Technical Supporting Information for Proposed Revisions to the Connecticut Water Quality Standards: Biological Condition Gradient

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What is the Biological Condition Gradient?

The Biological Condition Gradient is a conceptual framework that identifies a common pattern of biological responses to human disturbances. The condition or health of aquatic biological communities typically degrades with increases in the level of human disturbances.

Where did Biological Condition Gradient come from?

The conceptual framework has existed for a number of years, but was first published by Davies and Jackson in 2006. (Davies S.P., and S.K. Jackson. 2006. The biological condition gradient: a descriptive model for interpreting change in aquatic ecosystems. Ecological Applications. 16(4) 1251-1266.) CTDEP has participated in an EPA regional study that utilized this concept. In 2007, Calibration of the Biological Condition Gradient for High Gradient Streams in Connecticut was produced for U.S. EPA and CTDEP by Tetra Tech, Inc. This report summarizes work done for Connecticut streams using benthic macroinvertebrate data. The report describes the development of the CTDEP multimetric index and how it was calibrated the BCG model for use in Connecticut.

What aquatic communities are included?

The BCG model can be used for a variety of biological communities. Currently, the benthic macroinvertebrate data is the only data set that is calibrated for the BCG model in Connecticut.

How will it change the aquatic life assessment process?

There will be very little change in the aquatic life assessment process. The benthic macroinvertebrate multimetric index (MMI), which is a current assessment tool, will still be used as a primary method to assess aquatic life in streams and brooks in Connecticut. The MMI has been calibrated to fit into the Biological Condition Gradient (BCG) model to produce a tier assignment (see Tetra Tech 2007).

What are the advantages to a BCG approach?

It provides a nationally consistent approach for assessing biological condition and communicating results to the public. The framework with defined tiers and greater biological delineation, allows the results to be better used to establish baseline conditions, and in watershed protection, restoration, and antidegradation policies.

Isn't this going to make the CTDEP standards less strict?

The changes in the narrative criteria will be uniform for Class AA, Class A, and Class B waters. Although the current benthic macroinvertebrate narrative criteria in the Water Quality Standards is slightly different for classes AA, A and Class B waters, there is no clear reason to expect a higher quality community in Class AA or Class A waters than Class B waters. CTDEP assessments have focused on the quality and health of the aquatic communities rather than the class of the waterbodies when conducting the benthic macroinvertebrate assessments. Assigning waterbodies into BCG tiers will help to provide a more refined assessment tool for evaluating and protecting aquatic resources, better identify current conditions and can be used to help maintain current levels, establish restoration goals and protect waterbodies from degradation.

How was the BCG threshold between meeting Water Quality Standards and not meeting Water Quality Standards determined?

A national Tiered Aquatic Life Uses (TALU) workgroup, comprised of aquatic biologists, developed and tested the BCG model. There was a consensus among the aquatic biologists at the workshop that BCG tiers 1-4 meet the interim goals of the Clean Water Act. Results from additional State and regional projects support this threshold.

What is the difference between Tiered Aquatic Life Uses (TALU) and Biological Condition Gradient (BCG)?

Tiered Aquatic Life Uses refers to aquatic life uses, similar to Designated Uses, which are used to set policies and express goals in a more precise and measurable format. Biological Condition Gradient is a scientific tool used to measure the biological condition of waters in a nationally consistent format.

How will this framework, with defined tiers, allow the results to be better used in watershed protection, restoration, and antidegradation policy?

Currently, the biological community is assessed with a pass/fail approach, where a site's assessed condition can decline without consequence until it reaches the failing threshold. With the additional delineation provided by the BCG tiers, it will be easier to determine if the biological condition at a site is improving, remaining the same or declining prior to not meeting designated uses. Specific action could be designated based on changes in BCG tier assignment.

The Biological Condition Gradient has been fully incorporated into proposed revisions to the Antidegradation Implementation Policy proposed in the revisions to the Water Quality Standards. For Tier 1 Antidegradation reviews which focus on determining whether an activity or discharge is consistent with desiginated uses for a specific water body, the proposed revisions to the Antidegradation Implementation Policy reference the need to maintain biological communities at no less than a BCG Tier 4, the threshold for meeting designated uses.

The potential for activities to affect High Quality Waters, that is, surface waters where the water quality is better than necessary to meet the standards and criteria in the Water Quality Standards, is also proposed to be evaluated with respect to the Biological Condition Gradient. DEP is proposing to incorporate consideration of BCG into the definition of High Quality Water. Additionally, DEP is proposing for Tier 2 Antidegradation Implementation reviews which focus on protecting high quality waters. BCG tiers are proposed to be considered in order to prevent a decline in the biological community from a more natural to a less natural state.

How will this framework better identify current conditions and help maintain current levels, establish restoration goals and protect waterbodies from degradation?

The framework allows for multiple biological communities to be assessed along the Biological Condition Gradient. Currently, only one community is calibrated to the BCG, but the assessment of existing conditions will be further strengthened as additional biological communities are calibrated. The delineation provided by the tiers, allows for better documentation and tracking of the biological condition in the targeted waterbodies. Changes in BCG tier assignment can be evaluated under the antidegradition policy implementation. Existing land use based models, calibrated to the BCG, along with BCG assessments, could be used to estimate stream biological potential and help to establish restoration goals and provide a framework for decision making and prioritization of DEP activities.