

## Meeting Summary

### SAB Working Group on Nutrient Criteria Enhancement

**Date:** November 23, 2010

**Time:** 9:30 AM – 12:00 PM

**Place:** Omni Environmental LLC, Research Park, 321 Wall Street, Princeton, NJ 08540

**SAB Attendees:** Ray Ferrara, Chair; David Vaccari, Judith Weis, Thomas Amidon

**NJDEP Attendees:** Judy Louis, Tom Belton, Leslie McGeorge, Marzooq Alebus, Deb Hammond, Bob Schuster

#### SAB Nutrient Criteria Issue

"Site-specific factors may mitigate or exacerbate biological responses to excessive nutrients. What are the best state-of-the-art approaches for technically sound and implementable nutrient thresholds/criteria in fresh and coastal waters?"

This issue was one of many submitted to the SAB for consideration on September 8, 2010. See: <http://www.state.nj.us/dep/sab/draft-issues.pdf> In a subsequent meeting of the full SAB in Trenton on October 18, 2010 the Board asked that some particular questions be developed to better address this issue. See:

[http://www.state.nj.us/dep/sab/minutes/sabmin10\\_18\\_10.pdf](http://www.state.nj.us/dep/sab/minutes/sabmin10_18_10.pdf) To that end, a SAB Nutrient Work Group was formed and a meeting held on November 23, 2010 to discuss a set of specific charge-questions developed by NJDEP staff. The following is a summary of that meeting.

#### Introduction:

At the beginning of the meeting Tom Belton pointed out that NJDEP is responsible for the development of water quality criteria to protect New Jersey's rivers, streams, lakes, reservoirs, coastal bays, estuaries and ocean. Unlike traditional toxic pollutants, nutrients are necessary to support a healthy ecosystem. However, excessive nutrients cause undesirable effects such as objectionable algal densities and shifts in the biological community. NJDEP adopted a narrative nutrient criterion that specifies that nutrients, unless due to natural conditions, should not cause undesirable impacts. In addition, NJDEP adopted numeric total phosphorus criteria for freshwater lakes/reservoirs and rivers/stream. Analysis, through TMDL efforts and water quality assessment, of nutrients and the response variables of nutrient over-enrichment has provided information that supports use of a site-specific approach, as envisioned by the narrative nutrient criteria. The goal of the meeting was to ensure that the methods chosen by NJDEP to evaluate nutrient impacts on state waters are based on sound science and applied in an appropriate fashion.

#### Work Group Procedure

First on the agenda was the selection of a Work Group Chair. Judith Weis said she asked Ray Ferrara and he accepted. Second, was a discussion of whether the SAB work group needed more expertise from other SAB members to help with the nutrient questions. It

was the consensus of the work group that additional expertise would be brought in as needed. David Vaccari, the chair of the SAB Water Quality and Quantity Committee, said he'd asked the members of his committee to join but only one agreed to help, Tom Amidon who was already in attendance at the meeting. It was suggested by Leslie McGeorge (NJDEP) that Tony Navoy (USGS) and Jonathan Kennen (USGS) who are members of other SAB Committees be asked to join. Ray Ferrara will reach out to them.

### **Charge Questions**

The list of charge questions were then discussed in detail as broken up into three categories: Wadeable Streams; Marine and Estuarine Waters; Lakes and Impoundments. It was pointed out that the existing nutrient criteria applied to all non-wadeable streams and that freshwater and salt water systems could not use the same methods or endpoints due to intrinsic aspects of each water body type, (e.g. salinity, unidirectional flows vs. tidal cycles, etc.).

Judith Weis pointed out that the scientific results of any given approach looking into nutrient impacts on biology would result in a continuum of responses and she felt it is the job of regulators such as DEP to pick a number out of the continuum and it could be difficult to justify that number scientifically. NJDEP staff pointed out that what we needed from SAB was the tool box of scientifically defensible approaches and that the Department would select the best numbers based on the best science with their guidance. Deb Hammond observed that the USEPA in a recent Florida nutrient criteria decision allowed a range of nutrient concentrations as criteria endpoints. David Vaccari suggested we find a statistical approach to look at responses, perhaps relying on power curves if data allowed it. More likely, the idea of there being a trade-off between false positives and false negatives forms a conceptual model for understanding the effect of a numerical criterion, as opposed to the idea that a particular numerical value could produce a threshold effect. Tom Amidon suggested the shape of the response might be more instructive.

Marco Alebus observed that aquatic macrophyte biomass (in-stream plants) could add a level of confusion for setting criteria and needed to be addressed on a site-specific basis. Currently we use dissolved oxygen and pH as secondary surrogates for actions of macrophytes on a site specific basis. How can we accommodate macrophytes in our analysis?

Marco Alebus raised the point that NJDEP only looks at periphyton impacts (i.e., increased Chlorophyll a (Chl a) if the dissolved oxygen (DO) criteria is not met). His question: Is DO a good enough indicator for evaluating Biomass?

Marco Alebus raised a related question that had to do with the AMNET macroinvertebrate IBI currently used to assess meeting aquatic life uses in a stream but is also part of the new "weight of evidence" approach proposed by NJDEP to assess nutrient impairments. The problem is that this IBI could be reflective of nutrient impairment as well as other stressors (e.g., erosion, habitat loss, storm drains impacts on flows, etc). In essence could macroinvertebrates be used to support nutrient criteria? Tom

Belton pointed out that New York DEC uses macroinvertebrates in an analysis called the Nutrient Biotic Index (NBI) and that NJDEP's Office of Science had piloted this approach in a study done by the Philadelphia Academy of Natural Sciences. The results were inconclusive but promising for NJ streams but might be made more predictive with additional studies. What is the SAB's opinion on this approach?

Deb Hammond explained that NJDEP's recommend approach for future nutrient criteria assessment is based on a "weight of evidence" approach using multiple parameters besides just phosphorus and nitrogen concentrations. She asked if this was defensible and the Working Group felt it was but needed to look into the underpinning data to support using these three metrics: macroinvertebrate IBI scores, DO criteria and diurnal DO swings of 3.0 mg/l.

Deb Hammond also pointed out how the W of E approach could be superseded by USEPA's "Independent Applicability" philosophy which states that if there is more than one criterion to assess impairment then violating one implies impairment in spite of the other criteria, even if there is a good biological explanation (e.g., site-specific or natural variability). Deb pointed out that this IA philosophy was developed in support of toxic chemical criteria in water where there is often one threshold whereas with nutrients there may be multiple geochemical and biochemical responses ameliorating the impacts from nutrients. She asked the Work Group to look into the underlying science behind IA and to compare/contrast it with the "weight of evidence" approach.

Leslie McGeorge raised the issue of how conservative the diurnal DO field methods were as developed by USGS and used by NJDEP. She asked the Work Group to look at these methods and determine whether we might justifiably amend them to be more user friendly for routine sampling. Marco Alebus also asked them to evaluate whether a 3 mg/l swing was justifiable as a nutrient criteria due to "primary productivity" as opposed to non-nutrient driven swings (as presented in the weight of evidence approach). Would there be more site-specific swings based on localized conditions?

Deb Hammond asked the Work Group to address the statistical ways we might look at nutrient related data generated by routine monitoring to label waterways impaired. How many violations would be defensible (e.g. 10%, 2 over two years of quarterly sampling), should we use annual geometric means, seasonal values, and/or should we sample periods outside of the growing season (i.e., the current approach)?

Tom Belton observed that the Trophic Diatom Index and TALU-based assessment of nutrient impairment developed by the Office of Science might be used to supplement and/or replace macroinvertebrates for assessing aquatic life usage and impairment from nutrients in the weight of evidence approach. He asked the Work Group to review the underlying studies used to make this determination and how they might be integrated into the weight of evidence approach.

Tom Belton asked if there was enough data available from the NJ TDI and TALU studies or any other studies to justify a nitrogen criteria protective of aquatic life. The current

nitrogen surface water criterion is based on a safe drinking water level (potable use) and not in-stream effects (aquatic life).

Bob Schuster observed that downstream affects of nitrogen are critical to any criteria development since that is where the biology responds the strongest. Most primary productivity in estuarine and coastal areas is nitrogen limited, which is why USEPA in Florida developed downstream protective values for nitrogen based on load reductions upstream. Should NJ be looking at this same approach?

Bob Schuster pointed out that NJDEP and USEPA are funding multiple studies from Rutgers and USGS in Barnegat Bay to develop stressor-response models for nutrient impairments in estuarine waters using both in-faunal macroinvertebrates, submerged aquatic vegetation, phytoplankton (Chl a) and marsh periphyton. He asked the Work Group to assess these methods under development and possibly suggest others.

Tom Belton observed that NJDEP's lake monitoring program is working with the Office of Science to develop biological endpoints for nutrient impairment using paleolimnological cores of lake sediments to develop nutrient-bio inference models based on diatom communities? In addition, NJDEP needs to develop nutrient protective values for both lakes and potable reservoirs. The latter may require different indicators (e.g., blue green algal indicators for taste-and-odor protection of finished water) and endpoints (e.g., most reservoirs are manipulated by herbicide application). The Work Group was asked to evaluate these approaches and recommend others, if indicated.

Deb Hammond pointed out the issue of “competing designated uses,” that nutrient criteria protective of recreation (swimability – clearer water) may be overly protective of aquatic life usage (fishability – need to fertilize low end of fish food chain). How do we manage these competing uses as far as criteria development is concerned? Does one size fit all, or can we create criteria protective of the primary use of a waterbody?

### **Prioritization**

Ray Ferrara suggested that since the range of questions and technical issue were so large that we prioritize five key questions to address first. The following five were selected by the Work Group:

1. Evaluate the utility for using the NJ diatom-based TDI and TALU studies for developing bio-criteria and related protective nutrient concentrations for wadeable streams (i.e., for both phosphorus and nitrogen).
2. Evaluate the USGS method currently used by NJDEP to perform diurnal DO sampling and recommend any changes to simplify field utility without losing scientific validity. A corollary is to investigate what DO swings would indicate impairment due to primary productivity.
3. Evaluate whether NJDEP should expand their current sampling regime from the growing season to include annual or seasonal data and are there consequences for

assessing impairment to designated uses (e.g., do winter algal blooms cause DO sags in summer).

4. Evaluate what the appropriate averaging period should be for nutrient criteria, which then determines the averaging period for assessing monitoring data. For example, should the phosphorus criterion of 0.1 mg/l in streams be assessed as a monthly average criterion, annual average criterion, or a seasonal peak criterion?
5. Evaluate what indicator to use for nitrogen aquatic life use impairment in coastal bays, focusing on Barnegat Bay and the research going on there now. Are there ways to develop downstream protective numbers based on upstream concentrations or loads?

### **Schedule**

The SAB Nutrient Work Group members agreed to look at these five questions but focusing on the first two in order to get answers and/or recommendations back to NJDEP and the main SAB within two months (January 30, 2011).