

North Carolina Nutrient Science Advisory Council

July 12, 2017

Potential Elements of a CHLa Criteria Proposal for High Rock Lake



Outline

- Compare and contrast two approaches to CHLa criteria derivation
- Identify a range of potential CHLa criteria
- Describe a framework for using this range to identify reservoir-specific criteria

Previous SAC/DEQ Discussion Point to Two Contrasting Methods for CHLa Criteria Derivation

- Method 1 – “Maintain Existing Use Support”
 - Focused on protecting reservoir’s current condition.
 - Predicated on conclusion that HRL is currently meeting uses.
- Method 2 – “Balanced Uses”
 - Would likely set CHLa criteria lower than existing HRL condition.
 - More driven by literature and general concerns/uncertainties.

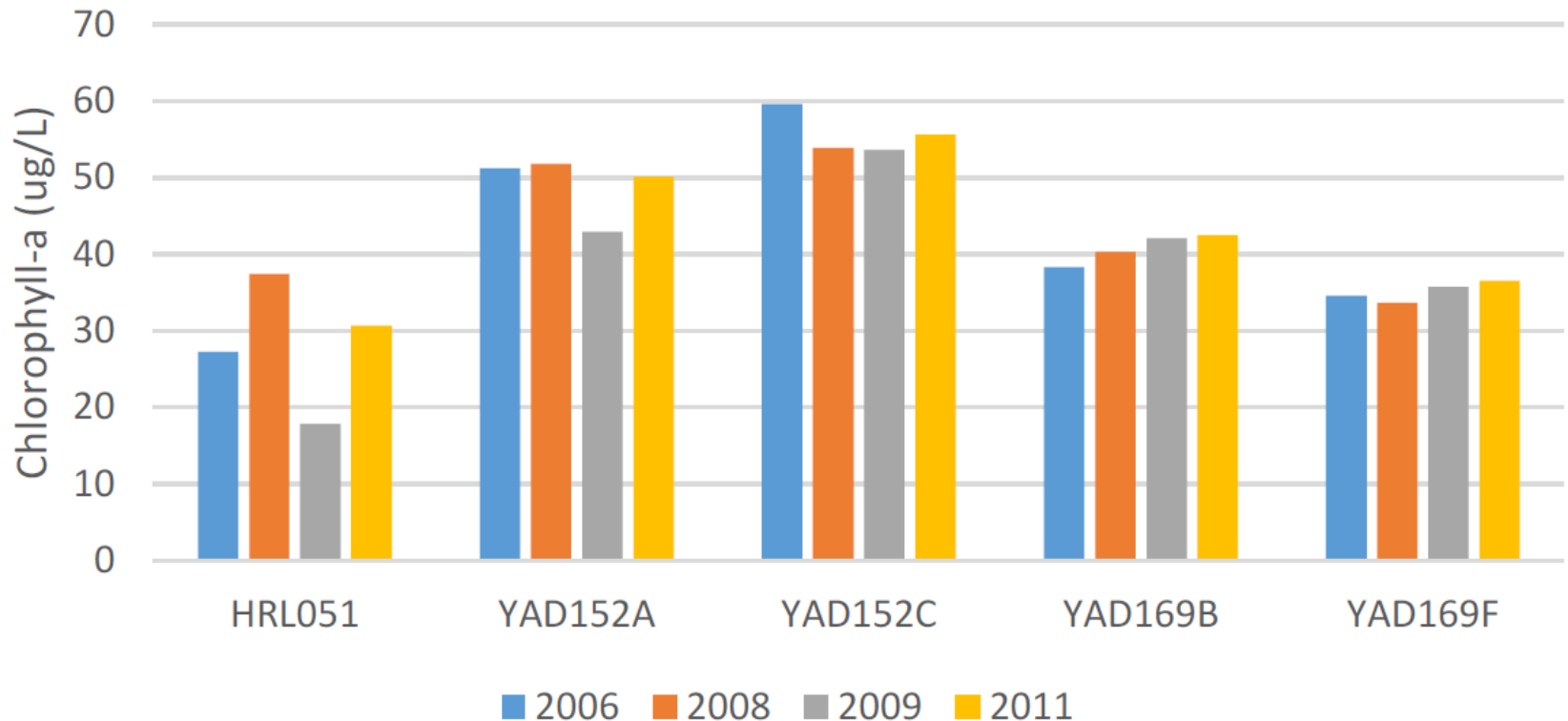
Rationale for Method 1 – Maintain Existing Use Support

- HRL is an excellent fishery and popular recreational resource.
- Little to no record of floating nuisance blooms or user complaints
- Algal toxins low (pending add'l info)
- Raw water quality well within water treatment capabilities



HRL Currently Experiences CHLa in the 30-55 ug/L range (growing season geomean)

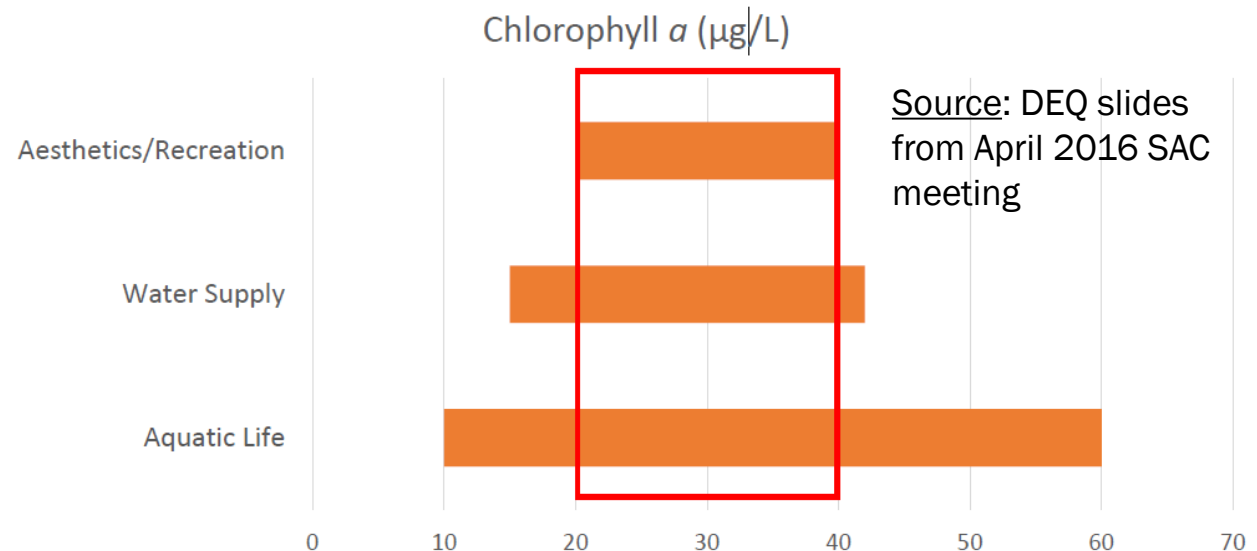
High Rock Lake - Center Line Stations
Growing Season Geometric Mean



Source: W. Hall slides from April 2016 SAC meeting

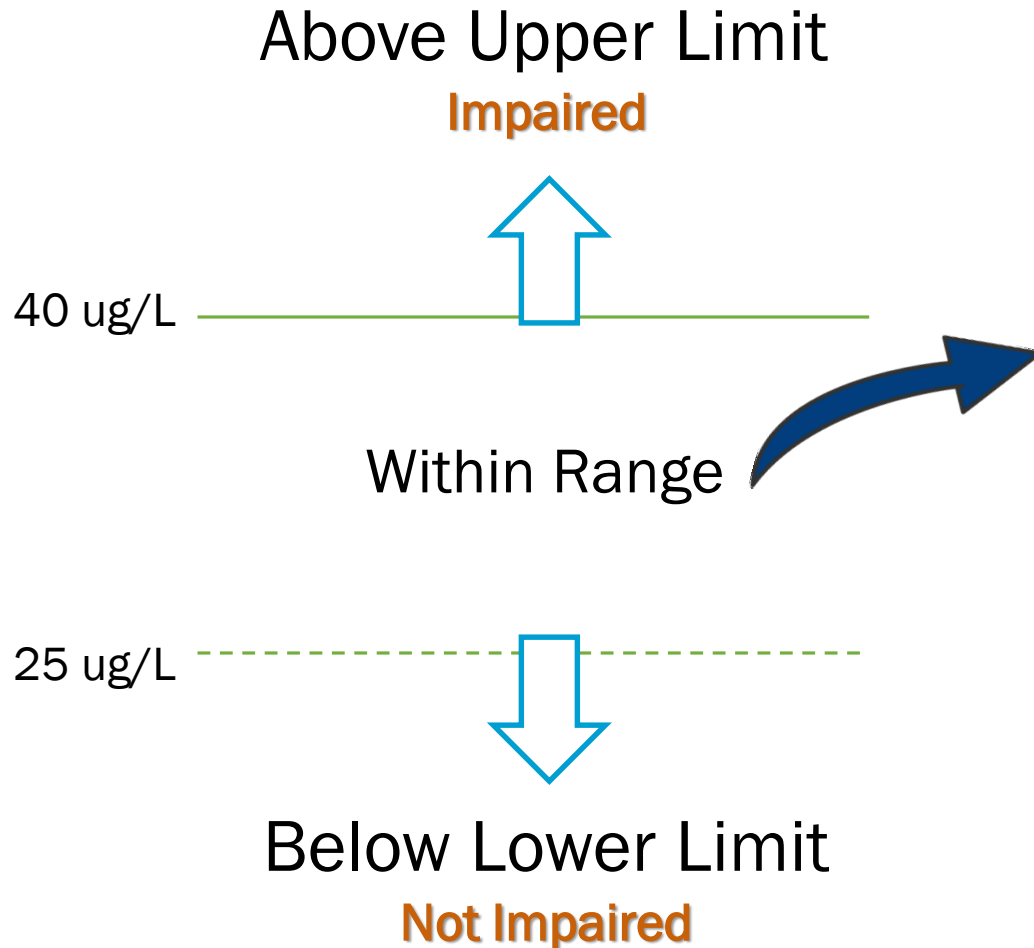
Rationale for Method 2 – Balanced Uses

- Literature indicates CHLa tradeoff between warmwater fishery, swimming/aesthetics, drinking water, etc.
- General concerns over diel DO/pH.
- Potential for algal toxins?



A Potential Framework for Site-Specific Goal-Setting in Reservoirs

CHL

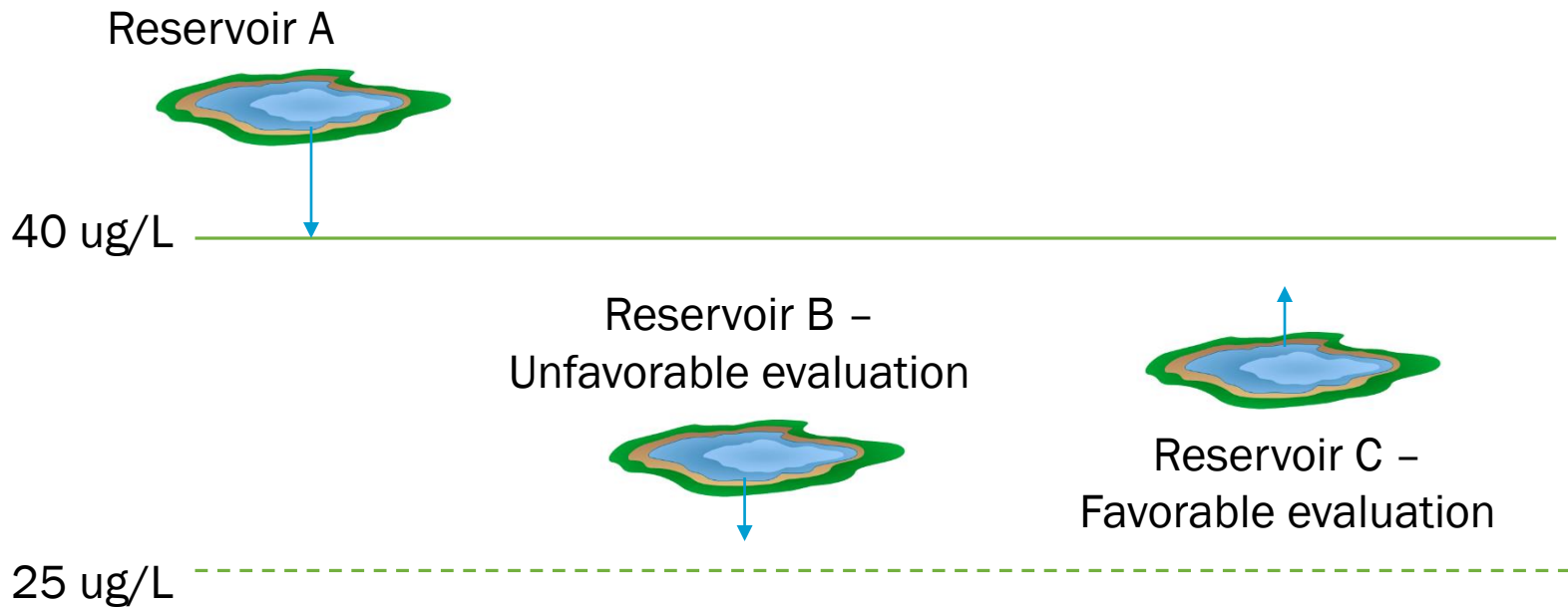


Narrative Evaluation:

- Fishery status
- Algal toxins
- Fish kills
- Water treatment issues
- *Etc.*

Conceptual Approach for Setting Site-Specific CHLa Goals

CHLa



Also consider role of antidegradation policy as a CWA tool.

Example Precedents for Numeric + Narrative Evaluation

- Arizona (R18-11-108.03)

1. The mean chlorophyll-*a* concentration is less than the lower value in the target range chlorophyll-*a* for the lake and reservoir category; or
2. The mean chlorophyll-*a* concentration is within the target range for the lake and reservoir category and:
 - a. The mean blue green algae count is at or below 20,000 per milliliter, and
 - b. The blue green algae count is less than 50 percent of the total algae count, and
 - c. There is no evidence of nutrient-related impairments such as:
 - i. An exceedance of dissolved oxygen or pH standards;
 - ii. A fish kill coincident with a dissolved oxygen or pH exceedance;
 - iii. A fish kill or other aquatic organism mortality coincident with algal toxicity;
 - iv. Secchi depth is less than the lower value prescribed for the lake and reservoir category;
 - v. A nuisance algal bloom is present in the limnetic portion of the lake or reservoir; or

Example Precedents for Numeric + Narrative Evaluation (cont.)

- Virginia (9VAC25-260-187)

“When the board determines that the applicable criteria in subsection B of this section for a specific man-made lake or reservoir are exceeded, the board shall consult with the Department of Game and Inland Fisheries regarding the status of the fishery in determining whether or not the designated use for that waterbody is being attained... If the designated use is being attained, the board shall assess the waterbody as impaired...until site-specific criteria are adopted and become effective for that waterbody.”

Example Precedents for Numeric + Narrative Evaluation (cont.)

- Missouri (proposed by Mo. DNR, Nov. 2016)

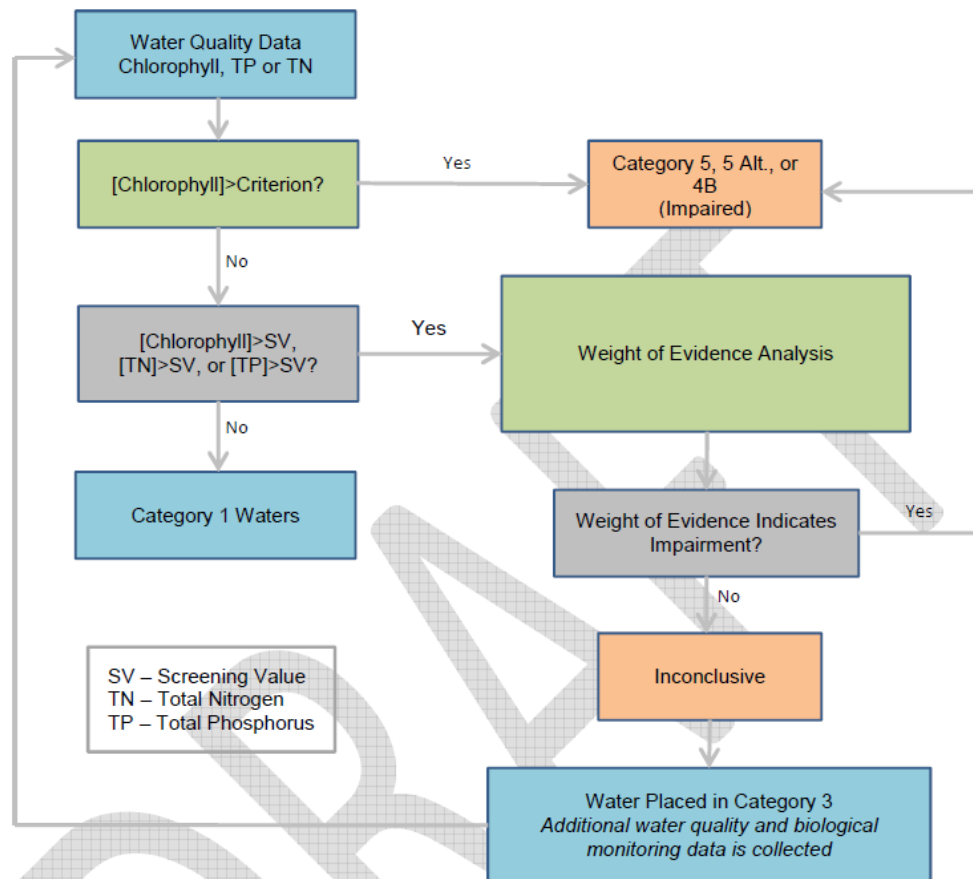


Figure 7-1. Missouri Chlorophyll Criteria and Gray Zone Decision Framework Implementation Approach.

CHLa criteria duration/averaging period

- Warm weather months average
 - Clarifying original intent of NC criterion
 - Much of literature and state criteria precedents uses seasonal average
 - Time-integrated metric is appropriate for general indicator of trophic status
 - Variability of individual CHLa measurements
 - Both empirical and mechanistic models are better at predicting seasonal averages than short-term values [an observation noted by EPA in supporting current calibration of HRL EFDC model]
- Geometric mean
 - Best measure of central tendency for lognormally-distributed parameter such as CHLa (USEPA, 2010)
 - Precedent examples: Florida, Virginia, and others

Materials from Mike McGhee, chair of original advisory group

- Meeting notes from 1977
- Presentation materials
- From McGhee email: *“I was concerned to hear that some considered the [CHLa] standard a...not to exceed...value...It is clear in those documents that the technical basis, derivation, and intent of the 40/15 standards were...growing season averages...”*

Basis of CHLa range, with consideration of High Rock Lake

- 25 ug/L floor was based on need to protect existing fishery status
- 40 ug/L was the upper limit of the SAC/DEQ literature survey
 - Originally based on aesthetics
 - Interpreted as geometric mean for HRL based on lack of nuisance blooms, TSS control on clarity

CHLa Criteria Frequency Options

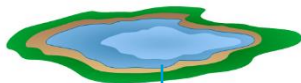
- Calculate growing season geomean for each year, with an allowable exceedance frequency (e.g., Florida, Alabama approach)
- Express criteria as long-term (multi-year) average (e.g., Minnesota approach)

Alabama:

A reservoir...will be considered to have a nutrient impairment when a growing season mean criterion has been exceeded in two consecutive years or three times during the previous six years.

Example Application of Conceptual Framework to High Rock Lake

HRL



- Criteria set lower than existing condition, drawing on “balanced uses” concepts.
- Criteria set to top end of range, drawing on multiple favorable indicators.

40 ug/L



25 ug/L



CHLa