NC Nutrient Criteria Development Plan – Scientific Advisory Council (Meeting #15) 9/27/2017

Attendees

SAC members in attendance:

Lauren Petter	Michael O'Driscoll
Bill Hall	James Bowen
Linda Ehrlich	Martin Lebo
Clifton Bell	Astrid Schnetzer
Deanna Osmond	Nathan Hall

SAC meeting facilitator:

Andy Sachs

NCDEQ DWR staff in attendance:

Jim Hawhee	Jeff Manning
Tammy Hill	Jucilene Hoffman
Mike Templeton	Nora Deamer
Connie Brower	Brian Wrenn
Pam Behm	

CIC members in attendance:

In person:

Andy McDaniel

Anne Coan

Doug Durbin

Audience members:

Will Scott (Yadkin River Keeper)	Jay Sauber
Steve Tedder	Bill Kreutzberger
City of Durham	
Danny?	

Meeting materials can be found on the Division of Water Resources Nutrient Criteria Development Plan Scientific Advisory Council webpage. Click here for a direct link.

Meeting notes

All questions, comments and answers are paraphrased

1. **Convene** (Andy Sachs)
    a. SAC members, DWR staff and audience attendees provide names and affiliations.
    b. Bill Hall requested clarification of minutes related to the 303(d); Is 90% threshold used for listing but not delisting?
        Pam Behm: Listing on the 303(d) must have minimum of 10 samples; 10 % exceedance, with 90% statistical confidence. If it doesn't meet that criteria we delist. If we required 90% confidence of meeting, the calculation would require more samples to delist.
    c. Facilitator asks for approval on meeting notes from May and July 2017 SAC meeting (meeting #13 and #14)
        i. No comments after previous clarifications
    d. Desired outcomes for today's meeting
        i. pH discussion
        ii. arithmetic vs geometric means? Statistical methods for assessment
        iii. Field visit overview
        iv. Resolution on Chlorophyll a
2. **High Rock Lake field trip update (Brian Wrenn)**
    a. Trip was conducted on August 30, 2017; perfect day; low 80's
    b. Hans was the noted photographer
    c. Jason Green (WSS) was the guide; provided info on how monitoring samples are collected
    d. Visited 3 monitoring sites (HRL 051; YAD 152C and YAD 169F)
        i. Couldn't quite get to HRL051 due to lake level and size of boat; were about a mile downstream
    e. Some cove investigations by both groups (Riverkeeper was also on the lake)
    f. Met at Southmont Abbott's Creek boat ramp
    g. DWR physical data is in - but not the chemical data
        i. HRL051: Secchi depth= 0.35m; No issues with DO /pH; no indications of bloom conditions, some indications of higher turbidity as seen in lowered temperature due to light limitations
        ii. YAD152C -a little clearer/mildly greener/pH higher/DO higher at surface/less temp change/secchi depth profile = .55 m
        iii. 169F: clearest secchi depth = 0.8m; nothing major to indicate bloom conditions; temperature profile was mixed
        iv. Cove station: midge casings seen; development happening/depth shallow; more turbid due to wind

h. Linda Ehrlich- Discussion of Examination of Samples Taken during the HRL Field Trip
   i. *Pseudanabaena* was predominant – a bit atypical for piedmont lakes; but noted that a recent sample from Falls lake indicated the presence of the taxon
      1. Small filamentous blue-green
      2. 75.5 um
   ii. *Komvophoron* (genus)– also atypical;
      1. The presence may give us a clue as to what is going on in the lake; (Andy S) – why is this atypical? (LE) Temperatures are a bit low for late August, may be that increased turbidity is affecting the taxa distribution; cyano are usually dominant under higher temperatures
      2. (Bill Hall?) were these cell counts? (LE) unit density
      3. (Brian W)- we (WSS) normally use > 10,000 unit density to determine if there is a "bloom"
   iii. *Cylindrospermopsin* should predominate; it did not predominate
   iv. Mixed flora noted; not scum forming taxa
   v. (Brian W) noted that aerial photography demonstrates some blooms
      1. Clifton Bell – asked how we knew that the photo wasn't turbidity
      2. Brian Wrenn – more of a greenish tint, not brown. Will (Riverkeeper) indicated that the conditions were indicative of a bloom
   vi. (Nathan Hall) – biomass vs biovolume
   vii. (Astrid S): took lake water and sediment samples, did not get finished with evaluation
      1. Plan to culture/germination studies planned
      2. Will take some time to get this going

3. Discussion of Statistical Methods; Derivation of Standard/ Assessment of Standards (Nathan Hall)
   a. Why are we doing this? (Andy Sachs)
      i. (NH) Assessment processes – "to list or not to list"
   b. Nathan's power point (CommentsOnStatsSept27_NHall.pptx)
      i. Don't waste money!
      ii. Protect the designated uses
      iii. Problem: all systems may (at times) look impaired
      iv. Lack of data to prove impairment or disprove is at issue
      v. Because there is natural variability within systems; so "confidence" is problematic when you have a small data size;
      vi. Unmanageable events: natural events/processes may lead to WQ problems (example Hurricane Floyd); floods, high turbidity "plumes"
      vii. Data in many water bodies are sparse; many are less than 10 samples; statistical assessment generally only looks at stations with greater than 10 data points
      viii. Exceedance: a single data value that is higher than the standard;

ix. Sample exceedance percent (big data set) – what percentage of the sample size exceeded the standard.

x. If we could sample everywhere, all the time… what would be the sample exceedance percent – we don't know this. This would be the "true exceedance percent." Unknown % of possible samples that are higher than the standard, ideally what the list/no list decisions should be based upon

xi. Assumption – Assessment approach - Current Assessment Approach
   - Assumes a water body is not impaired, must prove that it is impaired
   - Data collected and compared against a water quality standard
   - 10% of samples can violate the standard. Equivalent statement is that the 90% quantile is less than the standard (assumes that natural events might cause poor water quality no more than 10% of the time)

xii. If sample exceedance % is greater than 10 percent, a binomial test is used to determine the probability that the observed sample exceedance % could be generated by random chance from a water body where the true exceedance % was acceptable (<= 10%).

xiii. If the calculated probability is greater than 90%, then the water body is kept on or added to the 303(d) list.

xiv. If there is an unacceptable risk (≥10%) that the high sample exceedance % could just be due to chance (meaning the confidence is less than 90%), or if n<10, then the water body is categorized as Category 3 (data inconclusive)

xv. Ultimately - We must prove beyond a reasonable doubt, that we should "list". If probability is low (random chance), then is there an unacceptable risk? Is this a meaningful decision? How much confidence is required?

xvi. Binomial Test: Example – testing against a weighted coin toss; choosing the level of confidence is the challenge

xvii. Because the null hypotheses says it's not impaired – must prove impairment, therefore, the Exceeded % always has to be higher than 10% to list – just math. A lot of lakes – the exceedance is a lot higher than 10 % and they are not listed.

xviii. Geomean is better than 90% quantile approach
   Good measure of central tendency
   Central tendency more intuitive
   Modeled better
   Parametric statistical approach: more power, less incidence of lakes being "not - listed" when they should be listed
   Can use a t-test for statistical validation with log-normal data

xix. If the geometric mean is used, the standard would need to be lowered to maintain a current level of water quality protection; approximately 20 ug/l for the test example. Geomean would not be set at 40 ug/L.

xx. Statistical tests/assessment should be considered that look at sample size.

Discussion:

(James B)   Is there a parametric equivalent to the 10% quantile evaluation? Agree with assumptions – recognizes that level of exceedance is not noted in the current assessment. Same result from differing levels of exceedance (40.1 ug/l vs 200 ug/L).

(Nathan H – A)   Not sure.

(James B)   the probability of increased chlorophyll a is to be avoided – not just the central tendency – must avoid negative outcomes such as high levels being "ignored" …

(Nathan H- A)   need more data = which statistic is not the issue – but, there is an advantage of a better examination of central tendency

(Mark O'D)   Can we separate out the groundwater and stormwater impacts? Do we have flow data?

Storm events should be looked at – is there a bias to the sampling timeframe?

Are their stormy /non-stormy conditions that we need to look at related to discharge and residence time? Major influence on chlorophyll?

(Clifton B)   Support use of central tendency

Where the high-end threshold = stronger effect (dose response) – when you hit this level – you have "this effect". Not sure that's what we are doing here.

We're trying to look at a wide range of indicators – many expressed as different averaging periods. Models better predict central tendency (ties to management efforts); we can look at a target distribution, we can pick any statistic; we need more data to support the higher percentile. Existing criteria was intended to be a central tendency.

(Bill H)   How should the criteria be expressed? They should be designed to protect designated uses

Ammonia – averaged? Use that with the standard

(Jeff M)   Need slide for presentation to the EMC – graph was great (add powerpoint slide number?) Using limited resources – the data set

(Pam B)   We have numerous choices for measures of central tendency. Geomean is used when we have data that has a broad range, such as fecal coliform than can values from 0 to over 6,000. We don't see that range with chlorophyll-a – Are we dampening the results of high exceedances by using the geomean vs a straight arithmetic mean?

(Nathan H)   The ability to use a T-test on arithmetic mean; most data is log-normal; fecal coliform = human health – more worried about the extremes.

(James B)   chlorophyll-*a* concentrations are log-normal; statistical inference should be done on the geomean

(Pam B)   Geomean - should not be used with assessment/evaluation of pH -because it is already log transformed

(Nathan H)   Makes sense. "censored" data a problem with parametric test (use of non-detects); do we have to use the same statistical analysis for each standard (no)

(Martin L)   We have a numeric and a narrative component – so we could capture the "high end threshold" component with the narrative?

3. **Presentation: pH Discussion** (Brian Wrenn)
   a. Andy S – decision rules were briefly mentioned
      i. 100 % agreement not needed
      ii. Minority positions will be noted
   b. Brian W - Continuation of the pH criteria discussion – overview of several proposals (refer to Table: pH proposal summary_09272017.docx):
   c. Martin L – Factors related to "what is right" – where do aquatic life become affected?
      i. What pH value will begin to affect HRL aquatic life community?
      ii. Avoidance occurs – to move away from a stress; even if all habitat does not meet acceptable area
      iii. Spatial/vertical averaging components – use monitoring approach that would give a monthly accounting of depth; generally integrating pH with DO profiles
      iv. Other factors (such as DO) limits the habitat utilization
      v. We want adequate coverage. Is the pH an impairment? In deeper waters where instantaneous is less than 4 and pH elevated– is this area in the "middle" an adequate area for support? Is a vertical average profile protective? What percent of the time do we have adequate habitat. Chart is the number of profiles where 25% meet both criteria of adequate pH and DO. Stressful pH defined as 9.1 --- up .
      vi. (Lauren P) - 50% habitat available? Is that protective? Do we want the lake protected at 90%?
      vii. Is the chart showing the adequate habitat is the preferred habitat? Is the preferred habitat sufficient? Based upon profile examination of DO and pH? Discussion surrounding zero percent protection and ultimately protecting the habitat.
      viii. (James B) Fish are mobile, but what about the inverts/mussels that are not? Concept of mobility is at issue.
         1. (Martin L) – pH at the bottom of the lake was not an issue
      ix. (Michael O'D) are there temporal issues related to later summer values? Martin to look at it.
      x. Proposal by Bill H: based on old studies, 30 day averages – not an instantaneous, Frequency… how often? according to the US EPA as 1 in 3 years; Magnitude – can be higher than 9, suggest sticking with 9. Duration: over a week? or a month? Likes the vertical evaluation. Need a threshold amount of habitat available, as fish are mobile – we can look at lateral – but, may be more difficult to manage.
      xi. James B – Avoidance? Or evaluate "acute" impact – where habitat becomes unavailable. This indicates a need for a shorter duration of exposure.
      xii. Clifton B – when DO and PH are high together – there was no avoidance. Paper?
      xiii. Clifton B Proposal: 9.5 is protective; 9.0 protective of salmonids. Georgia has adopted and is approved. Frequency and Durations: Instantaneous? Averaged; Using 2016 data (YAD152C - surface) worst station provided as worst case. If 9.5 pH was criteria it would just slightly be out of criteria. This aids in translating literature vs distribution of the pH. Discussion around how to translate the means (over 3

weeks, a month, week -other) vs an instantaneous. Statistical relationships indicate that 9.0 is conservative for this fishery. Some solutions are needed – vertical averaging needed.

xiv. James B - 30-day averaging - how does that work with assessment?

1. Pam B – concerned that the approach sets us up for not being able to assess; Vertical averaging – can be done; 30-day data is not available
2. Clifton B – Because longer term studies are problematic, thought that the demonstration of a 30-day average of 9 provided relief to the load of work; 9.5 pH is the appropriate number for protections
3. Bill H – compliance is often assessed without longer term adequate data. Data on what is causing adverse effects should drive derivation of the criteria

xv. Lauren P – for comparison to the chlorophyll a, in Georgia, the 9.5 was adopted with a related operating growing season chlorophyll number that is lower. Not sure that we are keeping in mind the relationship of chlorophyll and pH.

1. Clifton reiterated that EPA approved 9.5 for a warm-water fishery.

d. Discussion/Straw Poll (see chart labeled: pH proposal summary_09272017)

i. Discussions on each component, much movement in the table and merging of thoughts.
ii. Vertical averaging is not the cure for the "out of compliance" issues
iii. Many wanted to assure the modifications in averaging or elevated pH levels were still protective.
iv. Instantaneous at 9.5 or vertical averaging? Vertical averaging provides some relief – some were not sure that was appropriate.
v. Can current criteria be used with a different assessment approach? (maybe)
vi. Averaging/ temporal vs vertical
vii. Strong considerations at habitat quality and availability of habitat
viii. Evidence 9.5 at the surface may be ok; but not 10.
ix. Discussions of how to use the DO component (DO > 4)
x. Discussed practical aspects of how to monitor; once a month during a growing season; five-year cycle; how to assess compliance
xi. Ended with 2 options. See: pH options_final_09272017

4. Component	Option 1	Option 2
Magnitude	6.0-9.5	6.0-9.0
Averaging Period	NA	NA

Spatial Component	NA	Vertical averaging; water column or column with DO >= 4.0 mg/L
Assessment Method	90th percentile	90th percentile
Supporters		

? Deanna O. Which option is more protective? (A) Martin L. Not so different

? Brian W: vertical averaging with DO > 4 mg/L (M.L.) yes

? Bill H: we should protect the use; so, the two options are equal – just expressed differently. One situation does not get an advantage from vertical averaging in shallow waters/ SAV high levels/ we may have high DO and high PH

? Martin L – do we currently assess SAV (Pam B) – not sure about the issue in HRL (Brian W) indicated that the issues may be seen in Waccamaw

? Lauren P- Is a modification to 9.5 pH a heavy lift? Likely – due to the age of the data /how the data have been gathered (older analytical methods)

? Deanna O- what about Georgia? Lauren P: not sure that we know the whole issue
> The area of application is very limited. May not be reapproved by EPA if it was resubmitted to them

? James B- Ammonia – is there a risk of ammonia toxicity at a pH of 9.5. (Clifton B- A)
> We have years of data on ammonia; discussion about exceedance of criteria (presumed to be on the latest proposed NRWQC); not a problem in HRL. (Bill H) Ammonia is a separate criterion. Mistake to set a pH criterion on a level of ammonia. Assessment – is based on all vertical data (No – it's on the surface -Pam B) Spatial component: where do we not want to apply? It fits for the deeper arms, additional stations may be in shallow areas. Since it is meant to protect warm-water fisheries, where is the standard not applicable – need further discussion of spatial component. Independent Applicability? (Lauren P) don't think it is an issue. (Martin Lebo) Is literature robust enough to support an increase to 9.5? (Clifton B) Magnitude will get more scrutiny. Agree that there is less literature on "non-fish" – a lot of literature on fish. Ammonia issues – Hans related the pH issue to ammonia. Many species have been tested for ammonia. (Brian W) If D.O. profile never gets above 4.0, and we have high pH… how does this apply? Is it instantaneous? Can dischargers affect the scenario (not necessarily for HRL- but, others)? (Martin L) you wouldn't average data if the DO is below 4.0. (Lauren P) is the issue related to

protecting recreational uses addressed? (Linda E) data presented pushed her towards Option 1 (Astrid S) Can we split hairs to make the decision 9.25? (Clifton B) How about 9.3? (James B) with challenges related to adoptions, isn't that the difficulty of 9.5? (yes) (Nathan Hall) still some concerns about potentially averaging out some very high values. Wanted to take another look at the data. (Martin L) there is still a potential for a 10 pH in both proposals. Considered to be high. Shallow issues can still be a problem. (Clifton B) tempted by the Option 2 – still staying with decisions to support application of 9.5 (Michael O'D) staying with support of Option 2 at 9 pH. Discussion included changes to the range to 9.25 or 9.2/9.3 instead of 9.5.

*Choice / "count" was fairly equally distributed among the members between Options 1 and 2.
Decision was made to allow time to bring back to the full SAC in November (as a few members were missing)

5. **Chlorophyll a/Averaging**
   a. (Brian W.) Intro – Last meeting, Lauren P/ Clifton B provided us with some literature based ranges for several uses, DWR agreed to provide a chart noting some overlap; where overlap occurs, further discussions need to follow-up on duration, frequency of monitoring, averaging periods, and site-specific issues related to HRL. (See PowerPoint- slide)
      i. Roughly 20-30 ug/L is the overlap area
   b. (Clifton B – re-review of proposal) presented some pre-meeting comments, upfront recommendations – we should agree on an averaging period, first. Recommended a "seasonal geomean" with an allowable exceedance frequency and spatial averaging on segments that are geomorphologically similar (riverine, lacustrine, transitional); clarified the proposal: presented a framework for the SS #; Concept: NCDP calls for a statewide SSC. Don't use range as the criteria (doesn't work, we need A number): what is the upper bound (range) in a warm water reservoir that we think that we can streamline assessment: above the number? impaired. Below that number, don't waste resources, lake is meeting uses on that number alone. Some lakes could experience problems at other levels. The top of the range could be the SSC number for HRL. Chlorophyll in HRL can be above the literature range (20-30 ug/l) a lot of favorable indicators(?), but HRL can have geomean above 50 ug/L . This proposal balances the two approaches: literature plus lake specific type thinking- bring it down but not to the literature based values as they have no empirical value. Noted that other lakes may need other examinations. Clifton objects to examination of the overlapping ranges – as that was controlled by a person that threw out the lowest maximum, did not believe this fit a consensus based process as one person would control the process. Discussed 40 ug/L as a season average and reminded the group that the original proposal suggested an average.
   c. Does discussion lead to "independent applicability issues"

    d. (Lauren P) temporal averaging, lake wide averaging approach should be considered, first, then the actual development of the number. Agrees to use some of the ideas, but, not with re-broadening the discussion of the number.

    e. (Bill H) - we have all sorts of numbers (literature) / they are almost never based upon the aquatic life use attainment, use impairment/ attainment; researchers are looking at specific things, the research values do not select ranges of acceptability based upon use attainment. Don't select a range based on improvement or degradations.

    f. Bill H and Clifton B - Seasonal Geometric Mean (SGM)

        i. (Bill H) That has been done elsewhere; does this protect the uses?

        ii. (Clifton B) – we are merging the uses – the number will balance the uses, its gradational.

        iii. (Deanna O) What are your thoughts on use of a geomean. (Bill H) – it is used in a number of criteria (nutrient/bacterial); Florida used it, for the entire year or growing season, did it cause a "use impairment"? who knows? – it allows a fair amount of variability, it is a less restrictive approach. Allows a larger range in the data, you get blooms, that give you very high numbers on occasion. Using a geomean allows you to average those high values out without setting criteria that are too high.

        iv. (James B) – likes the use of the Seasonal Geometric Mean (SGM) as it characterizes the distribution, likes the current assessment approach that allows for exceedance probability of the number around 40 that seems to protect the use (use attainment). Geomean approach has the advantage of being parametric, but the SGM would need to be significantly less than 40 ug/L.

        v. (Deanna O) Why would the SGM need to be less than 40 ug/L (chlorophyll)?

        vi. (James B) - From looking at a skewed right distribution of chlorophyll a, that I then log- transform and where 10% of that is above the log of 40, then the geomean is going to be less than 40 ug/L.

        vii. (Nathan H) the geomean of 40 would be equal to our current standard set at 75 or 80 ug/L.

        viii. (Clifton B) a geometric mean will always be less than the 90th percentile, however, HRL has numbers above 50, without a lot of unfavorable indicators. We would need to bring HRL down to meet a geomean of 40, it is meeting all its' uses, so reiterated position that 40 ug/L for chlorophyll a was acceptable/conservative as a geomean;

        ix. (Deanna O) Is this reservoir like others? Can we use the same argument (40 as a geomean) in other reservoirs?

        x. (Clifton B) is HRL a precedent – maybe not -just using the framework to examine the lake

        xi. (James B) – HRL is in the middle. It's in the region where chlorophyll-a is at levels where it may be a problem, but, it is seen as a favorable evaluation because we are not seeing fish kill, don't see algal toxins? As long as it passes the narrative, but,

what if we see algal toxins? (Astrid S) – they are there. (James B) – number may need to be above 40 ug/l, but if it is 60, it could be favorable as long as we don't see other problems.

xii. (Clifton B) – Geomean? Question is "Do we want to use a measure of central tendency"? How stringent we make it is another consideration. Yes, because it is not a toxic endpoint, we are looking at a range of potential effects, with different averaging periods.

xiii. (Deanna O) still trying to think of the process for the next reservoir

xiv. (Deanna O) Nathan, is geomean the right way to do it? How do we average this? the model is a great way to examine it.

xv. (Nathan H) believes in the power of the parametric approach –central tendency is much more intuitive - being able to make an assessment on 5-6 data points is a positive. In the end, it's using a single value to make a determination.

xvi. (Lauren P) For sure the growing season is a measure, with the geomean being a part/detail of it. So, growing season, not instantaneous. Narrative – the only quantitative review was in Jing's presentation on density (numeric). So, numeric evaluation goes with what we are looking at.

xvii. (Bill H) Chlorophyll-a is not instantly toxic, a high level measured does not cause a toxic adverse effect right away. Cyanotoxins may occur, but, they have not been demonstrated in the lake. EPA agrees with the geomean. Florida used annual geometric mean, all the data in one year results in one point. Can you evaluate on an exceedance frequency of once in three years – you need three sets of data, if you only have no more than one exceedance in three years then you are meeting the standards.

xviii. (James B) Still concerned with using one measure of the distribution. The higher the chlorophyll-a, the more likely the adverse impact. If you have some normal distribution, and above some level there is an unacceptable risk of something bad happening, then you need to know both the mean and the variance. The standard captures that now, with the exceedance probability. Believes that you can do the same thing parametrically, with log-normal transformed data, but, not base the criteria solely on the geomean. Capture the mean and variance – then a fraction above a particular value would indicate that you are not meeting the standard.

xix. (Martin L) Believes that the geomean is an appropriate measure to look at central tendency. Doesn't eliminate the ability of the state to look at the distribution and to look at the data in other fashions. It would put a benchmark – a central tendency would indicate an excess plant growth.

xx. (Lauren P) For James B. Did you mention /mean that we need two criteria?

xxi. (James B) thinking about how to write the standard. How do you assess compliance? Are we losing something important about the range of values that are observed in the system if we are looking solely at the geomean to some confidence level below a certain value.

(Andy S) Switching subjects away from the temporal averaging to spatial averaging (segments)

6. **Other discussions:**
    a. (Connie B) For Lauren, you mentioned that in Florida there is an annual geomean, was it a rolling annual geomean. (Lauren P) it was a calendar year – there both an arithmetic averaging and annual geomean.
    b. (Deanna O) is it more accurate to use a geomean than to use the way it is currently being done?
    c. (various) yes
    d. (Connie B) do you have an idea of how to define the word "seasonal"
    e. (Clifton B) yes, April to October
    f. (Various) need to look at current rules – and determine if these need to be "alike" or can be different? (April 1 – Oct 31; April 1 through September 30?)
    g. (Bill H) when do we monitor? (Brian W) timeframe can change based on the lake/other needs/

7. **Spatial Averaging:**
    a. (Clifton B) more of a segmentation question? Assessments? We are drawing segments around our stations. Not setting stations around the segments. We want a homogenous body of water. (?) Look at Riverine/ transitional/? Pool down by the dam. Mentioned Virginia as precedent. Segmentation in HRL now has tiny little segments around one station, suggest transitional part should be a part of that small segment. Suggest spatial averaging around segments geomorphically and hydrologically similar.
    b. (Martin L) Question on logistics of data collection/ averaging: Are all chl a data collected on a given date w/i a segment unit be averaged before they were integrated into the geomean? A pre-process? So, you would have a higher "n" value?
    c. (Clifton B) I was thinking that you would aggregate all values when you calculate the geomeans
    d. (Deanna O) The side arms – I would presume they are different – are you going to average each of them (the arms) all together?
    e. (Clifton) Not part of the proposal. Each of them would be separately - the tiny segment would be joined with the big lacustrine segment
    f. (Deanna O) – don't you lose information about the system when you do that?
    g. (Clifton B) Academic information, it could tell us where the numbers are the highest. Well, this is an assessment.

    h. (Deanna O) well, there are reasons to look at why you have a problem. Just aggregating data is useful, may not allow us to understand things.
    i. (Jeff M) Example: Falls lake – if done differently would give you a completely different impairment assessment; segmentations gives us more information about a particular arm (Deanna O) it also aids in distinguishing what sectors to talk to.

j. (James B) We can temporally average? take multiple data points? Are you increasing the "n" – to quantify the mean. We are looking at a unit to get the seasonal mean.

k. (Clifton B)– we may have multiple sites that are very close together, but we are treating them as two separate segments

l. (Nathan H) don't the two separate segments show that you have assessed them differently? One station show impairment – and one doesn't we split them – we split them into two assessment units

m. (Clifton B)- yes, but that should not be done. Specifically related to chl a and mobility of species. The reason that one segment is so small – it has only one station.

n. (Lauren P) – related to her proposal: ? station in the period of record – are they homogenous enough? Stick with what the states have selected so far…need to examine.

o. (Clifton B) well - we have splitters and lumpers. Gave Virginia precedent. For chlorophyll a and mobility of species – makes no sense to look at tiny little segments.

p. (Astrid S) we will use each station as its own assessment. (yes) If we have different chl-a values in different sections of the lake? Different from having one chl standard for the whole lake. Worried about how evenly distributed the sampling is across the lake. The spatial extent is varying across the arms. (Brian W) The Lakes Program will primarily look at three stations. Other stations are done by other programs – at a more regular basis. Some stations are only "boat based" – (Astrid S) so there will be differences in sampling results due to the numbers of samples taken during Lakes Program intensive sampling?

q. (Martin L) Spatial averaging makes a lot of sense for chl a. Resolutions for elevated chlorophyll being a TMDL is going to be on a watershed/basin scale

r. (Nathan H) discussion on how to draw the segments -

s. (Deanna O) wanted to see the sampling sites and which are being separated and which two are being lumped. (Clifton B) visually indicated. (Deanna O) – wanted to know how this might not work (or work) in other lakes relative to the "land use". Does the land use matter in some lakes. (Nathan H) we may have already seen it (Clifton B) we need seasonal (dates); lumping vs splitting? Transitional segment? Land use map? Chlorophyll a data. (Jeff M) noted that some segments are separated due to the classification (WS vs C)

t. (Jim H) options when Nutrient Strategy is written the data can be looked at differently.

u. (Lauren P) magnitude – how often can that occur? (Astrid S) occurrence /frequency questions related to sampling and whether we do or do not need (or want) to catch a bloom. Goal is to capture the distribution. (Lauren P) – did we look at unit density vs chlorophyll a? (Astrid S/Linda E) numerical density vs biovolume are not always clearly related. (Lauren P.) worried that we are getting wrapped up in bigger concepts and getting away from HRL. (Martin L) – agree with Lauren, look at numerics in HRL to move to the next steps. (Clifton B) Piloting this process in HRL will help us with other lakes – the numbers will help us get to the idea of what to do with HRL. What we need is the appropriate range? Balance out literature with lakes specifics. If we agree to consider both – then this is a framework for doing this. The range is indicated on both thoughts as an

example of a high-end lake. (Bill H) 40 ug/L doesn't appear in the literature? (Clifton B) probably not.

8. **Preparation for the November SAC meeting** (Andy Sachs)
   a. What topics of discussion should be addressed during the next meeting?
      i. Connie B – the list? Needs for spatial averaging
         1. Brian W: Staff will look at two different growing seasons/ how do numbers play out?