Path Forward Committee Meeting
10:40 AM on July 7, 2020
Remote Access Only (see next slides)

Remote Access Options

Equipment Type	Access Information	Notes
Computers with microphones and speakers	Join Microsoft Teams Meeting **Please mute your microphone** unless you want to provide input.	Press control and click on this link to bring up Microsoft Teams through the internet. You can view the screen share and communicate through your computer's speakers and microphone
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Remote Access Guidelines

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Agenda

- Opening comments
- Status of the Interim Alternative Implementation Approach
- North Carolina Nutrient Criteria Development Plan, Scientific Advisory Council (SAC) Report for High Rock Lake Site Specific Chlorophyll-a Criteria
- EPA Federal Register Notice May 22, 2020 - Draft Ambient Water Quality Criteria Recommendations for Lakes and Reservoirs
- Site Specific Chlorophyll-a Criteria in Relation to Falls Lake
- Modeling and Regulatory Support Status
- Other items
- Closing comments

Status of the UNRBA Stage I Existing Development (ED) Interim Alternative Implementation Approach (IAIA)

Review of IAIA Status – Ongoing Actions

- Summarize June 17, 2020 Board Meeting
- Discuss separate compliance organization versus modifications to UNRBA Bylaws (pros/cons)

Topics Discussed During the June 17, 2020 UNRBA Board of Directors Meeting

- Reasonable assurance provided by temporary “credits” for Stage I WWTP reductions without formal credit exchange
- Voting by IAIA members, not the full UNRBA membership
- Use of UNRBA meeting times to host IAIA meetings
- Anticipation of member status updates at UNRBA Board meetings to assure commitments are on track
- Reporting requirements for submittal to DWR and subsequently to the EMC
- Lack of participation or dropping out of the program would require a local government to submit a Local Program

Topics Discussed During the June 17, 2020 UNRBA Board of Directors Meeting

- If a member drops out of the IAIA
  - Notify DWR and the IAIA membership
  - Modify list of participants and table of investment levels
- Enforcement at individual local government level
  - Individual local government would revert back to Local Program
  - DWR would need to determine the allowable time to implement the Local Program
- Need to poll UNRBA members on the status of discussions at their local governments and likelihood of participating
- Pros and cons of a separate compliance organization (more detail provided on next slide)

Separate Compliance Organization versus Modifications to UNRBA Bylaws (pros/cons)

- Separate organization
  - Requires creation of a separate organization with separate bylaws (con)
  - Additional operational administrative burden (con)
  - More transparent in terms of voting rights (pro)
- Modification of UNRBA bylaws to address IAIA
  - Easier to manage from an administrative standpoint (pro)
  - UNRBA members that are not participating in the IAIA may have voting rights depending on language (con)
    - May be able to address through formation of a subcommittee along with appropriate modification to bylaws

The legal group will continue these discussions, and Board members are interested in participating – invited today

Report from the Legal Group

- Previous meetings
- Meeting on July 1st
- Pros/cons of two administrative options
- Recommendation

Action Items

- Modify draft Program Document based on input from the Legal Group
  - Finalize approach to administration of the Program
  - Inclusion of an Interlocal Agreement (ILA) format for projects between participants
  - Template contracts for agreements with non-member organizations
- Invite Board members to participate in PFC discussions about the IAIA
- Continue review of the Program Document with the legal group and PFC for recommendations to the Board
- Engage Board members and provide information for discussion with other elected officials

Development Schedule for UNRBA IAIA Program Implemented under the Falls Lake existing rules for a potential start date of July 1, 2021.

Feb 2020: DWR provides draft language in the Falls Lake Existing Development Model Program to allow an IAIA

UNRBA and members review and provide comments.

Mar and Apr 2020:

UNRBA develops draft IAIA Program including investment levels, reporting requirements, etc.

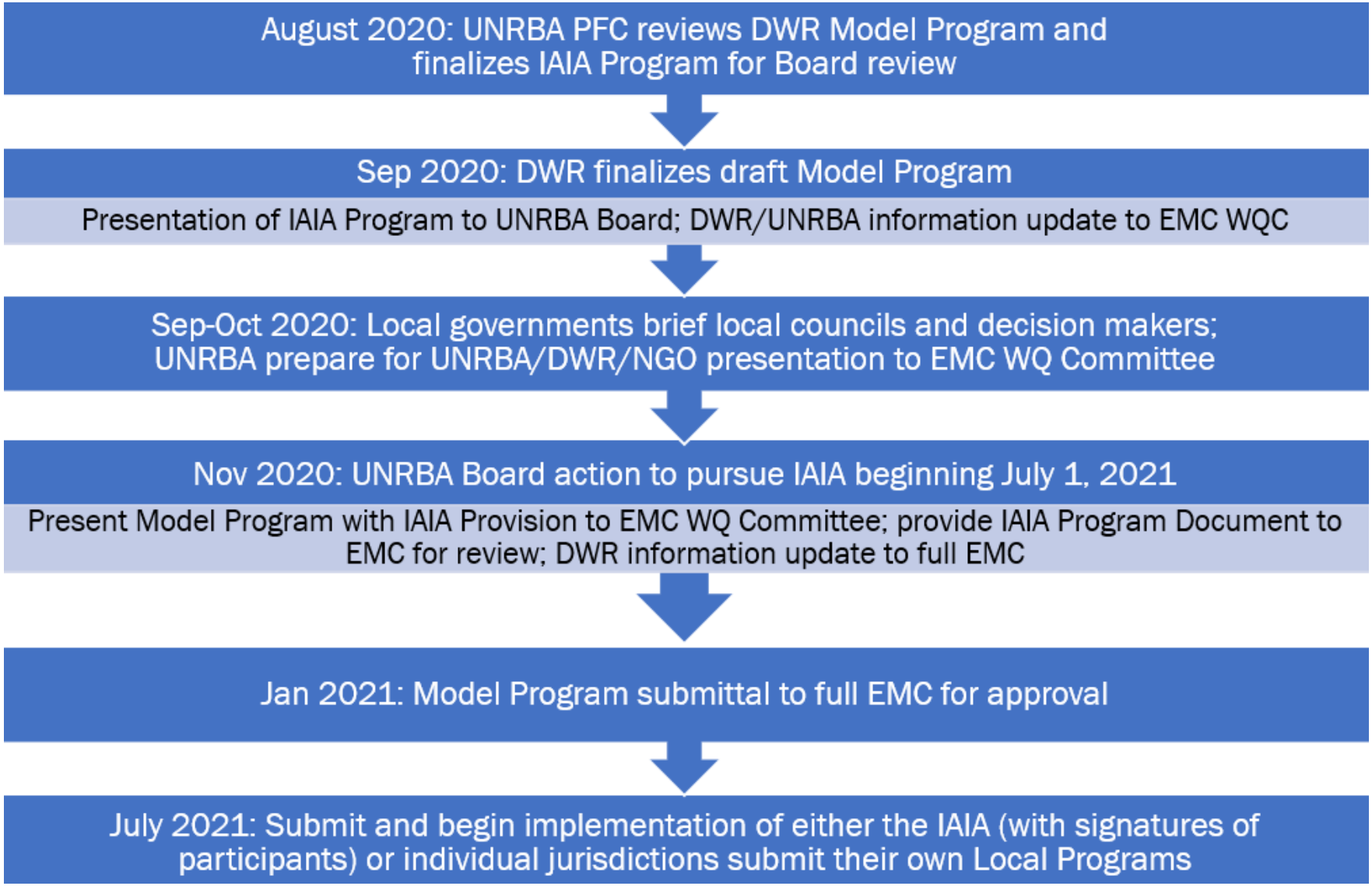
Apr 2020: Meeting with DEQ leadership to discuss IAIA and impacts on other practices like land conservation

May 2020: Internal review of UNRBA IAIA

Develop revised draft for external review; provide status presentation to UNRBA Board

June 2020: DWR reviews UNRBA IAIA Program document

July 2020: DWR provides a revised draft Model Program for UNRBA review


August 2020: UNRBA PFC reviews DWR Model Program and finalizes IAIA Program for Board review
Sep 2020: DWR finalizes draft Model Program
Presentation of IAIA Program to UNRBA Board; DWR/UNRBA information update to EMC WQC
Sep-Oct 2020: Local governments brief local councils and decision makers; UNRBA prepare for UNRBA/DWR/NGO presentation to EMC WQ Committee
Nov 2020: UNRBA Board action to pursue IAIA beginning July 1, 2021
Present Model Program with IAIA Provision to EMC WQ Committee; provide IAIA Program Document to EMC for review; DWR information update to full EMC
Jan 2021: Model Program submittal to full EMC for approval
July 2021: Submit and begin implementation of either the IAIA (with signatures of participants) or individual jurisdictions submit their own Local Programs

DWR 2020 Water Quality Assessments, Integrated Report, and 303(d) list

The DWR draft Integrated Water Quality Assessment Report and the 303(d) list for 2020 were previously anticipated for June 2020.

This target date has been pushed back to probably late September 2020 or perhaps even later.

A Chlorophyll-a Criterion for High Rock Lake

by the North Carolina Nutrient Criteria Science Advisory Council (SAC)
May 26, 2020 Final Report
Meetings from 2015-2020

SAC Recommendations
Chlorophyll *a* Criterion for High Rock Lake

Designated uses:
aesthetics, water supply, aquatic habitat, and recreation

- Multiple lines of evidence.
- Literature review.
- Water quality monitoring.
- Designated use attainments.
- Appropriate averaging period.
- Frequency of exceedance.
- Appropriate sampling strategy.

SAC Recommendations
Chlorophyll a Criterion for High Rock Lake

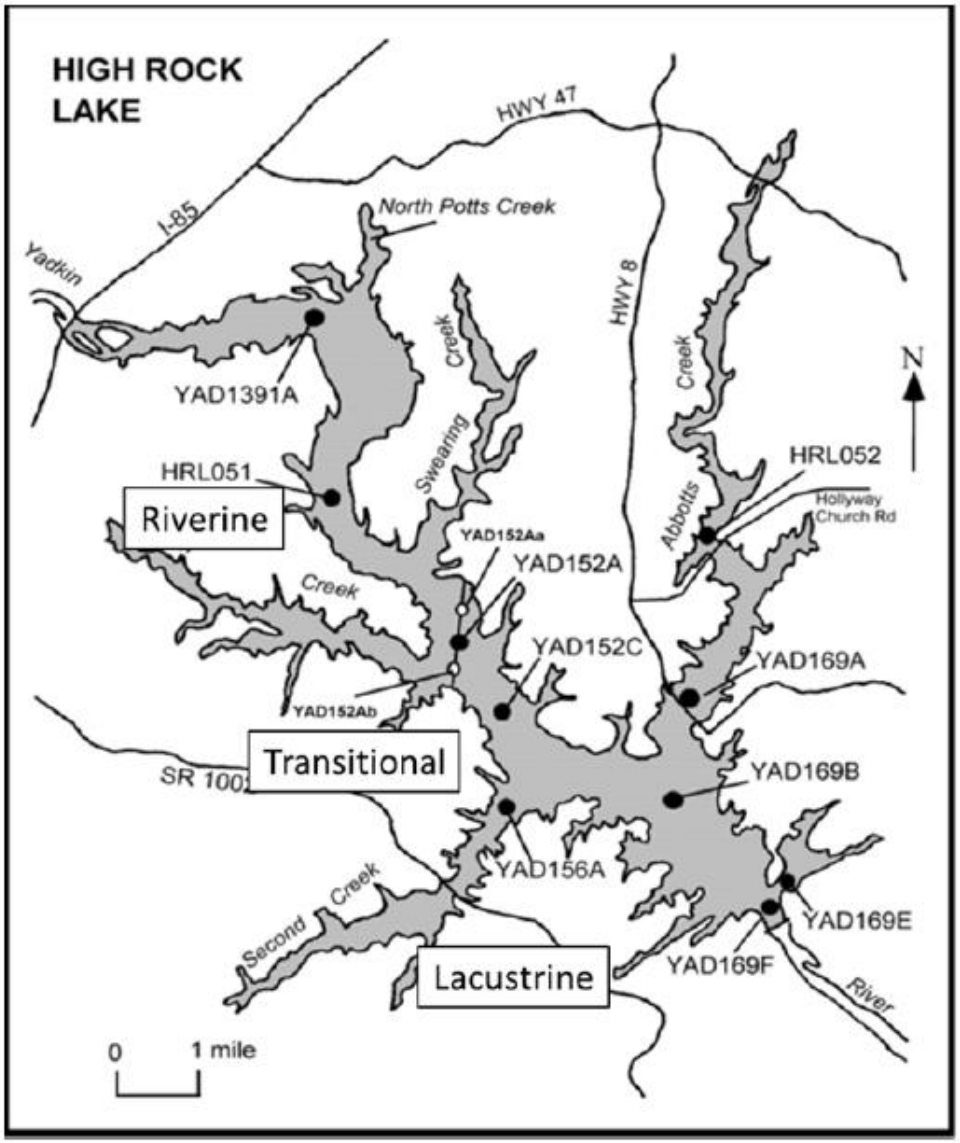


Figure 3.3. High Rock Lake monitoring station locations and lake zones.

SAC Recommendations
Chlorophyll *a* Criterion for High Rock Lake

The SAC Reviewed water quality studies from 1973 - 2016.

- Generally, fisheries production responds positively to chlorophyll-a.
- An upper threshold exists between chl-a and overall fisheries.
- Chl-a beyond the threshold may have negative impacts to fish.
- Higher chlorophyll-a values may increase risks from phytotoxins. However, the SAC does not advise establishing chlorophyll-a standards based solely on cyanotoxin risk to aquatic life.

SAC Recommendations
Chlorophyll a Criterion for High Rock Lake

- High Rock Lake has consistently been eutrophic.
- A “run-of-the-river” reservoir with distinct riverine, transitional, and lacustrine zones.
- Chlorophyll-a highest in the transitional zone and frequently exceeds existing 40 µg/L standard.
- pH exceedances of 9.0 observed over the entire range of chlorophyll-a values, more common when chl-a >30 µg/L.
- 2016 Algal toxin SPATTs indicated microcystin, anatoxin, and cylindrospermopsin present much of the summer.
- Water analysis indicated toxin concentrations were all below “action limits or health advisory concentrations”.

Max observed value 0.00008 µg/L
Recreation criteria 8 µg/L microcystins and 15 µg/L cylindrospermopsin
Drinking Water criteria 0.3 µg/L microcystins and 0.7 ug/L cylindrospermin

SAC Recommendations
Chlorophyll *a* Criterion for High Rock Lake

- From NC WRC Assessments
  Water quality supportive of a sport fishery for
  largemouth bass, striped bass, crappie, sunfish, and catfish.
  largemouth fishery consistently evaluated as a “quality fishery”

- Fish kills are uncommon, and large fish kills have only been noted during the major drought of 2002

- The SAC is not aware of any aesthetic or swimming use impairment of the lake, even though chl-a concentrations routinely exceed 50 µg/L.

SAC Recommendations
Chlorophyll a Criterion for High Rock Lake

- Chlorophyll-a criterion: growing season geometric mean of 35 µg/L.
- Not to be exceeded more than once in three years.
- Growing season April - October (7months).
- All monitoring data from April through October in open waters within assessment units used to compute the geometric mean.
- The criterion would apply to all months of the year.
- The geometric mean should include samples collected from at least five different growing season months.
- SAC recommends assessment data be collected in two or more years to incorporate year-to-year variability in chlorophyll-a.
- If data are only available for a single year within an assessment period, data from previous assessment periods could be used in order to complete the assessment.

(continued)

SAC Recommendations
Chlorophyll a Criterion for High Rock Lake

- SAC would support extending the assessment period up to a total assessment period of 10 years.
- The SAC recommends a third year of sampling when data are needed. An additional year of sampling to determine if criterion is met or not met.
  - Met if only one of the three geomean year values exceed 35 µg/L
  - Not met if two of the three geometric mean year values are >35 µg/L.
- No additional sampling would be added if both existing seasonal geomean chl-a values are below 35 µg/L or both geomean values are above 35 µg/L.
- This approach adds additional sampling only in instances when the data are needed to assess the one-in-three maximum exceedance frequency.

(continued)

SAC Recommendations
Chlorophyll a Criterion for High Rock Lake

- Open waters are used for calculating the seasonal geometric mean.
- Locations in backwaters, isolated coves, or where water depth is typically shallow (e.g. <10 feet) would be excluded from the calculation of the chl-a seasonal geometric mean.
- These areas would be evaluated based on narrative criteria as these locations are not representative of the data used to develop the criterion.
- The SAC recommends that chl-a compliance samples be collected as photic zone composite samples (e.g. from the water surface down to twice the Secchi depth).
- Next Steps:
  - DWR Nutrient Criteria Implementation Committee Review
  - DWR Water Quality Standards Proposals for High Rock Lake
  - EPA Federal Review of proposed standards.
- **Questions ????**

EPA May 22, 2020 Federal Register

Draft Ambient Water Quality Criteria Recommendations for Lakes and Reservoirs of the Conterminous United States: Information Supporting the Development of Numeric Nutrient Criteria

EPA Water Quality Criteria for Lakes and Reservoirs Comments due July 21, 2020

- The criteria are not fixed numbers but stressor-response models. The models can yield chlorophyll-a, TN (*minus* DIN), and TP concentrations to protect:
  Aquatic Life, Recreation, and Drinking Water uses.

- The criteria models when finalized will replace EPA criteria based on the ecoregion/reference condition approach.

- If adopted this document could potentially influence EPA's and DWR's oversight review of the UNRBA re-examination process.

EPA Water Quality Criteria for Lakes and Reservoirs Basics

- EPA developed different stressor-response models for three Chlorophyll-a risk metrics: Zooplankton/Phytoplankton, Deepwater D.O., and Microcystins. The models yield criteria for chlorophyll-a corresponding to each of the risk metric endpoints.
- EPA then developed models that can translate each of the different Chlorophyll-a criteria into draft recommended TN and TP criteria.
- Different risk metrics are identified for each designated use. Criteria for any lake would need to protect the most sensitive use.
- Thus, the most stringent numeric nutrient criteria is selected.

EPA Water Quality Criteria for Lakes and Reservoirs Risk Hypothesis

Aquatic Life

Increased nutrient concentrations increase phytoplankton biomass (chlorophyll-a). Increased phytoplankton biomass can increase the relationship between zooplankton and phytoplankton to the point that phytoplankton biomass are no longer associated with increases in zooplankton biomass and increases in primary production at the base of the lake food web are not transferred to higher trophic levels.

Recreation and Drinking water

Increased nutrient concentrations increase the biovolume of cyanobacteria and concentrations of microcystin.

EPA established endpoints and risk metrics

- **For Recreational Use**
  EPA selected 8 µg/L of microcystin for adverse effects on children from incidental ingestion of water during recreation.
- **For Drinking Water use**
  EPA selected 0.3 µg/L of microcystin for adverse effects on children resulting from oral exposure to drinking water. Criteria applies to finished drinking water. States can evaluate the treatment process and add safety factors to establish ambient concentration criteria.
- **For Aquatic Life Use for all lakes and reservoirs**
  EPA selected the relationship between zooplankton and phytoplankton biomass. The premise is that phytoplankton biomass can increase at rates that exceed the capacity of zooplankton to consume the phytoplankton when excess nutrients are available.

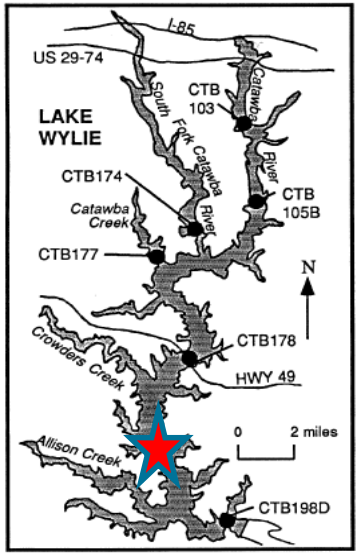
  Dimictic Lakes (ice covered) Cold water fish lakes based on deep water dissolved oxygen concentration.

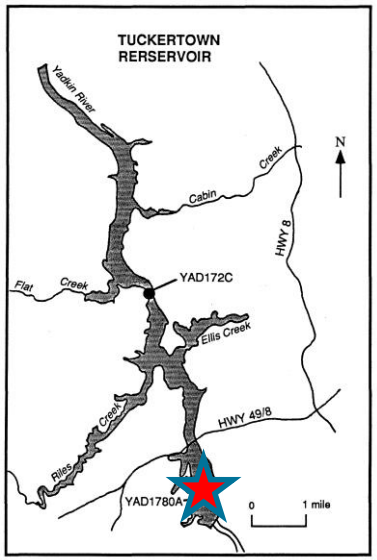
Data Sources used for establishing the criteria

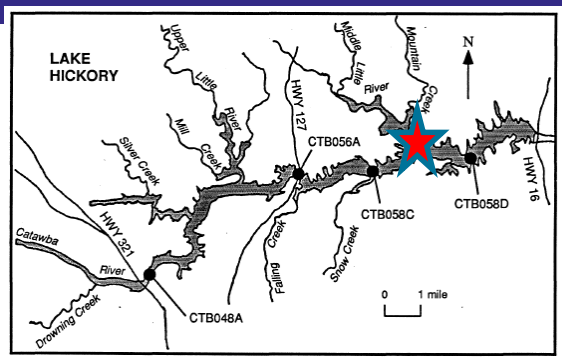
EPA National Lake Assessment (NLA) data collected from May–September of 2007 and 2012.

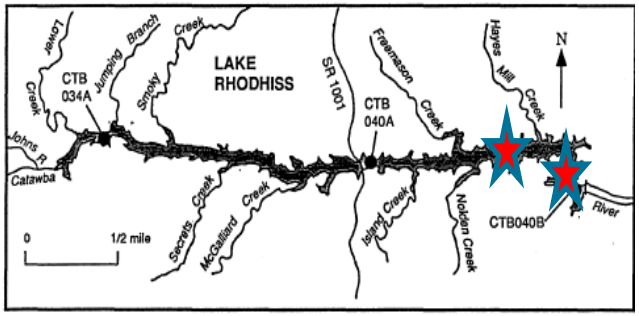
- The NLA data were mostly based on a random sample of lakes.
  2007 - lakes with surface areas larger than 10 acres
  2012 - lakes with surface area larger than 2.5 acres
- Approximately 1,800 different lakes included.
  One location was established in open water at the deepest point of each lake or in the mid-point of reservoirs.
- In 2012, an additional littoral zone sampling location for microcystin, algae, and Chl-a data was located approximately 10 meters from a randomly selected point on the shoreline.
- At the open water site, a vertical, depth-integrated sample was was collected from the photic zone of the lake (to a maximum depth of 2 m).

2007 NARS Lakes Examples



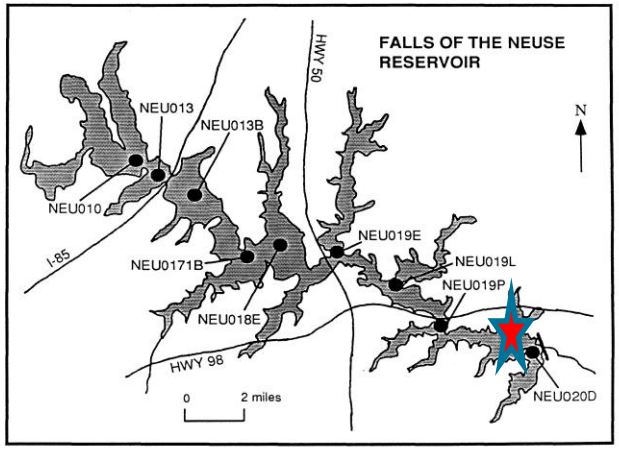




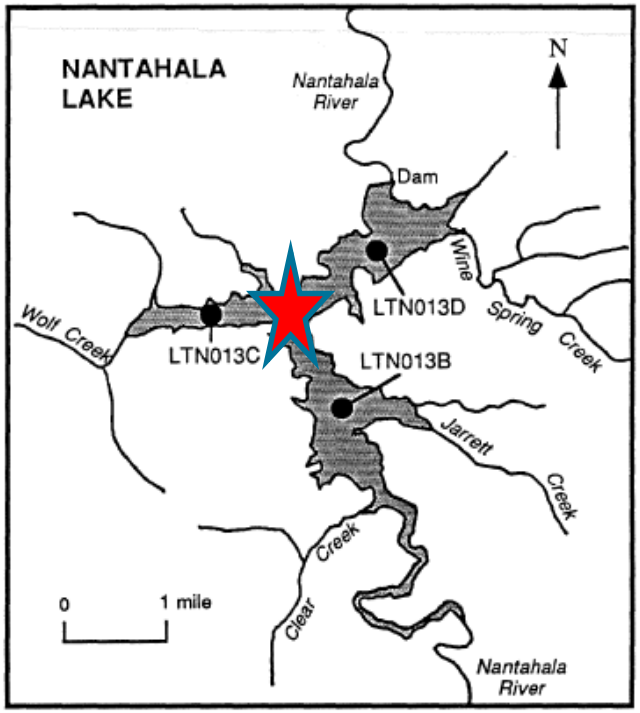


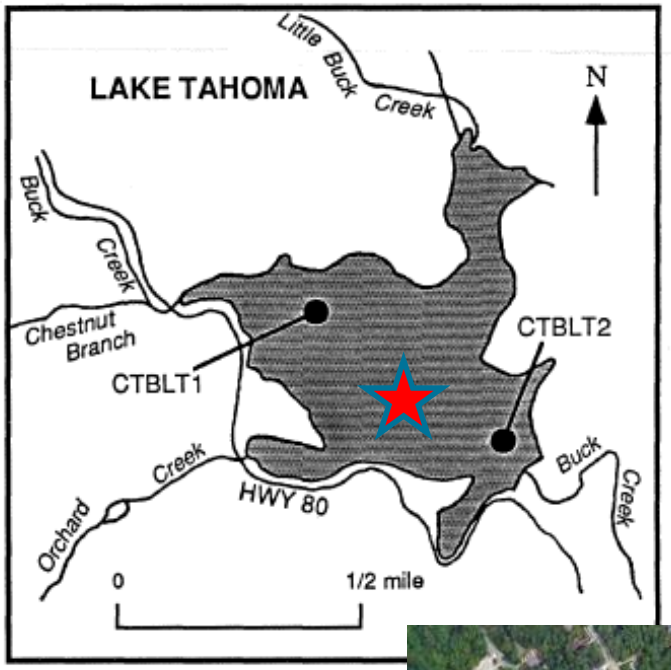
Lake Rhodhiss

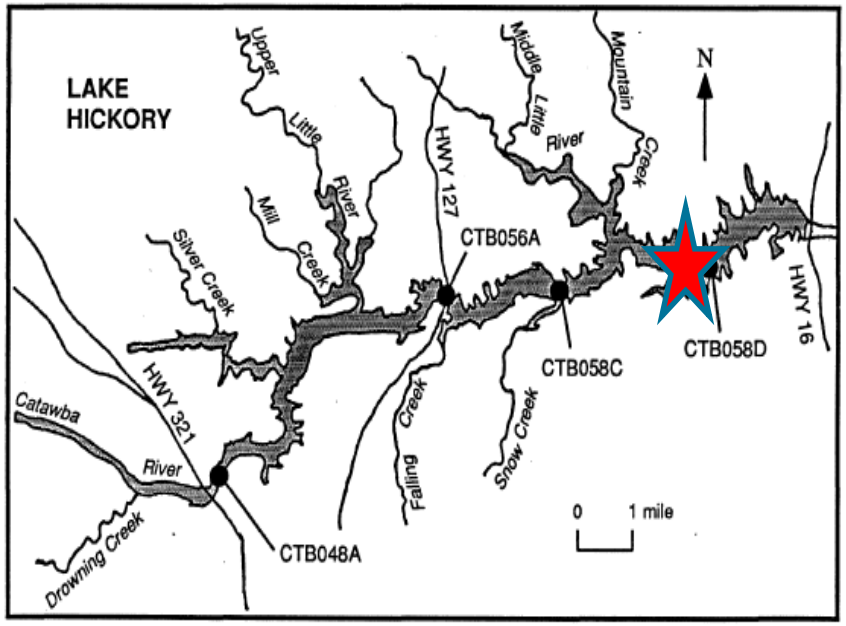
Falls of Neuse



2012 NARS Lakes Examples







Shelly Lake

Data Sources used for establishing the criteria

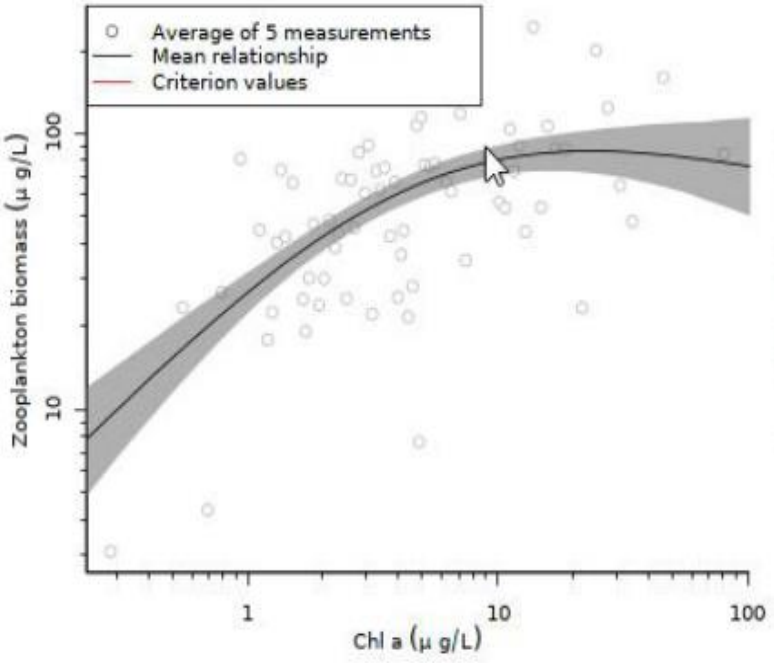
- Two zooplankton samples were collected with vertical tows for a cumulative tow length of 5 meters using fine and coarse mesh nets.
- Zooplankton in lakes at least 7 m deep, one 5-m deep tow was collected with each mesh. In shallower lakes, vertical tows over shorter depths were combined to reach the cumulative tow length of 5 m.
- At the littoral zone site samples were collected 0.3 m below the surface where the lake was at least 1 m deep for quantifying algal toxins, phytoplankton community, and Chlorophyll-a.

- Phytoplankton biomass is typically derived from chlorophyll-a.
- Zooplankton is typically estimated by counting collected samples.
- NC does not have a zooplankton monitoring program.

EPA Rationale for Aquatic Life Assessment Endpoint Zooplankton/Phytoplankton Criteria

"The Z/P biomass relationship was consistent with the initial assumption that, in oligotrophic lakes with low levels of phytoplankton biomass, the slope approached 1, and in eutrophic lakes with high levels of phytoplankton biomass, the slope approached zero."

"The slope identifies the point at which food web connectivity between phytoplankton primary productivity and zooplankton grazing is likely too low to control excess primary productivity in the lake."



EPA Rationale for Zooplankton/Phytoplankton Criteria

- The rate of change of zooplankton/phytoplankton biomass quantifies changes in the shape of biomass pyramids in lakes (Elton 1927).
- In lakes, the ratio of zooplankton to phytoplankton has been observed to decrease along eutrophication gradients (Leibold et al. 1997).
- At low levels of phytoplankton (oligotrophic lakes), zooplankton biomass should increase as a constant proportion of phytoplankton biomass.
- The interaction of zooplankton assemblage with benthic resources was expected to differ between shallow and deep lakes.
- EPA models assigned three classes for lakes:
  - Depth less than 3.2 meters
  - Depth between 3.2 and7.2 meters
  - Depth greater than 7.2 meters

Z:P have been the subject of much debate centering on the relative importance of top-down versus bottom-up food web effects.

EPA Modeling Tools (Shiny R)
to easily manipulate data and explore criteria endpoints

- Chlorophyll criteria based on zooplankton BETA VERSION
  https://chl-zooplankton-prod.app.cloud.gov/

- Chlorophyll - Microcystin Model BETA VERSION
  phytoplankton biovolume, cyanobacteria biovolume, chl-a
  https://chl-microcystin-prod.app.cloud.gov/

- Nutrient - Chlorophyll Models BETA VERSION
  TP and Chl a and TN and Chl a
  relationships for TP – chl-a, depth, ecoregion level III, turbidity
  relationships for TN – chl-a and ecoregion level III
  https://tp-tn-chl-prod.app.cloud.gov/

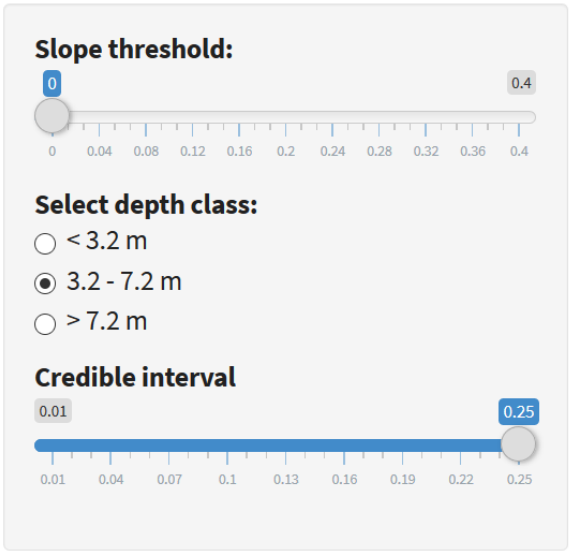
- Hypoxia Model BETA VERSION
  https://chl-hypoxia-prod.app.cloud.gov/

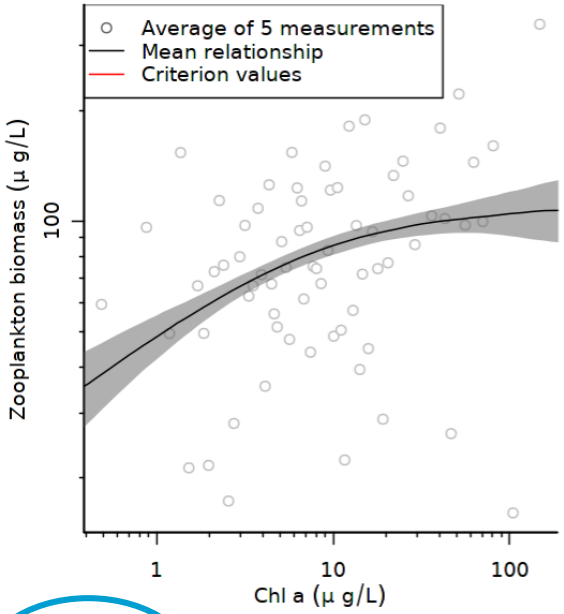
R is a free software environment for statistical computing and graphics

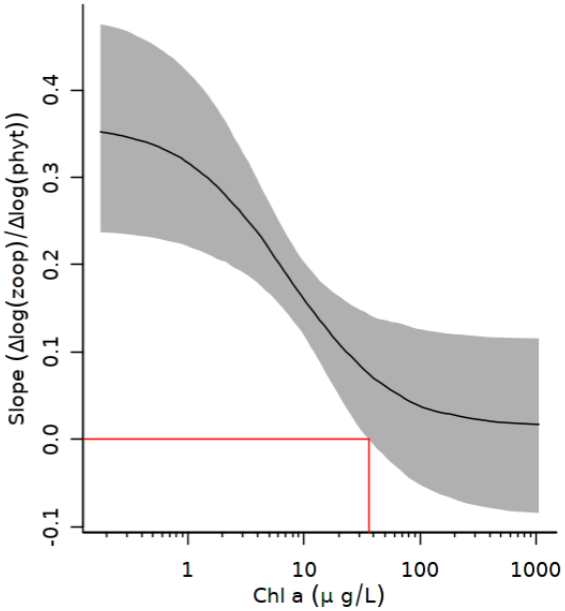
Chlorophyll criteria based on zooplankton BETA VERSION

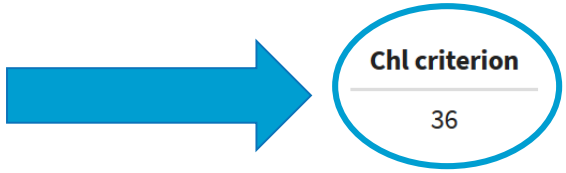
https://chl-zooplankton-prod.app.cloud.gov/

Chlorophyll criteria based on zooplankton BETA VERSION







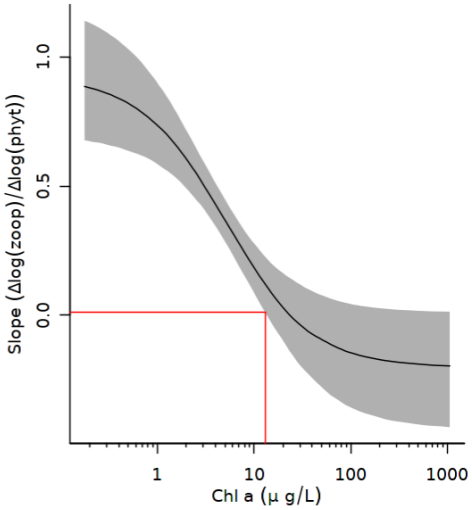


phytoplankton and zooplankton biomass models credible interval

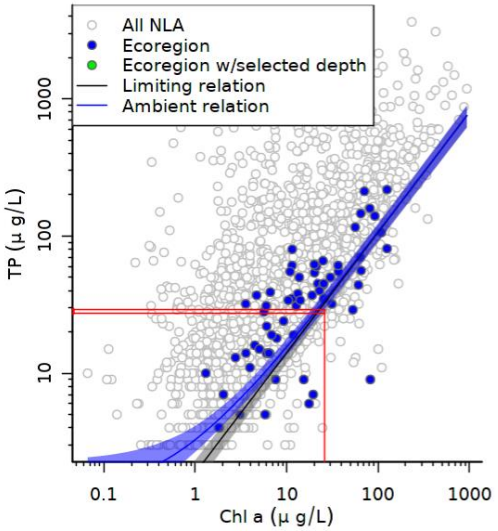
- The relationship between the slope and Chl-a represents the best estimate of the stressor-response relationship
- The credible interval reflects confidence in the model. It is a measure of uncertainty and is a management decision.
- A range of credible intervals from 1% to 25% is provided in the interactive tool. A lower credible interval provides additional assurance that the calculated criterion is protective, given the data and model uncertainty.
- Example, at a 25% credible interval a lake has a 75% chance of achieving the targeted condition. In contrast, selecting the 10% credible interval implies that a lake has a 90% chance of achieving the targeted condition.

Examples of Criteria Models

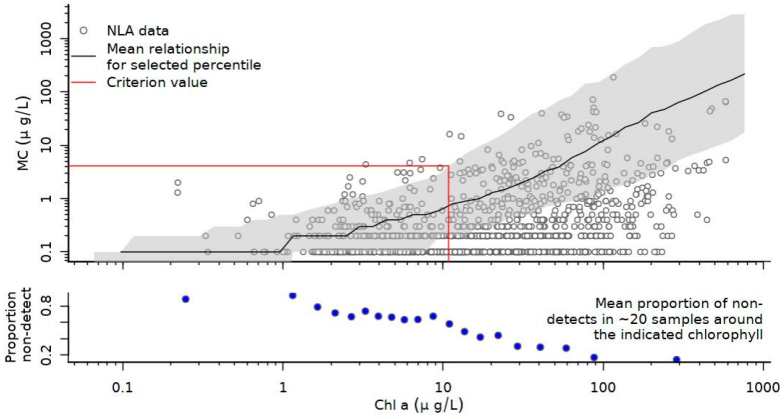
Chl-a / Zooplankton



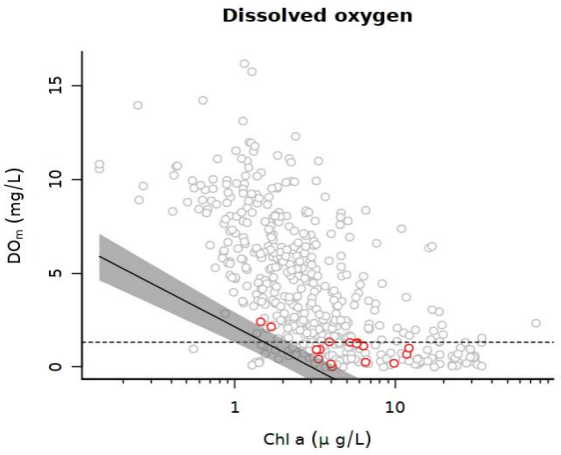
Chl-a / TP



Chl-a / Microcystin



Chl-a / Hypoxia



Examples:
phytoplankton and zooplankton biomass models

Table 3. Illustrative Chl a criteria (µg/L) for different credible intervals and a threshold value of 0 for Δ(log Z)/Δ(log P). Values shown for each lake depth class.

Credible interval	Depth class		
	< 3.2 m	3.2 – 7.2 m	> 7.2 m
10%	41	22	13
25%	48	36	16

Examples
Chlorophyll-a Criteria for Recreational Uses

Table 4. Illustrative Chl a criteria (µg/L) for different exceedance probabilities using the 25th credible interval

Probability of exceedance	Microcystin threshold = 8 µg/L to protect recreational uses
1%	22
5%	29
10%	35

Chlorophyll criteria Aquatic Life Slope Zoop:Phyto

Slope Threshold Range	Depth Class Choices	Credible Interval Choices
0.0 - 0.4	< 10.5 feet 10.5-23.6 feet >23.6 feet	0.01 - 0.25

Example Number	Slope Threshold	Depth Class	Credible Interval	Chl-a Criteria
1	0.0	<10.5 feet	0.1	41 ug/L
2	0.4	<10.5 feet	0.1	7 ug/L
3	0.0	>23.6 feet	0.1	13 ug/L
4	0.4	>23.6 feet	0.1	3 ug/L

Chlorophyll Criteria Recreational- Microcystin Model

Target MC concentration Range	Allowable Exceedance Prob Range	Credible Interval Choices
0.3-8.0	0.01-0.1	0.01 - 0.25

Example Number	Target MC Conc	Allowable Exceed Prob	Credible Interval	Chl-a Criteria
5	8.0	0.1	0.1	15.1 ug/L
6	8.0	0.01	0.1	9.6
7	8.0	0.1	0.25	35.1 ug/L
8	6.0	0.05	0.1	10.9 ug/L

Nutrient - Chlorophyll Models

Lake Depth	DOC mg/L	Level III EcoRegion	Chl-a Target	Credible Interval	TP	TN-DIN	
					TP	**TN-DIN**	
13.5	6	45	36 ug/L	0.1	36	230	limiting relationship
					39	640	ambient
2	6	45	36 ug/l	0.1	36	230	limiting relationship
					46	640	ambient

Water Quality Criteria for Lakes and Reservoir comments due July 21, 2020

"The draft document provides a site specific pathway for establishing N&P concentration standards for all lakes based on EPA's Nationwide survey and "*reformulated*" nutrient-chlorophyll models to account for variations in TP and TN rather than in Chlorophyll-a."

Sauber Water Quality Consulting opinion:
This approach is based on EPA's long desire to establish N&P numerical standards rather than observations or measurements on designated use impacts.

The document does not distinguish important differences between constructed reservoirs and natural lakes. The document needs significant work to provide confidence that the criteria are neither under protective nor over protective of the designated uses. A combination of numeric and narrative criteria are the best approach to handle the uncertainty.

Site Specific Chlorophyll-a Criteria in Relation to Falls Lake

Site Specific Chlorophyll-a Criteria in Relation to Falls Lake

- Both the High Rock Lake site specific chlorophyll-a criteria and the EPA proposed models for establishing numeric nutrient criteria have implications for Falls Lake
- The Legal Workgroup as well Fred Andes will be considering the nutrient criteria development process for High Rock Lake and EPA's draft water quality criteria for lakes and reservoirs
- The MOA with DEQ that is under development should also address site specific criteria for Falls Lake
- Develop a schedule for submitting a petition to the EMC for a water quality standard change for Falls Lake

Modeling and Regulatory Support (MRS) Status

Modeling and Regulatory Support Status

- Executed FY2021 contracts
  - Prime contract between BC and UNRBA
  - Subcontracts between BC and
    - Systech Water Resources
    - Dynamic Solutions
    - KDV Analytics
- FY 2021 contracts to be developed
  - Ken Reckhow
  - Ashley Abernethy (economist)
- The Executive Director is reviewing a preliminary, interim draft for the WARMF watershed hydrologic modeling
- DEQ is in the process of finalizing the 319 grant contract with the UNRBA

Other Status Items

Ongoing Items

- Communications work for 2020-2021
- Coordination with the UNC Collaboratory
- Ongoing DEQ/DWR Items
  - 2019 UNRBA Data Report meeting
    - Schedule for face to face when possible
  - IAIA Program meeting with DEQ/DWR
    - Schedule for face to face when possible
  - 303(d), chlorophyll-a listing, and lake segmentation
  - MOA for re-examination

Future Meetings as Currently Scheduled:

Next MRSW Meeting
August 4, 2020, 9:00 AM to 10:30 AM
Remote Meeting

Next PFC Meeting
August 4, 2020, 10:40 AM to 1:10 PM
Remote Meeting

Next BOD Meeting
September 16, 2020, 9:30 AM to Noon
Remote Meeting

Closing Comments
Additional Discussion