying this provision – DO, pH, temperature, and possibly nutrient criteria
- Desired a standard process for consist application of the provision

## Use Revision

- MDEQ has a single aquatic life use narrative
- See the need to revisit and perhaps refine this use
- Desired an exploration of options

# Natural Conditions

- EPA 1997 Memo
  - States may set site specific numeric aquatic life criteria to *natural background* where exceedance is due only to non-anthropogenic sources
    - State should include in WQS:
      1. a definition of natural background consistent with the above;
      2. a provision that site specific criteria may be set equal to natural background;
      3. a ***procedure for determining natural background***, or alternatively, a reference in their water quality standards to another document describing the binding procedure that will be used.
  - MS has 1 and 2, this document provides 3

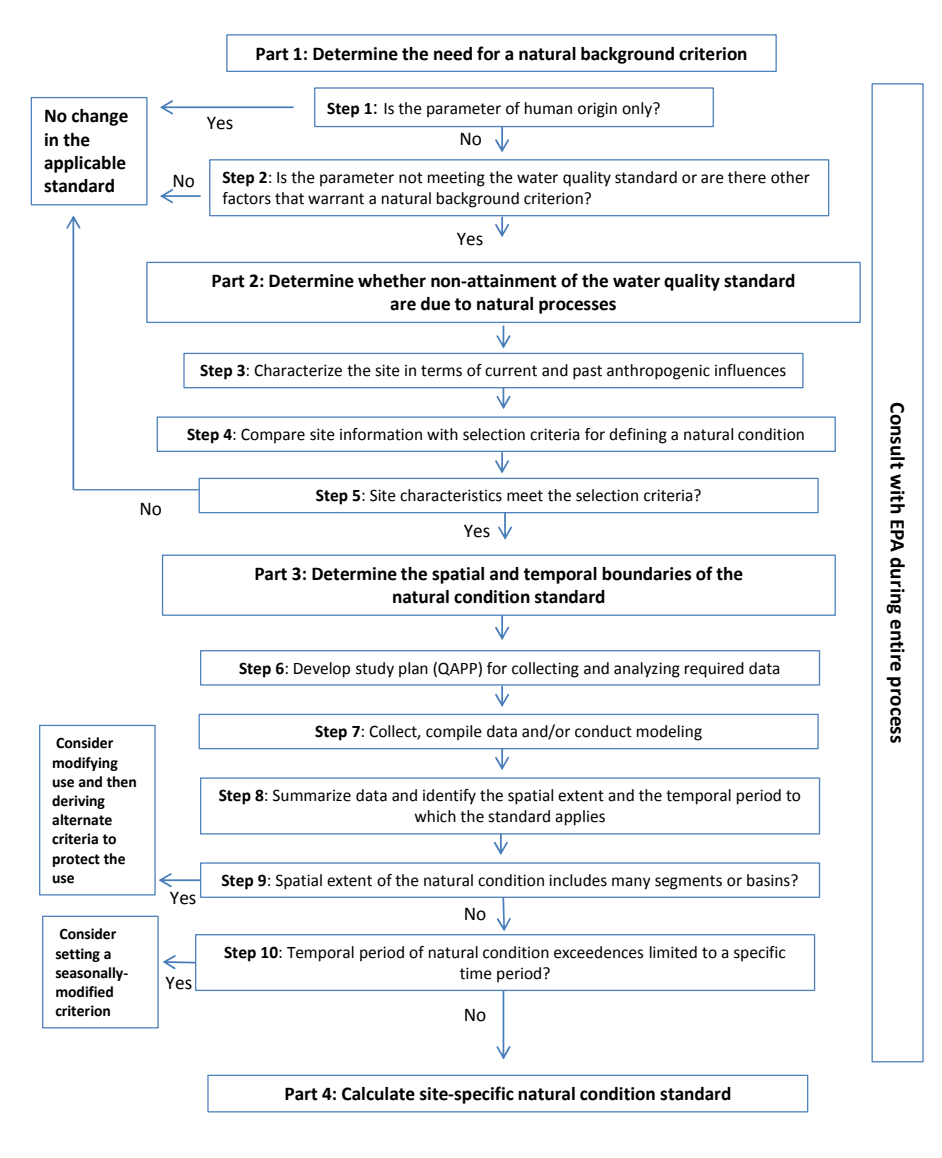
# Natural Conditions

- MS WQS Definition and Provision:
  - “Natural conditions are defined as background water quality conditions due only to non-anthropogenic sources…Waters may naturally have characteristics outside the limits established by these criteria. Therefore, naturally occurring conditions that fail to meet criteria should not be interpreted as violations of these criteria.” (State of Mississippi Water Quality Criteria for Intrastate, Interstate and Coastal Waters, WPC-2, Section 1, 4. Natural Conditions)
  - Other sections reference natural condition

# Natural Conditions

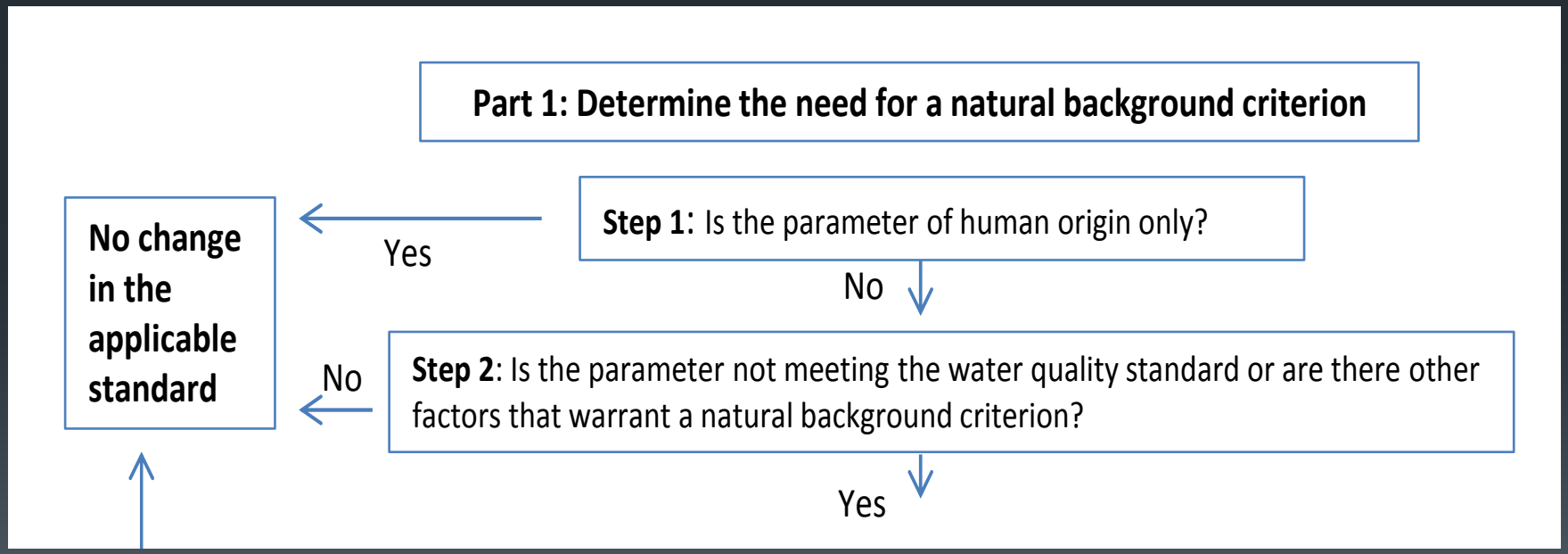
- Procedure Framework – 4 parts

1. Determine the need for a natural background criterion;
2. Determine whether non-attainment of the State-wide water quality criterion is due to natural processes;
3. Determine the spatial and temporal boundaries of the natural condition;
4. Calculate a site-specific natural background criterion.



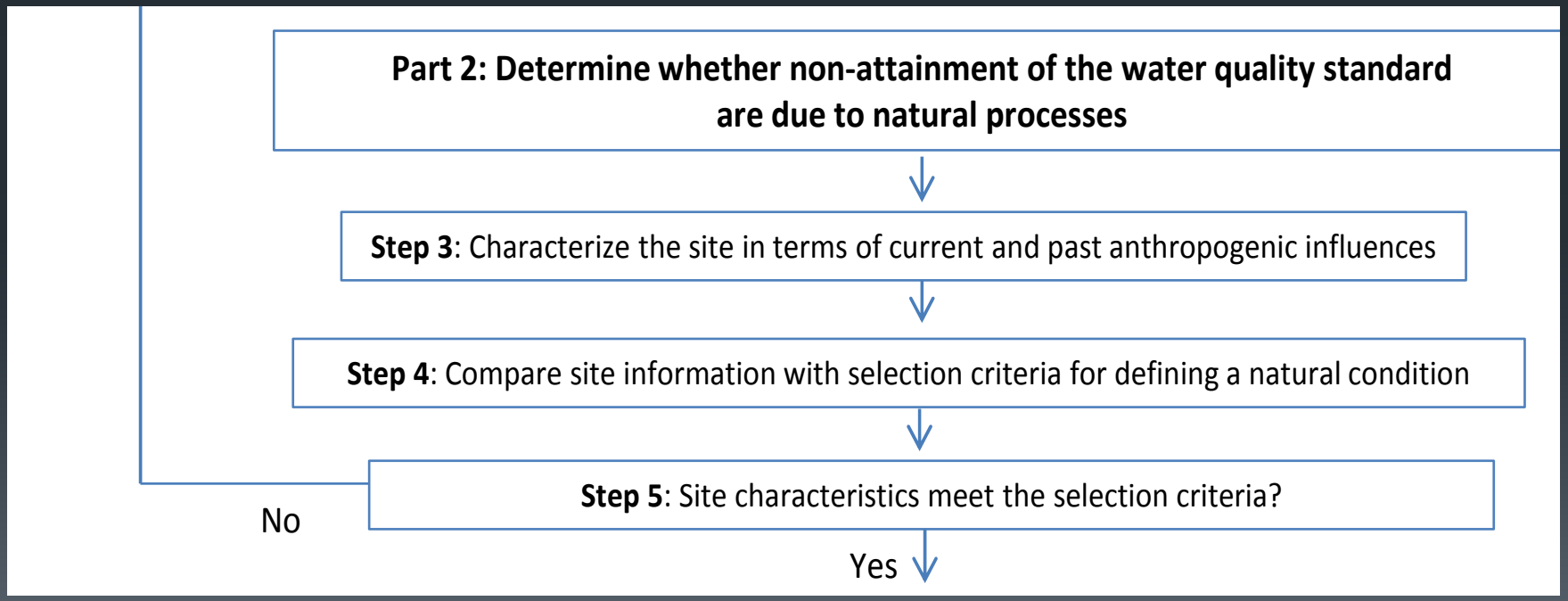
# Natural Conditions

- Part 1 – Determine the need
  - (1) Is the parameter of human origin only?
  - (2) Is the parameter not meeting the applicable water quality standard?



# Natural Conditions

- Part 2 – Is Nonattainment due to Natural Processes
  - Characterize current and past anthropogenic influences;
  - Compare site information with natural condition selection criteria;
  - Determine if site characteristics meet natural condition selection criteria.



# Natural Conditions

- Part 2 – Is Nonattainment due to Natural Processes
  - Characterize current and past anthropogenic influences;
  - Compare site information with natural condition selection criteria;
  - Determine if site characteristics meet natural condition selection criteria.

    - Sample selection criteria, for example:
      - High quality water evidenced by biological community scores
      - Undisturbed vegetation and natural buffers
      - Historical land use within the segment and upstream does not indicate anthropogenic impacts
      - Insignificant groundwater withdrawal in the area
      - Minimal evidence of hydrological alteration (e.g., dams, impoundments, channelization)
      - Groundwater recharge to the surface water not impacted by anthropogenic activities
      - Point source discharges are not present near or upstream of a site
      - Non-point source runoff from agriculture, lawns, golf courses, impervious surfaces, and other human activities is absent in the immediate catchment and upstream

    - Some upstream human activity may be allowed if known not to affect variable of interest or of demonstrated distance and/or amount known not to affect uses

# Natural Conditions

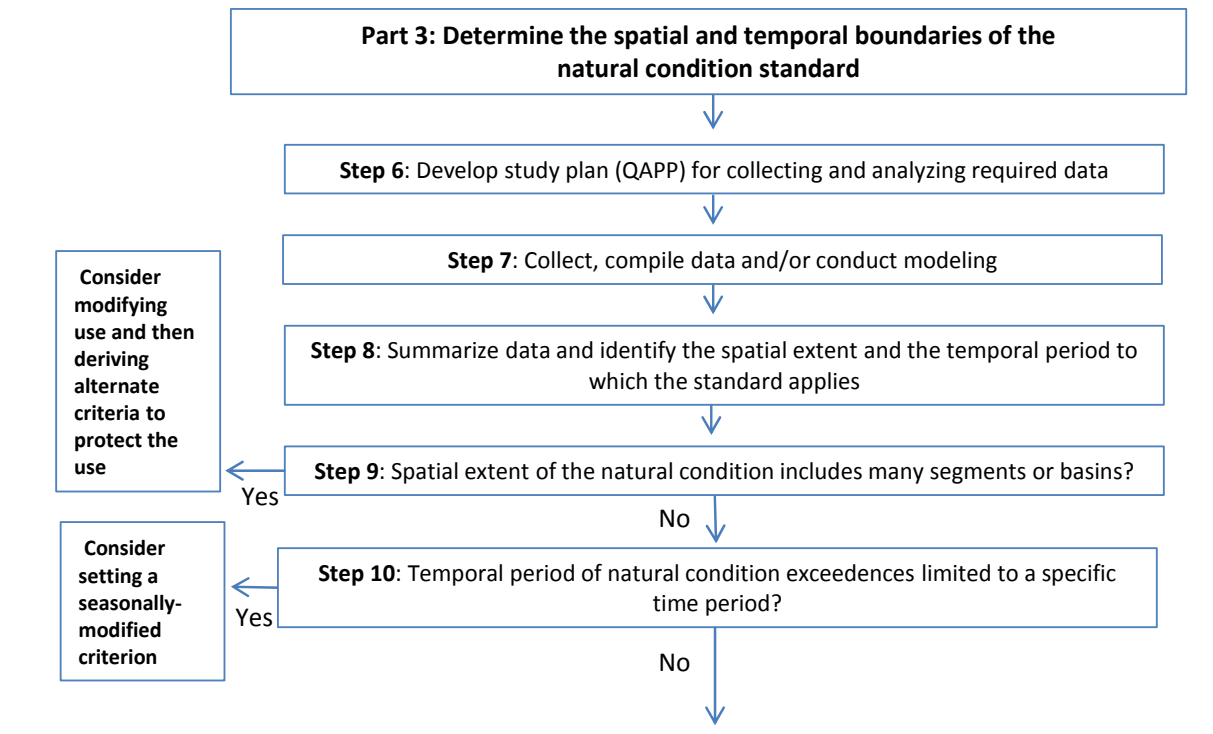
- Part 2 – Is Nonattainment due to Natural Processes
  - What is not a natural condition?  Some examples:
    - Water quality that has been or is currently impacted by industry or is substantially impacted by other human activities.
    - Permanent human-induced landscape changes that may not be feasible to reverse might be better addressed through a use change via a Use Attainability Analysis (UAA).
    - Human-caused conditions (or “anthropogenic impacts”) from sources outside the watershed, such as atmospheric deposition or ground water aquifers that extend beyond the watershed, determined from GIS or historic documentation.

# Natural Conditions

- Part 2 – Is Nonattainment due to Natural Processes
  - Document the process
  - Finding of natural condition should include:
    - Explain why human activities, if any, are not directly/indirectly the cause of non-compliance;
    - Evidence of minimal human activity in the watershed that would affect the parameter in question;
    - Explain how natural processes explain the observed non-attainment;
      - Include a conceptual model.
      - Consider: hydrogeomorphology, geology, land use/biology
    - Demonstrate reference waterbody consistency with natural condition, if possible.

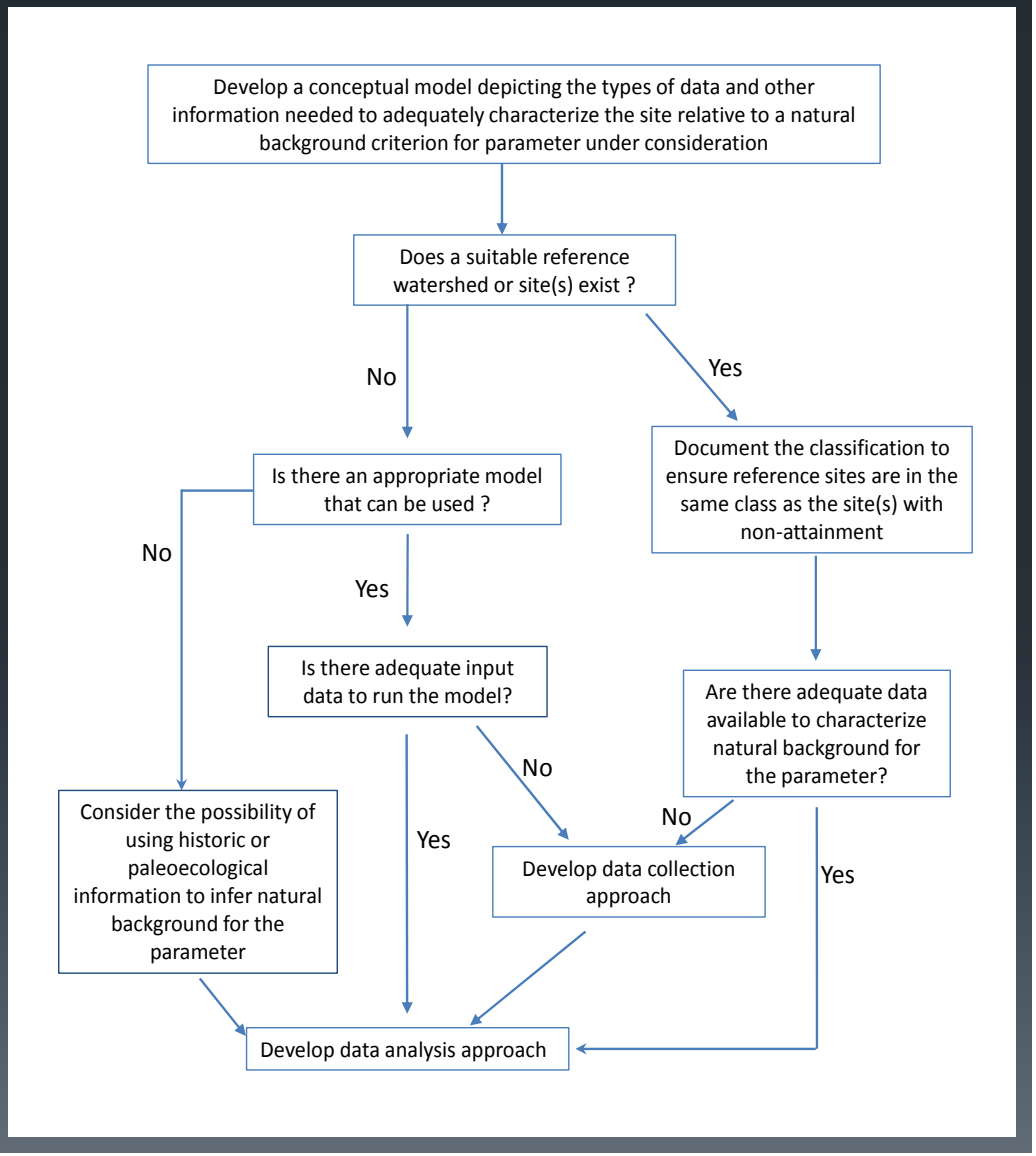
# Natural Conditions

- Part 3 – Determine spatial/temporal boundaries
  - Where and when natural condition should apply
    - Develop a study plan
    - Collect/compile data
    - Summarize data spatially and temporally
    - Establish spatial extent and temporal period of natural condition



# Natural Conditions

- Part 3 – Determine spatial/temporal boundaries
- Flow diagram for determining study plan and data analysis approach
- Can include mechanistic modeling
- Plan should be reviewed by EPA Region 4



# Natural Conditions

- Part 3 – Determine spatial/temporal boundaries
  - Once data are collected and analyzed, develop spatial boundaries and temporal boundaries
    - Spatially:  Do these apply to a single site or multiple sites within a region (e.g., oxygen in similarly situated low gradient streams)?
    - Temporally: Do these apply annually or only during a specific season (e.g., natural condition only exceeds criterion in summer)?

# Natural Conditions

- Part 4 – Calculate a natural condition criterion
  - Empirical statistical approach:
    - Characterize existing condition with data collection and use to set site specific criterion
  - Mechanistic modeling approach:
    - Model conditions and use model output with statistical approaches above
    - Requires well calibrated and validated model

↓

**Part 4: Calculate site-specific natural condition standard**

# Natural Conditions

- Procedure Framework – 4 parts

1. Determine the need for a natural background criterion;
2. Determine whether non-attainment of the State-wide water quality criterion is due to natural processes;
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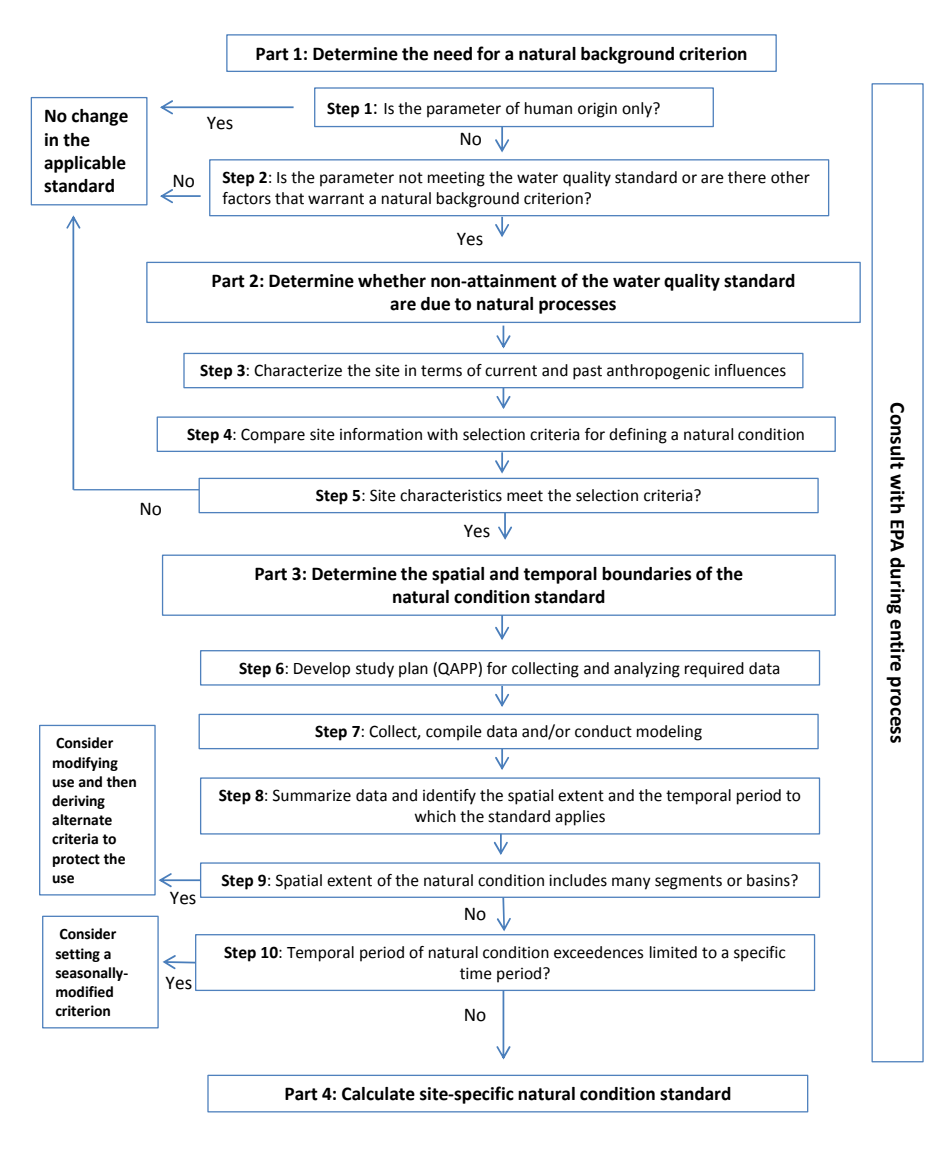

# Natural Conditions

- Document includes regional/state examples
  - Chesapeake Bay DO
  - Florida SSAC
  - Georgia models
  - North Carolina Chowan River Basin study
  - Minnesota natural condition document
  - Louisiana reference DO
  - Kansas background implementation procedures
  - EPA Region 10 Natural Conditions Workgroup Report

# Revised Aquatic Life Use Options

- Goal: Develop a framework to organize aquatic life use revision issues and options for MDEQ
  - Not a road map for use revision
- Natural and Modified Use Background
- Use Options

# Revised Aquatic Life Use Options

- Supporting the aquatic life use and having different aquatic life are not the same thing

These two stream types have different invertebrate aquatic life

But they have the same aquatic life use expectation:
Support “propagation of fish, aquatic life, and wildlife”

So may just decide to have one aquatic life use with a highland and lowland indicators.

States often have different indices for different biological classes (lowland and highland streams)

# Revised Aquatic Life Use Options

- But…one option is to refine uses to reflect natural differences: including different biological and water chemical criteria

Organisms in these streams like coldwater

These two stream types have different invertebrate aquatic life

Organisms in these streams like warm water

Coldwater Aquatic Life Use

Warmwater Aquatic Life Use

# Revised Aquatic Life Use Options

- Sometimes, meeting designated uses is not feasible and use revision is also an option
- Factors that determine when a use can be revised or removed - 40 CFR 131.10(g) (simplified):
  - Naturally occurring pollutant concentrations prevent the attainment of the use;
  - Natural flow conditions or water levels prevent the attainment of the use;
  - Human pollution prevents the attainment of the use and cannot be remedied or would cause more environmental damage to correct than to leave in place;
  - Hydromodifications preclude the attainment of the use, and it is not feasible to restore the water body;
  - Natural physical features preclude attainment of aquatic life uses;
  - Controls would result in substantial and widespread economic and social impact.
- Does not apply to revision of existing uses (11/28/1975 and after)

# Revised Aquatic Life Use Options

- Sometimes, meeting designated uses is not feasible and use revision is also an option then

- Example – Ohio Modified Warmwater Use
  - OH WQS specifically spell out the physical modifications that may prevent attainment and justify a refined modified use
  - Require a UAA to place a site in this class
  - “extensive stream channel modification activities permitted under sections 401 and 404 of the act, extensive sedimentation resulting from abandoned mine land runoff, and extensive permanent impoundment of free-flowing water bodies”

- Example – Florida Class III Limited Waters
  - CLASS III-Limited - Fish Consumption; Recreation or Limited Recreation; and/or Propagation and Maintenance of a Limited Population of Fish and Wildlife” [62-302.400(1) F.A.C.]
  - Similarly limited to human-induced physical or habitat conditions
  - Require a UAA to place a site in this class
  - Same toxic aquatic life criteria, site specific criteria for: nutrients and nutrient response variables, bacteria, dissolved oxygen, alkalinity, specific conductance, transparency, turbidity, biological integrity, and/or pH
  - Site specific criteria need to be developed and submitted to EPA as part of UAA

# Revised Aquatic Life Use Options

- Revised Use Options
  - Aquatic Life Designated Use
    - Current use
    - “propagation of fish, aquatic life, and wildlife“
    - MS could clarify ALU in definitions part of WQS: “propagation of fish, aquatic life, and wildlife *is defined as* support and growth of a balanced and indigenous community of organisms having species composition, diversity, population densities and functional organization similar to that of applicable reference conditions”
  - Modified Aquatic Life Designated Use
    - Anthropogenically modified waters that meet 131.10(g)
    - UAA *would be required* to place waters into this use
    - “provides maintenance of aquatic life and wildlife”
    - Defined as: “*is defined as* support of a modified community of organisms having a species composition, diversity, and population densities different than that expected of reference conditions. Waters in this modified aquatic life use are constrained by irretrievable anthropogenic modifications of physical habitat”

# Revised Aquatic Life Use Options

- Revised Use Options cont.
  - Agricultural Drainage Waters
    - For waters behind managed drainage structures
    - In FL, secondary and tertiary canals part of water control structures are Class IV waters
      - Many criteria different or not applicable in Florida Class IV waters
    - As for Modified ALU, would require a UAA to move any water into this class
  - Exceptional Aquatic Life Designated Use
    - Existing quality is among the highest observed and/or
    - Waters that harbor exceptional diversity and quality of sensitive, endemic, endangered, and/or otherwise unique assemblages
    - Could include more stringent criteria

# Revised Aquatic Life Use Options

- Implementation
  - Can encode biological criteria for each use as narrative or eventually as numeric biocriteria
    - State currently uses numeric translators of the narrative
  - All waters would retain aquatic life designated use (current aquatic life use)
  - If alternate use classes are established, UAAs needed to move waters into them, except for exceptional waters (upgrade of use)
  - Water quality criteria
    - Toxics would apply to all uses
      - Some exceptions may exist for agricultural drainage waters – but still must protect downstream waters
    - The following criteria would likely vary as site specific criteria: nutrients and nutrient response variables, bacteria, dissolved oxygen, alkalinity, specific conductance, transparency, turbidity, biological integrity, temperature, and/or pH
    - Site specific criteria would need to be developed and submitted to EPA as part of UAA

# Revised Aquatic Life Use Options

- Some examples of waters in different uses:

- Aquatic Life Designated Use

| | |
|---|---|
| Lotic | Springs, spring run streams |
| | Seeps |
| | Headwater streams |
| | Bluff hill originating streams |
| | High gradient streams (Clark Creek) |
| | Intermittent streams |
| | Wadeable streams |
| | Low Gradient wadeable streams |
| | Nontidal streams |
| | Non-wadeable streams |
| | Low Gradient non-wadeable streams |
| | Blackwater streams |
| | Blackland prairie stream |
| | Braided streams |
| | Beaver waters |
| | Sloughs |
| | Normal flow Bayous |
| | Low flow Bayous |
| | Natural water bodies Bayous |

| | |
|---|---|
| Lentic | Open-channel backwater oxbows |
| | Large oxbow lakes |
| | Small oxbow lakes |
| | Oxbows with connections to original channels |
| | No flow Bayous (Reservoirs?) |
| Special Use | National Park waterbodies |
| | Outstanding resource waters |
| | Scenic rivers |
| Wetland | Legal wetlands |
| | Outcrop/recharge groundwater zones |
| | Riparian wetlands |
| | Batture - Land behind the levees |
| | Bogs |
| | Swamps |

# Revised Aquatic Life Use Options

- Some examples of waters in different uses:

- Modified Aquatic Life Designated Use

| | |
|---|---|
| Lotic | Urban/highly modified streams |
| | Regulated flow streams |
| | Maintained (desnagged) streams |
| | Dredged Streams |
| | Channelized streams |
| | Streams with control structures |
| | Historical oil field/modified stream |
| | Silted-in streams (legacy sediment) |
| | Channelized rivers |
| | Flow regulated rivers |
| | Bayous with control structures |
| | Effluent dominated stream |
| Lentic | Managed - Roundaway Lake Bayous |
| | Reservoir zones (backwaters) |
| | Recreation reservoir |
| | Flood control reservoir |
| | Water supply reservoir |
| | Fertilized reservoir |

# Revised Aquatic Life Use Options

- Some examples of waters in different uses:

- Agricultural Drainage Waters/Non Jurisdictional Waters

| | |
|---|---|
| Lotic | Road ditches |
| | Drainage ditch |
| | Drainage canals |
| | Drainage District Ditches |
| | Irrigation ditch |
| | Mosquito ditches |
| Lentic | Borrow pits |
| | Stormwater ponds |
| | Residential lakes |
| | Catfish ponds |
| | Fire protection ponds |
| | Farm ponds |
| | Fishing ponds |
| | Cooling ponds |
| | Wastewater lagoons |

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