August 18th SAC Meeting

- HRL Watershed Model
- HRL Nutrient Response Model
- HRL Classifications, Designated Uses & Impairments
- Discussion/Brainstorm
Developing a Water Quality Goal

Questions/Thoughts:

- How do we get to a goal?
- Is the existing condition of HRL actually a problem?
- Show us the impairment - We have no data to illustrate the impairment!
- Is there an actual impairment to aquatic life?
  - *Chlorophyll-a indicates “yes”*
- Need to list all uses for a WQ goal
- Need to understand what is appropriate for the system
High Rock Lake Water Quality Goal

To provide for the protection of designated uses in the HRL reservoir by defining and proposing the appropriate level of algal related indicators for each of the following uses:

- Aquatic Life
- Fishing
- Fish Consumption
- Wildlife
- Secondary Recreation (e.g. wading, boating)
- Agricultural uses (e.g. irrigation)
- Water Supply
- Lower lake: Primary Recreation – full human body contact (e.g. swimming, water skiing)
Indicators & Criteria

• Discussion/Brainstorm:
  • Use monitoring to provide more info on the current conditions
  • Establish a baseline for current conditions so it doesn’t get worse
  • What info do we have for HRL that can link:
    • Toxins
    • Excessive biomass
    • Impacts on indigenous populations
Potential Indicators

- Aquatic Life:
  - pH, DO, Algal toxins, Biovolume (better than unit density for Aq Life)
- Fishing:
  - Quality of fishery
- Recreational:
  - Algal toxins, Cyanobacteria density, Reported incidents of adverse impacts
- Water Supply:
  - Algal toxins, Taste & odor
Albemarle Sound: Nutrient Criteria Development Progress

Jim Hawhee
N.C. Division of Water Resources
14 October 2015

Department of Environmental Quality
Albemarle Sound

Department of Environmental Quality
Albemarle Sound - Designated Uses

Department of Environmental Quality
Albemarle Sound-Salinity

Legend:
- HUC 5
- high salinity
- low salinity
- transitional

Department of Environmental Quality
Why Nutrients Matter in Albemarle Sound

- Algae/phytoplankton blooms
  - toxins
  - hypoxia
  - fish kills
  - real estate
  - tourism
- Impacts to submerged aquatic vegetation
  - increased turbidity
  - SAV habitat limitation
  - loss of fisheries production

Department of Environmental Quality
N.C. Nutrient Criteria Timeline

- 2004: NC’s first Nutrient Criteria Management Plan (NCDP)
- 2011: NCDP update proposed to EPA, no concurrence.
- 2013: New draft NCDP proposed and public comment sought
- June 2014: Mutual agreement reached on NCDP update.
- Full history overview and other resources available on DWR’s website: http://portal.ncdenr.org/web/wq/nutrientcriteria

Department of Environmental Quality
Albemarle Sound NCDP Workgroup/ APNEP Nutrients Workgroup

• APNEP commented on 2013 drafts of the NCDP, offering support for development of estuarine standards.

• Recognizing local expertise and supporting work underway, Albemarle Sound was chosen as an estuarine pilot site for development of criteria.

• APNEP worked closely with DWR and EPA during the negotiation process regarding timelines for Albemarle Sound nutrient criteria development.

• Nutrient criteria development aligns with APNEP’s management plan and workgroup development process.

Department of Environmental Quality
Represented agencies and organizations (partial list)

- North Carolina League of Municipalities (NCLM)
- US Environmental Protection Agency (EPA)
- N.C. Division of Water Resources (NCDWR)
- U.S. Geological Survey (USGS)
- N.C. Farm Bureau (NCFB)
- UNC Institute of Marine Sciences (UNC IMS)
- East Carolina University (ECU)
- N.C. State University (NCSU)
- N.C. Sea Grant
- Albemarle-Pamlico National Estuary Partnership (APNEP)
- National Aeronautics and Space Administration (NASA)
- Waterkeepers Carolina
- Consultants

Department of Environmental Quality
APNEP Nutrient Workgroup Website

http://apnep.org/web/apnep/nutrients

Department of Environmental Quality
### Table 3. Task list for the Albemarle Sound.

<table>
<thead>
<tr>
<th>Task No.</th>
<th>Task</th>
<th>Anticipated Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>DWR initiates discussions with APNEP’s Science &amp; Technical Advisory Committee (STAC) and Policy Board regarding the Nutrient Criteria Development Plan.</td>
<td>July 2014</td>
</tr>
<tr>
<td>2</td>
<td>APNEP convenes an Albemarle Sound workgroup of water quality specialists, interdisciplinary scientists, and local stakeholders to advance Albemarle Sound portions of the NCDP in support of its Comprehensive Conservation and Management Plan. Work on Task 5 begins.</td>
<td>September 2014</td>
</tr>
<tr>
<td>3</td>
<td>APNEP, DWR and EPA representatives discuss the necessity and availability of additional federal resources for initial project tasks, including technical support for the Albemarle Sound workgroup, facilitation support for the SAC, and support for SAC members. (Note: external funding is crucial for progress on further NCDP development).</td>
<td>September 2014</td>
</tr>
<tr>
<td>4</td>
<td>Albemarle Sound workgroup recommends focus area of study for the Albemarle Sound criteria development.</td>
<td>November 2014</td>
</tr>
<tr>
<td>5</td>
<td>Albemarle Sound workgroup meets quarterly (or more often as necessary) to develop its Preliminary Phase I report.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meeting No. 1 February 2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meeting No. 2 May 2015</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Meeting No. 3 August 2015</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Preliminary Phase I report completion. Report will include:</td>
<td></td>
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<tr>
<td></td>
<td>- A bibliography and a summary of relevant findings that will inform the development of estuarine nutrient criteria in North Carolina’s estuarine waters.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- An analysis and summary of available water quality data for causal (N and P) and response variables (Table 1) in Albemarle Sound. The report will discuss the quality of the data available for Albemarle Sound and identify any spatial and temporal patterns.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- If necessary, identification of research or monitoring needs for establishing scientifically defensible NNC.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>- Appropriate numeric thresholds will be reported for all variables that have scientifically defensible information supporting them, and recommendations regarding their use as NNC will be provided to DWR.</td>
<td>November 2015</td>
</tr>
</tbody>
</table>
## Potential Criteria

### Table 1. Response and causal variables for consideration.

<table>
<thead>
<tr>
<th>Response variables</th>
<th>Causal variables</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chlorophyll-$\alpha$</td>
<td>Nitrogen</td>
</tr>
<tr>
<td>Phytoplankton</td>
<td>Phosphorus</td>
</tr>
<tr>
<td>Periphyton</td>
<td></td>
</tr>
<tr>
<td>Macrophytes</td>
<td></td>
</tr>
<tr>
<td>Diurnal dissolved oxygen (DO) range</td>
<td></td>
</tr>
<tr>
<td>Minimum DO</td>
<td></td>
</tr>
<tr>
<td>Diurnal pH range</td>
<td></td>
</tr>
</tbody>
</table>
# NCDP Timeline: Albemarle Sound Phase II

<table>
<thead>
<tr>
<th>Task No.</th>
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<th>Anticipated Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>With consultation from the Albemarle Sound workgroup, U.S. Geological Survey completes the Albemarle Sound pilot study of the National Monitoring Network for U.S. Coastal Waters and their Tributaries. Workgroup recommendations and report will be revised, if necessary.</td>
<td>December 2015</td>
</tr>
<tr>
<td>8</td>
<td>Present preliminary workgroup phase I report to the SAC and APNEP’s STAC for review and comment.</td>
<td>December 2015</td>
</tr>
<tr>
<td>9</td>
<td>Provide a formal status update to the EPA.</td>
<td>December 2015</td>
</tr>
<tr>
<td>10</td>
<td>The Albemarle Sound workgroup adopts its final phase I report.</td>
<td>March 2016</td>
</tr>
<tr>
<td>11</td>
<td>Based on final report recommendations and subject to available resources, perform additional monitoring, research and/or modeling to inform criteria development. The timeline for this step may be revised or accelerated depending on research, monitoring and/or modeling timelines proposed in the phase I report.</td>
<td>September 2018</td>
</tr>
<tr>
<td>12</td>
<td>The Albemarle Sound workgroup incorporates new monitoring, research and modeling information into a final phase II report. Appropriate numeric thresholds will be reported for all variables that have scientifically defensible information supporting them and recommendations regarding their use as NNC will be provided to DWR. Upon completion of the phase II report, the Albemarle Sound workgroup will have evaluated all causal and response variables in Table 1 for use as nutrient criteria.</td>
<td>April 2019</td>
</tr>
<tr>
<td>13</td>
<td>DWR proposes recommended criteria for adoption and proposed approaches in developing nutrient criteria for estuaries statewide.</td>
<td>May 2019</td>
</tr>
<tr>
<td>14</td>
<td>Adoption of nutrient criteria for the Albemarle Sound per NC Administrative Procedure Act.</td>
<td>December 2020</td>
</tr>
</tbody>
</table>
## NCDP Timeline: Estuaries

<table>
<thead>
<tr>
<th>Task No.</th>
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<th>Anticipated Completion Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Data review and summary for estuaries. Collect, compile and review water quality data for causal (N and P) and response variables (Table 1). An initial review will focus on data quality, determining any spatial and temporal patterns and if there are any data gaps.</td>
<td>June 2018</td>
</tr>
<tr>
<td>2</td>
<td>Based upon the water quality data review estuaries will be summarized by watershed characteristics with SAC input.</td>
<td>December 2018</td>
</tr>
<tr>
<td>3</td>
<td>Present findings to the SAC.</td>
<td>January 2019</td>
</tr>
<tr>
<td>4</td>
<td>Prioritize specific estuaries for nutrient criteria and confirm approaches proposed in the Albemarle Sound nutrient criteria development process with SAC involvement.</td>
<td>December 2019</td>
</tr>
<tr>
<td>5</td>
<td>Review progress to date and make revisions to the NCDP if necessary.</td>
<td>January 2020</td>
</tr>
</tbody>
</table>

**Develop nutrient criteria with SAC involvement using the confirmed approaches:**

| a. | Begin consultation with the SAC | January 2020 |
| b. | Present tentative NNC to SAC   | March 2021    |
| c. | Present refined NNC to SAC     | July 2021     |
| d. | Present proposed NNC to WQ Committee | September 2021 |
| e. | Present proposed NNC to EMC    | November 2021 |
| 7. | Adopt nutrient criteria per NC Administrative Procedure Act            | June 2023     |
Phase I Considerations

- Review and synthesize information.
  - Identify ecological pathways influenced by nutrients.
  - Identify criteria thresholds or ranges
  - Identify reference conditions to the extent possible.
  - Incorporate spatial (local) considerations
Phase I Considerations (continued)

- Determine range of scientifically defensible criteria
  - All criteria for which information is available?
  - Suite of complimentary criteria.
  - Linkage to water body uses and designations
  - Causal indicators, response indicators, or both?
Building Albemarle Sound Nutrient Criteria Development

Phase I Considerations (continued)

• Incorporating policy:
  • Monitoring feasibility
  • Assessment methodology (for chl. a, greater than 10% exceedance, 90% or greater confidence, n≥9.)
  • Permitting
  • Enforceability
  • Recent water quality conditions and state
  • Qualitative understanding of financial implications of criteria (regulatory changes subject to a fiscal note).
• Impacts on stakeholder groups
• Other states’ experiences (Chesapeake Bay, Florida, and others…)

Department of Environmental Quality
Generally recognized nutrient criteria development approaches

• Reference condition
  • Study of historical data and/or relatively unimpaired water bodies can provide a baseline by which criteria can be adopted in a broader class of waters

• Stressor-response
  • Regression analyses or scientific studies that relate nutrient inputs to desired environmental outcomes or thresholds.

• Water quality simulation models
  • Simulates the relationship between physical, chemical, and biological processes to study water quality scenarios.

Department of Environmental Quality
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Department of Environmental Quality
Albemarle Sound - Status

NASA DEVELOP Project

• Status: Complete
• Results inconclusive
• Summary: Project participants analyzed satellite color imagery to evaluate its accuracy for detecting chlorophyll a. Results showed poor correlation with previously collected water quality data.
• Full report on Google Drive

Department of Environmental Quality
Albemarle Sound- Status

USGS Albemarle Sound Initiatives

• Status: Nearly complete
• An inventory of monitoring programs and available data in the Albemarle Sound watershed has been completed.
• Duke MEM project supervised by lead USGS PI offers trend analysis of variables including chl a, DO, turbidity, nitrogen and phosphorus.
• Both reports available on Google Drive
• USGS report analyzing results of field efforts ready soon.

Department of Environmental Quality
Albemarle Sound - Status

Literature Review

- Status: Complete
- NSTEPS proposal for literature review funded and conducted by Tetra Tech.
- Summary: ~4,000 estuarine literature citations organized and associated with keywords for further exploration. Abstracts provided for most sources. Tags include geographical sorting, environmental endpoints, and methods.
- EndNote database and a series of text files associated with each keyword are available via Google Drive.

Department of Environmental Quality
Albemarle Sound - Status

DWR Data Review and Analysis

• Status: Underway
• NSTEPS proposal for data analysis funded, review underway by Tetra Tech
• Summary: Advanced statistical and spatial analyses of historical DWR monitoring data in and near Albemarle Sound to inform criteria development
• Report due Dec. 2015

Department of Environmental Quality
Nutrient Criteria Law and Policy Review

- Status: Nearly complete
- Summary: An evaluation of case law regarding numeric nutrient criteria development nationally and high-level policy case studies of other jurisdictions that have revisited nutrient criteria.
- Analysis conducted by a legal fellow associated with N.C. Sea Grant and the N.C. Coastal Resources Law, Planning and Policy Center.
Albemarle Sound—What’s Next

- November phone call to reacquaint workgroup, discuss progress to date, and plan through the conclusion of phase I.
- Monthly meetings through next spring under consideration to discuss project results and their implications for Albemarle Sound criteria development.
- Phase I report targeted for summer 2016, including preliminary recommendations and/or areas for further study.
- Role of the SAC/CIC?

Department of Environmental Quality