UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Region 1
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Boston, MA 02109-3912

September 24, 2015

Eugene Forbes, P.E., Director
New Hampshire Environmental Services
Water Division
6 Hazen Drive, Box 95
Concord, NH 03302-0095

Re: 2012 303(d) List

Dear Mr. Forbes,

Thank you for submitting New Hampshire's 2012 §303(d) list of water quality limited segments. In accordance with §303(d) of the Clean Water Act (CWA) and 40 CFR §130.7, the U.S. Environmental Protection Agency (EPA) has conducted a complete review of the State's list, including all supporting documentation. Based on this review, EPA has determined that New Hampshire's 2012 §303(d) list meets the requirements of Section 303(d) of the Clean Water Act and EPA's implementing regulations. Therefore, by this order, EPA hereby approves the State's list, submitted electronically on February 12, 2014.

Thank you for your hard work in developing the 2012 §303(d) list. My staff and I look forward to continuing our work with NHDES to implement the requirements under §303(d) of the CWA. If you have any questions or need additional information please contact Ralph Abele at 617-918-1629 or Toby Stover at 617-918-1604.

Sincerely,

Ken Moraff, Director
Office of Ecosystem Protection

Enclosure

cc: NHDES: Ted Diers, Gregg Comstock, Ken Edwardson
EPA: Ralph Abele, Ann Williams, Greg Dain

EPA REVIEW OF NEW HAMPSHIRE'S 2012 SECTION 303(d) LIST

INTRODUCTION

EPA has conducted a complete review of New Hampshire's 2012 section 303(d) list, supporting documentation and other information and, based on this review, EPA has determined that New Hampshire's list of water quality limited segments (WQLSs) still requiring total maximum daily loads (TMDLs) meets the requirements of section 303(d) of the Clean Water Act ("CWA" or "the Act") and EPA implementing regulations. Therefore, by this order, EPA hereby approves New Hampshire's 2012 final section 303(d) list. The statutory and regulatory requirements, and EPA's review of New Hampshire's compliance with each requirement, are described in detail below.

II. STATUTORY AND REGULATORY BACKGROUND

Identification of Water Quality Limited Segments for Inclusion on the Section 303(d) List

Section 303(d) (1) of the Act directs States to identify those waters within its jurisdiction for which effluent limitations required by section 301(b) (1) (A) and (B) are not stringent enough to implement any applicable water quality standard, and to establish a priority ranking for such waters, taking into account the severity of the pollution and the uses to be made of such waters. The section 303(d) listing requirement applies to waters impaired by point and/or nonpoint sources, pursuant to EPA's long-standing interpretation of section 303(d).

EPA regulations provide that States do not need to list waters where the following controls are adequate to implement applicable standards: (1) technology-based effluent limitations required by the Act, (2) more stringent effluent limitations required by State or local authority, and (3) other pollution control requirements required by State, local, or federal authority. See 40 CFR §130.7 (b) (1).

Consideration of Existing and Readily Available Water Quality-Related Data And Information

In developing section 303(d) lists, States are required to assemble and evaluate all existing and readily available water quality-related data and information, including, at a minimum, consideration of existing and readily available data and information about the following categories of waters: (1) waters identified as partially meeting or not meeting designated uses, or as threatened, in the State's most recent section 305(b) report; (2) waters for which dilution calculations or predictive modeling indicate non-attainment of applicable standards; (3) waters for which water quality problems have been reported by governmental agencies, members of the public, or academic institutions; and (4) waters identified as impaired or threatened in any section 319 nonpoint assessment submitted to EPA. See 40 CFR §130.7(b) (5). In addition to

these minimum categories, States are required to consider any other data and information that is existing and readily available. EPA's 2006 Integrated Report Guidance describes categories of water quality-related data and information that may be existing and readily available. See EPA's March 21st, 2011 memorandum on *Information Concerning 2012 Clean Water Act Sections 303(d), 305 (b), and 314 Integrated Reporting and Listing Decisions* which recommended that the 2012 integrated water quality reports follow the *Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305 (b) and 314 of the Clean Water Act* (2006 Integrated Report Guidance (IRG)) issued July 29, 2005 (available at http://www.epa.gov/owow/tmdl/2006 IRG/) as supplemented by the October 12, 2006 memo and attachments, the May 5, 2009 memo and attachments and the March 21, 2011 memo and attachments. All guidance, memoranda and attachments may be found at: http://water.epa.gov/lawsregs/lawsguidance/cwa/tmdl/guidance.cfm. While States are required to evaluate all existing and readily available water quality-related data and information, States may decide to rely or not rely on particular data or information in determining whether to list particular waters. In addition to requiring States to assemble and evaluate all existing and readily available water quality-related data and information, EPA regulations at 40 CFR §130.7(b)(6) require States to include as part of their submissions to EPA, documentation to support decisions to rely or not rely on particular data and information and decisions to list or not list waters. Such documentation needs to include, at a minimum, the following information: (1) a description of the methodology used to develop the list; (2) a description of the data and information used to identify waters; and (3) any other reasonable information requested by EPA.

Priority Ranking

EPA regulations also codify and interpret the requirement in section 303(d) (1) (A) of the Act that States establish a priority ranking for listed waters. The regulations at 40 CFR § 130.7(b)(4) require States to prioritize waters on their section 303(d) lists for TMDL development, and also to identify those WQLSs targeted for TMDL development in the next two years. In prioritizing and targeting waters, States must, at a minimum, take into account the severity of the pollution and the uses to be made of such waters. See section 303(d)(1)(A). As long as these factors are taken into account, the Act provides that States establish priorities. States may consider other factors relevant to prioritizing waters for TMDL development, including immediate programmatic needs, vulnerability of particular waters as aquatic habitats, recreational, economic, and aesthetic importance of particular waters, degree of public interest and support, and State or national policies and priorities. See 57 FR 33040, 33045 (July 24, 1992), and EPA's 2006 Integrated Report Guidance and the 2006, 2009 and 2011 memoranda and attachments.

III. ANALYSIS OF NEW HAMPSHIRE'S SUBMISSION

On July 30, 2013, the New Hampshire Department of Environmental Services (NH DES)

submitted to EPA as part of the State's 2012 Integrated Report (IR) an initial version of its final 2012 section 303(d) list. However, during the period between issuance of the State's draft 303(d) list (April 20, 2012) and issuance of the State's initial version of its final 303(d) list (July 19, 2013), NH DES identified additional segments that warranted delisting and for which NH DES decided to provide the public with an opportunity to comment. Accordingly, on November 18, 2013, NH DES solicited additional public comments pertaining only to the additional segments proposed to be delisted. This additional comment period lasted until December 20, 2013, and NH DES received no comments. Subsequently, on February 12, 2014, NH DES submitted to EPA an updated version of the State's final 2012 section 303(d) list and that is the version of NH DES's final list that EPA has reviewed and is approving, as set forth in this memorandum. The State's February 12, 2014 section 303(d) list submittal included the following specific components:

1. The State of New Hampshire's 2012 section 303(d) list;

2. A list of waters / impairments being removed or delisted from New Hampshire's section 303(d) list;

3. New Hampshire's 2012 sections 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM) and NH DES's Response to Public Comments on the CALM; and

4. New Hampshire's Response to Public Comments on the April 20, 2012 draft 303(d) list.

New Hampshire's section 303(d) list contains water segments for which available data and/or other information indicates that a water segment is not meeting water quality standards because it is impaired or threatened by one or more pollutants for one or more designated uses, and for which a Total Maximum Daily Load (TMDL) is therefore required to be established. EPA's regulations at 40 CFR §130.7 require EPA to review and approve, or disapprove, a state's section 303(d) list.

Pursuant to EPA's Integrated Report Guidance related to assessment and listing of waters pursuant to sections 305(b) and 303(d) of the CWA, states list their waters in one or more of five categories, depending on the status of each water body's attainment of water quality standards. Category 5 corresponds to the section 303(d) list. Category 4 is comprised of waters that are not meeting water quality standards, but for which a TMDL need not be established due to one of three reasons. Category 4A contains waters for which a TMDL has already been established and approved by EPA. Category 4B includes waters, for which a "functionally equivalent" control action has been developed and is being implemented, i.e., an impairment caused by a pollutant is being addressed through other pollution control requirements. Category 4C contains waters that are not attaining water quality standards due to pollution that is not associated with a pollutant. Although waters in Category 4 are not on the section 303(d) list, EPA reviews a state's Category 4 list to ensure that the waters are categorized appropriately and do not,

in fact, belong on the section 303(d) list. NH DES included waters in Category 4 with its 2012 submission to EPA.

Public Participation

New Hampshire conducted a public participation process, in which it provided the public an opportunity to review and comment on the State's draft 2012 section 303(d) list. A public comment period opened on May 18, 2012 and closed on July 5, 2012. NH DES posted its draft list on the Department's website, and mailed notices to 32 organizations and agencies. NH DES received a total of 7 comment submissions, some of which included multiple individual comments. Two comment submissions were received from New Hampshire municipalities, three were received from the Great Bay Municipal Coalition, and Conservation Law Foundation and Art Mathieson (UNH) each made one submission. Five of the comment submissions were received during the State's defined comment period, while two were received after the comment period's deadline but were still addressed by NH DES. NH DES assigned to individual comments a reference or section number to aid in identifying instances when a NH DES response applied to multiple individual comments and to ensure that all comments had been appropriately addressed. As described earlier in this document, during the period between issuance of the State's draft 303(d) list (April 20, 2012) and issuance of the State's initial version of its final 303(d) list (July 19, 2013), NH DES identified additional segments that warranted delisting and for which NH DES decided to provide the public with an opportunity to comment. Accordingly, on November 18, 2013, NH DES solicited additional public comments pertaining only to the additional segments proposed to be delisted. This additional comment period lasted until December 20, 2013, and NH DES received no comments.

Summary of Comments Received:

1. Eric Swope, Industrial Pretreatment Coordinator, City of Keene, commented that the Ashuelot River (NHRIV802010301-11) should be de-listed for impairment of the aquatic life use due to low dissolved oxygen saturation, based upon the improved effluent from the Keene WWTF and the resulting improved conditions of the Ashuelot River as demonstrated during 2010 sampling that occurred under low-flow conditions.

New Hampshire responded that most rivers have a break in the assessment units where they pass a WWTF, but that the Ashuelot River segment (NHRIV802010301-11) was a rare exception to that rule. Thus, for the State's 2012 303(d) list, in recognition of the differences in water quality expected upstream versus downstream of the Keene WWTF, NH DES split the Ashuelot River segment (NHRIV802010301-11) into two new sections at the point of discharge from the Keene WWTF. Based upon the split, the new water quality data collected at low flow, and the modified operations of the Keene WWTF, segment NHRIV802010301-11, Ashuelot River – Otter Brook to Keene WWTF, was retained on the list and the newly created segment NHRIV802010301-38, Ashuelot River – Keene WWTF to South Branch, is not included on the State's 2012 303(d) list. The full

data review is provided in the State's "2012 Delisting" document, 'Impairments Removed (i.e. delisted) from the 303(d) List of Threatened or Impaired Waters.'

EPA has reviewed the data relevant to dissolved oxygen saturation in the two sections of the Ashuelot River described above and concurs with NH DES's decisions to retain segment NHRIV802010301-11, Ashuelot River – Otter Brook to Keene WWTF, on the State's 303(d) list and not to include segment NHRIV802010301-38, Ashuelot River – Keene WWTF to South Branch, on New Hampshire's 2012 303(d) list.

EPA concludes that NH DES adequately responded to the comment.

2. Dr. Arthur C. Mathieson, Professor of Plant Biology, Jackson Estuarine Laboratory & Department of Biological Sciences commented that "based upon … observations and scientific data, eutrophication is creating an unstable and negative situation within the GBES [Great Bay Estuarine System], which needs to be quickly rectified."

NH DES responded that Dr. Mathieson's comment "supports DES's recommendation to include many assessment units in the Great Bay Estuary on the 2012 303(d) list for eutrophication-related parameters."

EPA concurs with NH DES's listing of the Great Bay Estuary water body segments in question. See Attachment A to this EPA approval memorandum, entitled "EPA Technical Support Document."

EPA concludes that NH DES adequately responded to the comment.

3. Tom Irwin Esq., Vice President and NH-Director, Conservation Law Foundation submitted comments supporting NH DES's listing of certain water body segments in the Great Bay Estuary for cultural eutrophication.

NH DES noted that the commenter provided information supporting its comments.

EPA concludes that NH DES adequately responded to the comment.

4. David Green, Chief Operator of the City of Rochester's Wastewater Treatment Facility, commented that the Cocheco River should not be listed as impaired for dissolved oxygen (DO) and should be removed from the 303(d) list for all nitrogen-based and chlorophyll-a-based DO violations because there is no DO data showing violation of the State's numeric DO criteria.

NH DES responded to the comment with a detailed explanation of this listing, essentially explaining that monitoring data showing high levels of total nitrogen and chlorophyll-a in the water body segment were a sufficient basis upon which to conclude that the segment is impaired for the aquatic life designated use. NH DES also explained that, in fact, it

had insufficient monitored data of dissolved oxygen levels in the Cocheco River upon which to make impairment decisions on that basis, and that the Cocheco River would be accounted for in Category 3 (Insufficient Information) on the State's Integrated List in relation to dissolved oxygen and dissolved oxygen saturation.

NH DES also stated in its response that "[i]t should be noted that the Cocheco River has also been classified as impaired for nitrogen under the Primary Contact Recreation designated use due to high chlorophyll-a concentrations."

EPA concludes that NH DES adequately responded to the comment.

5. Dean Peschel submitted comments on behalf of the Great Bay Municipal Coalition (GBMC) on three separate occasions, July 2, 2012, October 18, 2012, and November 2, 2012. The comments themselves were lengthy and will not be repeated in this approval memorandum. However, in essence, Mr. Peschel commented that the water body segments in the Great Bay Estuary and its tidal tributaries, listed by NH DES as impaired for the aquatic life designated use associated with total nitrogen as a pollutant cause, should be removed from the list. EPA has reviewed all of Mr. Peschel's comments and NH DES's responses and has concluded that NH DES adequately responded to the comments.

In addition, EPA's attached Technical Support Document, relating to the Great Bay Estuary and its tidal tributary water body segments listed for impairment of the aquatic life designated use, identifies the most significant comments submitted by the Great Bay Municipal Coalition and reproduces NH DES's responses. EPA concluded in its Technical Support Document that the nature and content of NH DES's responses to the Coalition's comments, in addition to the remainder of the NH DES's entire administrative record, supports the listings in question.

Additionally, EPA has attached to this approval memorandum, as Attachment B, responses to public comments EPA received directly from the Great Bay Coalition through its legal counsel. Attachment B therefore constitutes a component of EPA's administrative record supporting EPA's approval of New Hampshire's 2012 section 303(d) list.

Identification of Waters and Consideration of Existing and Readily Available Water Quality Related Data and Information

EPA has reviewed the State's submission, and has concluded that the State developed its section 303(d) list in compliance with section 303(d) of the Act and 40 CFR § 130.7. EPA's review is based on its analysis of whether the State reasonably considered existing and readily available water quality-related data and information and reasonably identified waters required to be listed.

New Hampshire used the NH DES assessment database to develop its 2012 section 303(d) list. The same database was used to assist in the preparation of the biennial

section 305(b) report. NH DES provides ongoing notice on its website to request data from outside sources. Information received from outside sources was assessed in accordance with the State's assessment methodology. In the development of the 2012 section 303(d) list, New Hampshire began with its existing EPA-approved 2010 section 303(d) list and relied on new water quality assessments to update the list accordingly. New Hampshire believes that information pertaining to impairment status must be well substantiated, preferably with actual monitoring data, for it to be used in section 303(d) listing.

Priority Ranking

As described in its methodology, New Hampshire established a priority ranking for listed waters by considering: 1) the presence of public health issues, 2) natural/outstanding resource waters, 3) threat to federally threatened or endangered species, 4) public interest, 5) available resources, 6) administrative or legal factors (i.e., NPDES program support or court order), and 7) the likelihood of implementation after the TMDL has been completed.

Individual priority rankings for listed waters are presented as the date shown on the section 303(d) list which indicates when the TMDL is expected to be completed. EPA finds that the water body prioritization and targeting method used by New Hampshire is reasonable and sufficient for purposes of section 303(d). The State properly took into account the severity of pollution and the uses to be made of listed waters, as well as other relevant factors described above.

Waters which are not listed on New Hampshire's 2012 section 303(d) List

The following section provides a summary of the NH DES's rationale supporting decisions not to include certain newly identified waters and certain previously listed waters on the State's 2012 303(d) list. As discussed below, the State has demonstrated, to EPA's satisfaction, good cause for not listing the following waters, as provided in 40 CFR § 130.7(b)(6)(iv):

1. **New AUIDs (Assessment Unit Identifications) Covered by New England Regional Mercury TMDL (79)**

Beginning with the 2010 listing cycle, NH DES moved its assessment units from the 1: 100,000 to 1: 24,000 mapping scale for hydrography units. This scale is linked to the National Hydrography Dataset (NHD) which is used by EPA. The difference in scales resulted in an additional 3,622 assessment units for the 2010 listing cycle. Further refinement of the assessment units has resulted in an additional 79 segments for the 2012 listing cycle. This new group of 79 assessment units was included in Category 4A (TMDL complete) due to the fact that all freshwater assessment units in New Hampshire are covered by the 2007 Mercury TMDL. All freshwater assessment units in New Hampshire are considered impaired for fish consumption due to atmospheric deposition of mercury. EPA

concludes that this is the appropriate course of action for these new assessment units. The increased resolution of the mapping scale used by New Hampshire will provide better assessment and monitoring for the future, and will also result in the use of the same dataset that EPA uses. EPA approves the State's section 303(d) list without these waterbody-pollutant combinations, because the State's decision not to include them on the 303(d) list is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements. (In the interest of space, all 79 assessment units are not listed here individually.)

2. AUIDs Covered by New Hampshire Statewide Bacteria TMDL (394)

On September 21, 2010 EPA approved the New Hampshire Statewide Bacteria TMDL which covered assessment units for rivers and streams, lakes and ponds, impoundments, estuaries and the Atlantic Ocean that were listed on the State's 2008 section 303(d) list. The TMDL accounted for the three types of bacterial impairments which are responsible for designated use impairments in New Hampshire surface waters; *E. coli* in freshwaters (primary contact, i.e. swimming), enterococcus in marine waters (primary contact, i.e. swimming) and fecal coliform in marine waters (marine shellfishing). As a result of EPA's approval of New Hampshire's statewide Bacteria TMDL, these 394 assessment units have been accounted for in Category 4A (TMDL Complete). EPA approves the State's section 303(d) list without these waterbody-pollutant combinations because the removal of these listings is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

3. AUIDs Covered by Beach Bacteria TMDL (59 Impairments on 58 AUs)

On August 29, 2011 EPA approved the "TMDL Report for 58 Bacteria Impaired Waters in New Hampshire." This TMDL specifically addressed primary contact impairments to beach segments due to bacteria contained in stormwater and improperly treated sewage. The report covers 59 impairments on 58 assessment units for *E. coli* for freshwaters (primary contact, i.e. swimming), enterococcus for marine waters (primary contact, i.e. swimming), and fecal coliform (marine shellfishing). As a result of EPA's approval of New Hampshire's beach bacteria TMDL, these 59 impairments in 58 assessment units have been accounted for in Category 4A (TMDL Complete). EPA approves the State's section 303(d) list without these waterbody-pollutant combinations because the removal of these listings is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

4. AUIDs Covered by Acid Pond TMDL (8)

On January 26, 2011, EPA approved the addition of 8 beach assessment units to the acid pond TMDL which was approved by EPA in FY 2007. These segments were impaired for aquatic life use due to low pH and correspond with the waterbody assessment units that were previously approved in the parent acid pond TMDL. As a result of EPA's approval of New Hampshire's acid pond TMDL, these 8 assessment units have been accounted for in Category 4A (TMDL Complete). EPA

approves the State's section 303(d) list without these waterbody-pollutant combinations because the removal of these listings is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

5. **AUIDs Covered by the Lake Phosphorus TMDL (84 Parameter/Designated use combinations on 26 assessment units) Plus CHANGES FROM APRIL 20TH, 2012 DRAFT 303(d) - One Additional Cyanobacteria Impairment Covered by the Lake Phosphorus TMDL upgraded to Category 2 (1)**

On May 12, 2011, EPA approved the "24 Lake Phosphorus TMDLs" and subsequently approved phosphorus TMDLs for Turtle Pond (October 18, 2011), Webster Lake (January 9, 2012) and Hoods Pond (June 1, 2012). None of these segments meet phosphorus criteria related to primary contact recreation and/or aquatic life designated uses and are impaired for various combinations of chlorophyll-a, cyanobacteria, low dissolved oxygen concentration and dissolved oxygen saturation. Additionally, during the 2012 listing cycle, another seven segments were found to be impaired for various combinations of the aforementioned causes/designated uses. As a result of the Lake Phosphorus TMDL approval, these 84 parameter/designated use combinations have been accounted for in Category 4A (TMDL Complete). The TMDL for Hoods Pond was approved after the draft 2012 303(d) list was released for public comment and subsequent review of the waterbody segments and impairments has revealed that the cyanobacteria impairment for Hoods Pond was erroneous. All monitoring data for Hoods Pond show compliance with water quality standards for cyanobacteria. This segment has been moved into Category 2 (Full Support) for the cyanobacteria assessment parameter. EPA approves the State's section 303(d) list without these waterbody-pollutant combinations because the removal of these listings is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

6. **Additional Cyanobacteria Impairments Covered by the Lake Phosphorus TMDL (3) Plus CHANGES FROM APRIL 20TH, 2012 DRAFT 303(d) LIST – Additional Cyanobacteria Impairments Covered by the Lake Phosphorous TMDL (10).**

Recent blooms of cyanobacteria hepatotoxic microcystins at three beach assessment units (Sebbins Pond-Camp Kettleford, Pawtuckaway SP and Forest Lake TB) have resulted in these assessment units being categorized as impaired for the State's primary contact recreation designated use. These beaches are located on waterbodies that are covered by the "Lake Phosphorus TMDL" which was approved by EPA on May 12, 2011. The waterbodies covered by the Lake Phosphorus TMDL did not meet phosphorus criteria for the State's aquatic life use and/or primary contact recreation use for assorted combinations of chlorophyll-a, cyanobacteria, low dissolved oxygen concentration and/or dissolved oxygen saturation. A 12 µg/L phosphorus target was set to protect designated uses in the

TMDL. As a result of EPA's approval of New Hampshire's Lake Phosphorus TMDL, these 3 beach assessment units have been accounted for in Category 4A (TMDL Complete) along with 10 additional beach segments that have been identified as being impaired for cyanobacteria since the draft 2012 303(d) list was released for public comment. All 13 of these beach segments can be found in Table 4 which identifies the segments that NH DES is delisting in its 2012 listing cycle. EPA approves the State's section 303(d) list without these waterbody-pollutant combinations because the removal of these listings is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

7. **Additional Dissolved Oxygen Impairments Covered by the Lake Phosphorus TMDL (2) plus CHANGES FROM APRIL 20TH, 2012 DRAFT 303(d) LIST – Additional Dissolved Oxygen Saturation Impairments Covered by the Lake Phosphorous TMDL (2).**

Pawtuckaway Lake (NHLAK600030704-02-01) and Robinson Pond NHLAK700061230-06-01) were listed in 2006 for dissolved oxygen percent saturation impairment for the State's aquatic life designated use. At the time of listing, beach assessment units inherited all impairments that were assigned to the parent lake assessment unit. As a result of these listings, Pawtuckaway SP Beach (NHLAK600030704-02-02), Pawtuckaway Town Beach (NHLAK600030704-02-03), Robinson Pond - Town Beach (NHLAK700061203-06-02) and Robinson Pond - Camp Winahupe Beach (NHLAK700061203-06-03) were also listed as impaired for dissolved oxygen percent saturation. These beaches are located on waterbodies that are covered by the "Lake Phosphorus TMDL" which was approved by EPA on May 12, 2011. The waterbodies covered by the Lake Phosphorus TMDL did not meet phosphorus criteria for the State's aquatic life use and/or primary contact recreation use for assorted combinations of chlorophyll-a, cyanobacteria, low dissolved oxygen concentration and/or dissolved oxygen saturation. A 12 µg/L phosphorus target was set in the TMDL to protect designated uses. As a result of the Lake Phosphorus TMDL approval, these 4 beach assessment units have been accounted for in Category 4A (TMDL Complete). EPA approves the State's section 303(d) list without these waterbody-pollutant combinations because the removal of these listings is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

8. **CHANGE FROM APRIL 20TH, 2012 DRAFT 303(d) LIST – Additional Excess Algal Growth Impairment Covered by the Lake Phosphorous TMDL (1)**

Baboosic Lake Town Beach was listed as impaired for primary contact use support during the State's 2006 listing cycle due to excessive algal growth, as well as for chlorophyll-a and cyanobacteria. The chlorophyll-a and cyanobacteria impairments are addressed as part of the Lake Phosphorus TMDL

described earlier in this document. All of these impairments are covered by the Lake Phosphorus TMDL which EPA approved on May 12, 2011. Baboosic Lake Town Beach is now accounted for in Category 4A (TMDL Complete). The delisting for excessive algal growth impairment was not part of the State's original submission to EPA, but is included in the State's final submission. EPA approves the State's section 303(d) List without this waterbody-pollutant combinations because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

9. Cains Pond (NHIMP600031004-05) Sedimentation/Siltation (1)

Cains Pond is an impoundment of Cains Brook located in Seabrook, NH which was listed on the State's 2008 303(d) list as impaired for secondary contact recreation due to sedimentation/siltation, which resulted in the pond no longer being suitable for navigation by watercraft. Sedimentation and dense aquatic plant growth, coupled with shallow water depths, severely restricted the use of personal watercraft in the pond. The increased sediment load was attributed to a combination of construction projects, highway maintenance practices and an upstream dam breach caused by the Mother's Day flood of 2006. These activities mobilized large amounts of sediment/silt that was then deposited in Cains Pond. In 2009, the Town of Seabrook began the process of restoring the secondary contact designated use by dredging the pond to depths that would support boat navigation and by building BMPs to control sediment/silt inputs to the pond. The main basin of the pond was dredged to an average depth of 7 feet and a deep hole of 10 feet was created to provide adequate habitat for fish. Additionally, the inlet section of the pond was dredged to an average depth of 4 feet and an oil and grit separator BMP was built to control sediment from Route 1. Construction activities in the watershed have been completed and the area is at or close to build out capacity, which will limit future construction activities. BMPs have been constructed at Lowe's and Kohl's to control stormwater runoff, and a shorefront retaining wall has been repaired to prevent erosion into the pond. Also, sand is no longer used on Route 1 in the winter for maintenance purposes. As a result of the dredging, BMP construction and road maintenance practices, Cains Pond is now suitable for boat navigation and other secondary contact recreation activities. Cains Pond has been removed from the State's section 303(d) list for impairment of secondary contact recreation due to sedimentation/siltation and has been placed into Category 2 (Fully Supporting). EPA approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

10. Contoocook River, Jaffrey WWTF to Peterborough WWTF (42 AUID/Designated Use/ Impairment combinations)

The Contoocook River contains nine assessment units between Jaffrey, NH and the Peterborough, NH WWTF. These nine assessment units were listed in 2006 for 42 impairments resulting from the evaluation of a QUAL2E model that was run in 2005. The model was calibrated to the permit limits of the Jaffrey WWTF. The

model was based on design flow for the facility and other permit requirements at the time. On September 28, 2009 (and modified with an effective date of August 16, 2010) EPA issued a new permit to the Jaffrey facility, requiring reductions in phosphorus and ammonia discharges to the Contoocook River in order to control chlorophyll-a, dissolved oxygen concentration and dissolved oxygen saturation and to prevent violations of New Hampshire's relevant water quality standards. The Jaffrey facility implemented the new permit limits in 2010 and has been in compliance with its permit since then, which means that the QUAL2E model is no longer applicable and is not an appropriate means of assessment for these assessment units. Based on the new permit requirements and the facility's compliance with these requirements, New Hampshire DES is delisting these assessment units to Category 3 (Insufficient Information) due to the limited data that has been collected since the implementation of the new permit requirements. The limited data that have been collected so far show compliance with water quality standards, but not enough data have been collected to categorize these segments as fully supporting (Category 2), consistent with the State's CALM document. EPA approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

11. Berry River (NHRIV600031002-01) Chlorophyll-a for Primary Contact Recreation (1)

The Berry River was originally listed during the 2006 listing cycle for chlorophyll-a, causing impairment of the primary contact recreation designated use. The listing was based on exceedances of the State's chlorophyll-a numeric threshold translator of the State's narrative nutrient standard for freshwaters. Between 2001 and 2002 there were three exceedances of the 15 µg/L translator threshold. Since 2002, there have not been any exceedances of the numeric threshold in the 15 samples taken during the critical summer swimming period (May 24th - September 15th) or in the 27 samples taken during the non-critical, off summer, swimming season (September 16th – May 23th). These more recent sampling conditions are representative of the dry sampling conditions that existed in 2001 and 2002, because the sampling periods in 2005 and 2007 also were during dry summer conditions. Based on the samples taken since 2002, under representative conditions, without any exceedances of the numeric translator threshold, the data support the delisting of this river for primary contact recreation use impairment. EPA approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

12. Clough Pond (NHLAK700060202-03-01) Chlorophyll-a for Primary Contact Recreation (1)

Clough Pond was listed as impaired for the primary contact recreation designated use due to chlorophyll-a exceedances of the State's numeric translator threshold (15 µg/L) for the State's narrative nutrient standard. The samples that exceeded the

applicable threshold were taken during a period of drier than normal conditions. Since 2007, 11 samples have been collected, none of which have exceeded the numeric translator threshold, including samples taken in 2010 under drier conditions than in 2007. All of the samples taken since 2002 for this pond have been collected during the critical summer swimming period. Based on the samples taken since 2007 under representative conditions, with no exceedances of the numeric translator threshold, the data supports delisting this pond for primary contact recreation use impairment. EPA approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

13. Oyster River (NHEST600030902-01-03) Chlorophyll-a and Total Nitrogen for Primary Contact Recreation (2)

The tidal portion of the Oyster River was listed in 2008 as impaired for the State's primary contact recreation designated use due to chlorophyll-a and high total nitrogen values. In 2002 and 2003, the Oyster River had exceedances of both the single sample maximum threshold for estuarine waters of 20 µg/L chlorophyll-a and the magnitude of exceedance threshold of 40 µg/L chlorophyll-a. This resulted in the assessment unit being listed during New Hampshire's 2006 303(d) list cycle. In 2008, the impairment due to total nitrogen was added due to the strong causal relationship between total nitrogen and chlorophyll-a production in estuarine waters. From 2002 until 2004, chlorophyll-a samples at the assessment location were collected by an autosampler set up to collect samples under a variety of tidal conditions. In 2005, the autosampler was removed. Sampling (a total of 56 samples, 30 of which were collected during the summer critical period) has not produced any exceedances since 2003. The post 2003 sampling was also completed under the same limiting conditions of tide, inflow and weather. It is likely that the high chlorophyll-a values from 2002-2003 are attributable to contamination of the autosampler device. Such devices can become clogged with pieces of moss, macroalgae and/or organic matter, which can produce artificially high values not truly representative of the phytoplankton concentrations in the river. This delisting only applies to the primary contact recreation designated use. The State's aquatic life designated use impairments attributed to excess chlorophyll-a, total nitrogen, dissolved oxygen concentration, dissolved oxygen saturation, estuarine bioassessments and light attenuation are being retained on the State's 2012 303(d) list and are supported by recent monitoring data. Based on the number of samples taken that do not exceed the applicable chlorophyll-a thresholds, and the representative nature of the sampling conditions, EPA approves the State's section 303(d) list without the Oyster River appearing on the list for impairment of the primary contact recreation use, because the removal of that listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

14. Ashuelot River (NHRIV802010403-19) pH (1)

The Ashuelot River was listed by New Hampshire during the 2004 303(d) listing cycle for impairment of the aquatic life designated use, due to four violations of the

water quality standard lower threshold of 6.5 for pH. Subsequent sampling (21 sampling dates) from 2005-11 did not result in any pH readings outside the allowable range. Based on the number of samples taken that did not violate the water quality standard for pH taken during the summer critical sampling period, EPA approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

15. Fresh Creek (NHRIV600030608-11) pH (1)

Fresh Creek was listed by New Hampshire during the 2008 303(d) listing cycle for impairment of the aquatic life designated use, due to two violations of the water quality standard lower threshold of 6.5 for pH. Subsequent sampling (24 sampling dates, including a 14-day period of continuous measurements taken every 15 minutes) from 2008-11, did not result in any pH readings outside of the allowable range. Based on the number of samples taken that did not violate the water quality standard for pH and the timing of such samples, EPA approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

16. South Mill Pond (NHEST600031001-09) pH (1)

South Mill Pond was listed by New Hampshire during the 2006 303(d) listing cycle for impairment of the aquatic life designated use, due to violations of the water quality standard upper threshold of 8.5 for pH. The samples were taken in 2004 for a particular project. The data from this project were rounded to the nearest whole number, which is not acceptable for pH data due to the fact that pH is based on a logarithmic scale. These data have now been deemed invalid by NH DES and removed from the assessment database. With this data removed, there have not been any violations of the pH standard since 2000 (151 samples taken between 2000 and 2009). Based on the number of samples taken that did not exceed the water quality standard for pH and the timing of such samples, EPA approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

17. North Mill Pond (NHEST600031001-10) pH (1)

North Mill Pond was listed by New Hampshire during the 2006 303(d) list cycle for aquatic life designated use, due to pH violations beyond the upper threshold of 8.5 for samples taken in 2004 for a particular project. The data from this project were rounded to the nearest whole number, which is not acceptable for pH data due to the fact that pH is based on a logarithmic scale. These data have now been deemed invalid by NH DES and removed from the assessment database. Subsequent monitoring samples (28) taken from 2006-09 have not produced any violations of the applicable pH criteria. Based on the number of samples taken that did not exceed the water quality standard for pH and the timing of such samples, EPA

approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

18. Adams Point South- Cond. Appr. (NHEST600030904-04-06) pH (1)

Adams Point South was listed by New Hampshire during the 2006 303(d) listing cycle for the aquatic life designated use, due to pH violations of the upper threshold of 8.5 based on data collected in 2004. The listing of this waterbody in 2006 was due to the samples taken in 2004. New Hampshire subsequently deemed the samples invalid because of a data reporting error; the samples were reported to the nearest whole number, which is not an acceptable way of reporting pH data due to the fact that pH is based on a logarithmic scale. Once the 2004 data were removed from the assessment, there were no longer any violations of the pH criteria for this site. Subsequent monitoring samples (51) taken from 2005-09 have not produced any violations of the pH criteria. Based on the number of samples taken that did not exceed the water quality standard for pH and the timing of such samples, EPA approves the state's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

19. Adams Point Mooring Field SZ (NHEST600030904-06-10) pH (1)

Adams Point Mooring Field SZ was listed by New Hampshire during the 2006 303(d) listing cycle for the aquatic life designated use, due to pH violations of the upper threshold of 8.5. The listing of this waterbody in 2006 was due to the samples taken in 2004. New Hampshire subsequently deemed the samples invalid because of a data reporting error; the samples were reported to the nearest whole number, which is not an acceptable way of reporting pH data due to the fact that pH is based on a logarithmic scale. Once the 2004 data were removed from the assessment, there were no longer any violations of the pH criteria for this site. Subsequent monitoring samples (43) taken from 2005-09 have not produced any violations of pH criteria. Based on the number of samples taken that did not exceed the water quality standard for pH and the timing of such samples, EPA approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

20. Black Brook (NHRIV700060801-05-02) Iron (1)

Black Brook was listed by New Hampshire during the 2006 303(d) listing cycle for the aquatic life designated use, due to exceedances of the water quality standard for iron. This data was obtained from the USGS NWIS database in 2005 and showed five exceedances of the iron standard for samples taken in 2001. In 2011, the NWIS database was queried again for this sampling location and it was discovered that the previous data from 2001, which had originally been reported in mg/L, had been corrected in the database and were now reported in µg/L. The corrected data samples meet the iron standard, which means that the 2006 listing was erroneous.

There has not been any sampling conducted for iron since the 2001 sampling season at this site location. Due to the lack of iron data, this segment has been removed from the State's section 303(d) list and placed in Category 3 (Insufficient Information) for the aquatic life designated use. EPA approves the State's section 303(d) list without this waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

21. Horseshoe Pond (NHLAK700060302-02) Chlorophyll-a (1)

Horseshoe Pond was listed by New Hampshire during the 2010 listing cycle for the aquatic life designated use, due to exceedance of the chlorophyll-a standard for lakes. The State subsequently discovered that the notation for exceedance of a water quality standard should have been for chloride in this segment instead of chlorophyll-a. This mistake occurred because chlorophyll-a and chloride are only one line apart in the State's assessment spreadsheet. The impaired notation was included on the spreadsheet before it was transferred to the Environmental Monitoring database, which is much less prone to assessment error. Additionally, data collected since 2010 shows attainment of both the State's chlorophyll-a and phosphorus thresholds based on the Trophic Class for this particular waterbody. For the 2012 listing cycle, the chloride impairment has been added and the chlorophyll-a impairment has been removed and placed into Category 2 (Full Support). EPA approves the State's section 303(d) list without the chlorophyll-a waterbody-pollutant combination because the removal of this listing is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

22. Kezar Lake (NHLAK700030303-03-01) Chlorophyll-a & Total Phosphorus (2)

Kezar Lake has had water quality problems dating back to the 1960's relating to excess phosphorus which was causing algae blooms and fish kills. These problems led to New Hampshire listing the lake as impaired for aquatic life use due to chlorophyll-a and total phosphorus. From 1931 until 1981, a wastewater treatment facility discharged to the lake, causing internal phosphorus loading problems well beyond the date the facility closed. Since the mid-1980's, Kezar Lake has been the site of a Restoration/Protection Project to restore aquatic life designated use attainment through the application of aluminum salts and manipulation of upstream riparian wetlands to encourage phosphorus uptake and sedimentation. Sampling conducted since 2005 demonstrates that Kezar Lake is now attaining chlorophyll-a and total phosphorus thresholds for a mesotrophic lake. Based on the number of samples taken that did not exceed the water quality thresholds for chlorophyll-a and total phosphorus and the timing of the samples, EPA approves the State's section 303(d) list without these waterbody-pollutant combinations because the removal of these listings is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

EPA's Guidance for Assessment, Listing and Reporting Requirements.

25. Lamprey River South (NHEST600030709-01-02) and Squamscott River North (NHEST600030806-01-02) Toxics – Changes due to Re-segmentation

The Lamprey River South and Squamscott River North are assessment units that were newly created for the State's 2012 303(d) listing cycle from the original Lamprey River segment (NHEST600030709-01) and the original Squamscott River segment (NHEST600030806-01). Both of the original segments were listed on the 2010 303(d) list as impaired for the State's aquatic life designated use, due to a suite of toxins. As a result of the re-segmentation of both waterbodies, the toxin impairments are being retained on the Lamprey River North (NHEST600030709-01-01) and Squamscott River South (NHEST600030806-01-01) segments for the 2012 listing cycle. The newly created Lamprey River South and Squamscott River North segments have either been categorized for the 2012 303(d) listing cycle as "Not Assessed" or "Insufficient Information," for assessment of the aquatic life use for each specific toxin. This is due to the fact that there is no recent toxics monitoring data available for these segments. Tables 21 and 22 of New Hampshire DES's document entitled "Impairments Removed (i.e., delisted) From the 303(d) List of Threatened or Impaired Waters July 30, 2013" provides all of the relevant information for each segment and how the segment has been re-categorized. The aquatic life use impairments, associated with toxins, that were included on the State's 2010 303(d) list, remain on the State's 2012 303(d) list in relation to the Lamprey River North (NHEST600030709-01-01) and Squamscott River South (NHEST600030806-01-01) segments. EPA approves the State's section 303(d) list without the Lamprey River South and Squamscott River North waterbody-impairment combinations because their absence from the list is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

26. Ashuelot River- Keene WWTF to South Branch (NHRIV802010301-38) Dissolved Oxygen Saturation for Aquatic Life Use (1)

The Ashuelot River segment from Otter Brook to South Branch of the Ashuelot River was listed on the State's 2010 303(d) list as impaired for the State's aquatic life designated use, due to low dissolved oxygen saturation. This listing was for the segment designated NHRIV802010301-11, and was based upon a combination of exceedances of the State's dissolved oxygen saturation criteria at three different monitoring stations in 2001, 2002 and 2007. For the State's 2012 303(d) listing cycle, this segment was split into two segments to reflect the upstream portion (NHRIV802010301-11) above the Keene WWTF to Otter Brook and the downstream portion (NHRIV802010301-38) from the Keene WWTF discharge to the South Branch of the Ashuelot River. The State's 2012 303(d) list is retaining the original segment NHRIV802010301-11, due to the dissolved oxygen violations. For the State's 2012 303(d) listing cycle, the new segment, NHRIV802010301-38, is not being included on the 2012 303(d) list due to the fact that monitoring data collected in 2010 demonstrate that this segment is meeting water quality standards for dissolved oxygen saturation. The State's decision not to include the new

23. Lamprey River South (NHEST600030709-01-02) Dissolved Oxygen (Concentration and Percent Saturation) (2) – Changes due to Re-segmentation

The Lamprey River South segment is a new assessment unit that was created by NH DES for the 2012 303(d) listing cycle by splitting the Lamprey River segment (NHEST600030709-01) into northern (NHEST600030709-01-01) and southern (NHEST600030709-01-02) segments. The original Lamprey River segment was listed by New Hampshire during the 2010 303(d) list cycle for aquatic life designated use impairment, due to low dissolved oxygen concentration and dissolved oxygen percent saturation. However, once the segment was split, the monitoring sites with the dissolved oxygen concentration and dissolved oxygen percent saturation violations were located wholly within the new Lamprey River North segment (NHEST600030709-01-01). Therefore, NH DES is retaining on its 2012 303(d) list the dissolved oxygen concentration and dissolved oxygen percent saturation impairments in the northern segment. NH DES is not placing the southern segment on its 2012 303(d) list because there are no impairments in that segment. EPA approves the State's section 303(d) list without the southern segment waterbody-impairment combination because its absence from the list is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

24. Lamprey River North (NHEST600030709-01-01) and Squamscott River South (NHEST600030806-01-01) Estaurine Bioassessments (2) and Light Attenuation Coefficient (2) – Changes due to Re-segmentation

The Lamprey River North and Squamscott River South are new assessment units that were created for the 2012 303(d) listing cycle from the original Lamprey River segment (NHEST600030709-01) and the original Squamscott River segment (NHEST600030806-01). These new segments were created to more accurately depict assessment units where eelgrass has historically existed. The new segments provide more clarity about the restoration goals for the individual segments (dissolved oxygen for upstream segments and eelgrass for downstream segments where the rivers discharge to Great Bay). As a result of the re-segmentation of these units, the eelgrass estuarine bioassessment and light attenuation coefficient indicators no longer apply to the Lamprey River North and Squamscott River South segments. Both of these new segments have been re-categorized from 5-P on the State's 2010 303(d) list to "No Standard" for the State's 303(d) 2012 list because the estuarine bioassessment and light attenuation coefficient indicators are no longer pertinent or applicable to these segments; that is, based on the nature of the segment, there would be no rational reason to assess these two parameters. The estuarine bioassessments and light attenuation coefficient impairments that were listed on the 2010 303(d) list remain with the appropriate new segments (Lamprey River South and Squamscott River North). EPA approves the State's section 303(d) list without the Lamprey River North and Squamscott River South waterbody-impairment combinations because their absence from the list is consistent with EPA's regulations and

segment, NHRIV802010301-38, on its 2012 303(d) list, is also supported by new NPDES permit limits (2007) for total phosphorus and an EPA Administrative Order (2008) that resulted in: 1) operational modifications to the old Keene WWTF; and 2) the construction and operation of a new treatment facility, replacing the older facility. The new facility was constructed in accordance with EPA's 2008 Administrative Order and actually began operation in early 2015. The new facility is designed to, among other things, reduce the amount of phosphorous discharged from the facility. The data used to support the State's decision were collected after the new NPDES permit's revised operational limits took effect and during warm weather, low-flow conditions. This demonstrates that the facility will be able to continue to meet its new permit limits and comply with water quality standards under the most difficult operational conditions. Based on the information described above, EPA approves the State's section 303(d) list without the new segment, NHRIV802010301-38, because its absence from the list is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

27. Changes From April 20th, 2012 Draft 303(d) List- Bacteria TMDL Corrections

When the State's first draft of the 2012 303(d) list was released on April 20, 2012, seven segments (see Table 24 of the 2012 303(d) delisting document) were included on both the impaired waters list and on the list of segments to be delisted. This was due to a flagging error in the State's database, and was subsequently corrected on the State's revised final 2012 303(d) list. These seven segments are now only included on the list of waters to be delisted for the 2012 303(d) cycle. As a result of EPA's approval of New Hampshire's statewide Bacteria TMDL, these seven assessment units have been accounted for in Category 4A (TMDL Complete). EPA approves the State's section 303(d) list without these waterbody-pollutant combinations because the removal of these listings is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

28. Changes From April 20th, 2012 Draft 303(d) List- Souhegan River, Dissolved Oxygen Concentration Impairments for Aquatic Life Designated Use (5)

During the 2006 listing cycle, five segments of the Souhegan River were added to the State's section 303(d) list as impaired for the State's aquatic life designated use due to low dissolved oxygen concentrations. Otis Dam (NHIMP700060901-07), Pine Valley Mill (NHIMP700060904-08), Furnace Brook (NHRIV700060901-07), Tucker Brook (NHRIV700060902-05) and Souhegan River (NHRIV700060909-13) were listed based on samples collected between 2002 and mid July 2005. Subsequent sampling and data analysis, during the period from late July 2005 through September 2009, has shown that water quality has improved and that these segments now meet the State's water quality criteria for dissolved oxygen concentration. Many of the samples taken since 2005 were collected during low flow/high temperature conditions when dissolved oxygen concentrations are expected to be lowest. Based on the lack of violations of the dissolved oxygen concentration criteria since 2005, and the conditions under which these samples were collected, EPA approves the State's section 303(d) list without these waterbody-pollutant combinations because the removal of these listings is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

29. Changes From April 20th, 2012 Draft 303(d) List- Little Cohas Brook, Benthic Macroinvertebrates Index for Aquatic Life Designated Use (1)

Little Cohas Brook (NHRIV700060804-04) was listed on the State's draft 2012 303(d) list as impaired for the State's aquatic life designated use, due to a poor score on the Index of Benthic Integrity for a sample collected in 2009. Subsequent review of this site and the one sample that had been collected, has revealed a clerical error in the entry of the site ID number. The one sample in question was actually collected from a different segment in Little Cohas Brook (NHRIV700060804-05) which was previously listed as impaired during the State's 2004 section 303(d) listing cycle based upon a poor score on the Index of Benthic Integrity for macroinvertebrates. Thus, the one sample simply confirms the previous documented impairment for segment (NHRIV700060804-05), and NH DES has no macroinvertebrate data for segment (NHRIV700060804-04). Therefore, NH DES removed this segment from the State's section 303(d) list, placing it into Category 3 (Insufficient Information) of the State's 2012 Integrated List. EPA approves the State's section 303(d) list without segment (NHRIV700060804-04) on the list because its absence is consistent with EPA's regulations and EPA's Guidance for Assessment, Listing and Reporting Requirements.

Waters impaired by nonpoint sources of pollution

The State properly listed waters with nonpoint sources causing or expected to cause impairment, consistent with section 303(d) and EPA guidance. Section 303(d) lists are to include all WQLSs still needing TMDLs, regardless of whether the source of the impairment is a point and/or nonpoint source. EPA's long-standing interpretation is that section 303(d) applies to waters impacted by point and/or nonpoint sources. In 'Pronsolino v. Marcus,' the District Court for Northern District of California held that section 303(d) of the Clean Water Act authorizes EPA to identify and establish total maximum daily loads for waters impaired by nonpoint sources. Pronsolino v. Marcus, 91 F. Supp. 2d 1337, 1347 (N.D.Ca. 2000). This decision was affirmed by the 9th Circuit court of appeals in Pronsolino v. Nastri, 291 F.3d 1123 (9th Cir. 2002). See also *EPA's Guidance for 2006 Assessment, Listing and Reporting Requirements Pursuant to Sections 303(d), 305(b) and 314 of the Clean Water Act*, EPA Office of Water, July 29, 2005.

ATTACHMENT A

EPA TECHNICAL SUPPORT DOCUMENT

Justification for EPA's Approval of the New Hampshire Department of Environmental Services' (NH DES) Listing of Water Body Segments in the Great Bay Estuary[1] Identified on New Hampshire's 2012 303(d) list as Impaired for the State's Aquatic Life Designated Use[2] and associated with Excess Concentrations of Total Nitrogen as a Pollutant Cause.

This technical support document ("this TSD" or "EPA's TSD") supplements EPA's September 24, 2015 approval of NH DES's 2012 303(d) list, submitted on February 12, 2014, and specifically addresses in more detail EPA's rationale for approving the listing of segments of the Great Bay Estuary for certain aquatic life use impairments. As described in this TSD, there is substantial evidence that the Great Bay Estuary waters in question are impaired for the State's aquatic life designated use as evidenced by eelgrass loss, poor water clarity, and /or low levels of dissolved oxygen. Furthermore, it is reasonable in light of the available data and other information to conclude that total nitrogen is at least a contributing cause to these impairments. No other pollutants have been identified by any other studies or monitoring as contributing to eelgrass loss, poor water clarity, and/or low dissolved oxygen in these waters, while total nitrogen *has* been monitored in these impaired waters at levels that are well above what would be considered natural background levels for an estuarine system. Water chemistry sampling conducted by NH DES in the Great Bay Estuary has shown median values of total nitrogen between 0.312-1.055 mg/L, where natural background levels of 0.2 mg/L would typically be expected for an estuarine system.[3]

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[1] The term "Great Bay Estuary" as used throughout this document is intended to include the bay's tidal tributary rivers, unless explicitly specified otherwise.

[2] For identification of the listings of the exact water body segments in question, please refer to Tables 4A-T of NH DES's Technical Support Document entitled "Assessments of Aquatic Life Use Support in the Great Bay Estuary for Chlorophyll-a, Dissolved Oxygen, Water Clarity, Eelgrass Habitat, and Nitrogen" prepared in support of the State's 2012 CWA sections 305(b) and 303(d) integrated report.

[3] See NH DES's Numeric Nutrient Criteria for the Great Bay Estuary. 2009. Pages 17-24.

I. New Hampshire's aquatic life designated use[4] and state water quality criteria.

The Great Bay Estuary is a unique resource in the State of New Hampshire and has been designated by EPA, pursuant to §320 of the Clean Water Act, as one of twenty-eight estuaries of national significance. The Great Bay Estuary is a national treasure and a valuable resource to New Hampshire. As set forth in much greater detail below, there is substantial data and other information contained in New Hampshire's administrative record (AR) for its 2012 303(d) list supporting the State's *continued* listing of water body segments in the Great Bay Estuary as being impaired for the State's aquatic life designated use. For the State's 2008 list, New Hampshire determined that most of the Great Bay Estuary did not meet surface water quality standards and specifically did not comply with Env-Wq 1703.14, the State's narrative water quality standard for nutrients. New Hampshire retained those impairment listings on the State's 2010 303(d) list. EPA approved the 2008 and 2010 lists on September 30, 2009 and September 7, 2011, respectively. All of those Great Bay Estuary segments listed on the State's 2010 303(d) list as impaired for the aquatic life designated use were retained on the State's 2012 303(d) list, with the exception that two assessment segments, those for the Lamprey and Squamscott Rivers, were split into two sections each for the 2012 list and only one part of each of those re-segmented assessment areas remained on the list.[5]

The NH DES analyzed multiple sources of data and information before concluding in its 2012 Section 305(b)/303(d) [Integrated] List Technical Support Document (TSD) titled "Assessments of Aquatic Life Use Support in the Great Bay Estuary for Chlorophyll-a, Dissolved Oxygen, Water Clarity, Eelgrass Habitat, and Nitrogen" dated April 20, 2012, that:

> "[e] utrophication from excess nutrients is a critical issue affecting the Aquatic Life designated use in the Great Bay Estuary. The Great Bay Estuary has all the classic signs of eutrophication: increasing nitrogen concentrations, low dissolved oxygen, and disappearing eelgrass habitat."

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[4] New Hampshire's list also listed certain of the segments in the Great Bay Estuary as being impaired for other uses, such as fish consumption and shellfishing. Those impairments are not discussed in this TSD because they are not related to total nitrogen. In addition, NH DES has listed certain Great Bay Estuary segments as impaired for the primary contact recreation designated use with nitrogen identified as being associated with the impairments. Those segments previously had been listed as impaired (since NH DES's 2004 list), and still are being listed, based on a chlorophyll-a threshold value of 20 µg/L. (NH DES's AR contains information demonstrating a significant statistical correlation between total nitrogen concentrations and chlorophyll-a.) This TSD also does not address NH DES's identification of aquatic life use impairments and the associated listings due to toxics because there is no relationship to nitrogen, but those impairments and listings also are supported by the data and other information considered and analyzed by NH DES.

[5] For an explanation of how the Lamprey and Squamscott River segments were split, see page 3 of New Hampshire's 2012 Section 305(b)/303(d) [Integrated] List Technical Support Document (TSD) titled "Assessments of Aquatic Life Use Support in the Great Bay Estuary for Chlorophyll-a, Dissolved Oxygen, water Clarity, Eelgrass Habitat, and Nitrogen." April 20, 2012.

NH DES defines the aquatic life designated use in the following way: "Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms."[6]

The NH DES criteria relevant to this TSD's discussion of total nitrogen in relation to the listings of impairment of the State's aquatic life designated use are:

Env-Wq 1703.14

> (b) Class B waters shall contain no phosphorus or nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring.

Env-Wq 1703.19

> (a) The surface waters shall support and maintain a balanced, integrated, and adaptive community of organisms having a species composition, diversity, and functional organization comparable to that of similar natural habitats of a region.
>
> (b) Differences from naturally occurring conditions shall be limited to non-detrimental differences in community structure and function.

Env-Wq 1703.07

> (b) Except as naturally occurs, or in waters identified in RSA 485-A:8, III, or subject to (c), below, class B waters shall have a dissolved oxygen content of at least 75% of saturation, based on a daily average, and an instantaneous minimum dissolved oxygen concentration of at least 5 mg/l.
>
> (c) For the period from October 1st to May 14th, in areas identified by the fish and game department as cold water fish spawning areas of species whose early life stages are not directly exposed to the water, the 7 day mean dissolved oxygen concentration shall be at least 9.5 mg/l and the instantaneous minimum dissolved oxygen concentration shall be at least 8 mg/l. This period shall be extended to June 30 for a particular waterbody if the fish and game department determines it is necessary to protect spring spawners or late hatches of fall spawners, or both.
>
> (d) Unless naturally occurring or subject to (a), above, surface waters within the top 25 percent of depth of thermally unstratified lakes, ponds, impoundments and reservoirs or within the epilimnion shall contain a dissolved oxygen content of at least 75 percent saturation, based on a daily average and an instantaneous minimum dissolved oxygen content of at least 5 mg/l. Unless naturally occurring, the dissolved oxygen content below those depths shall be consistent with that necessary to maintain and protect existing and designated uses.

[6] NH DES. 2012 Consolidated Assessment and Listing Methodology. January 2014. Page 44.

As described in more detail later in this TSD, New Hampshire's AR supports the State's listing of the Great Bay Estuary segments in question as impaired for the State's aquatic life designated use. The State's conclusion that the aquatic life designated use was impaired was based on the State's finding that for each of the listed segments one or more of the following three water quality criteria (set forth immediately above) were not being met: 1) Env-Wq 1703.14 (narrative nutrient criteria for nitrogen); 2) Env-Wq 1703.19 (protection of aquatic life); and/or 3) Env-Wq 1703.07 (dissolved oxygen).

The key evidence for the listed segments identified in New Hampshire's AR, for segments where eelgrass historically has grown, demonstrating that the listed segments "contain . . . nitrogen in such concentrations that" impair the aquatic life use (see Env-Wq 1703.14) and do not "support and maintain a balanced, integrated, and adaptive community of organisms . . ." (see Env-Wq 1703.19) are the significant amounts (greater than 20%) of eelgrass loss occurring over time in the segments where eelgrass had historically grown or recent annual trends showing greater than 20% loss.

For the listed segments where eelgrass historically has not grown, the key evidence identified in New Hampshire's AR demonstrating that the listed segments "contain . . . nitrogen in such concentrations that" impair the aquatic life use (see Env-Wq 1703.14) are the monitored levels of dissolved oxygen that do not meet the State's numeric dissolved oxygen criteria (see Env-Wq 1703.07) and/or high concentrations of chlorophyll-a (see Env-Wq 1703.19).[7]

For each of the listed segments, the State documented the presence of excess total nitrogen and one or more nitrogen enrichment response variables at levels that impair the aquatic life use because they do not attain Env-Wq 1703.07 and/or Env-Wq 1703.19, such as dissolved oxygen concentration, dissolved oxygen percent saturation, chlorophyll-a, eelgrass estuarine bioassessments and light attenuation coefficient (water clarity). This evidence supports the State's determination that the segments "contain . . . nitrogen in such concentrations that would

[7] NH DES indicated in its response to public comments that the Cocheco River was the only segment listed in the Great Bay Estuary on the 2010 and 2012 303(d) lists based only upon total nitrogen values and chlorophyll-a values. NH DES explained that the listing based on the nitrogen and chlorophyll-a values was designed to protect dissolved oxygen levels, and that the listing would be retained from the State's 2010 Section 303(d) list because there was no new nitrogen or chlorophyll-a data that would justify removing the Cocheco River from the 2012 Section 303(d) list. The high total nitrogen and chlorophyll-a values from the Cocheco River are indicative of cultural eutrophication and are present in levels that greatly exceed natural background levels. The analyses that were conducted in support of the NH DES's 2009 numeric nutrient criteria document contained an analysis demonstrating a correlation between chlorophyll-a concentration increases and dissolved oxygen concentration decreases and percent saturation flux swings resulting from the photosynthetic production of oxygen during the day and the subsequent crash of dissolved oxygen levels due to cellular respiration during the overnight period. See also the scientific literature discussed on page 45 of the NH DES's 2009 numeric nutrient criteria document. Based on the information described by NH DES and above, EPA concludes that it was appropriate for NH DES to retain the listing of the Cocheco River on the 2012 303(d) list and therefore EPA approves that listing.

impair" the aquatic life use (see Env-Wq 1703.14) and that nitrogen is at least one cause of the impairment.

After reviewing all of the available data and other information, NH DES concluded that the listed water body segments in the Great Bay Estuary are exhibiting the effects of cultural (i.e., anthropogenic) eutrophication due to point and non-point source loadings of nitrogen from atmospheric deposition, stormwater and wastewater. See, e.g., New Hampshire's 2009 report entitled "Numeric Nutrient Criteria for the Great Bay Estuary." The data and other information included as part of NH DES's 2012 303(d) list AR include evidence of that fact by documenting the loss of eelgrass meadows, decreased water clarity, proliferation of macroalgae, and low dissolved oxygen levels. The phenomenon of cultural eutrophication occurring in these waters has been well-documented by extensive long-term monitoring conducted by the NH DES, the University of New Hampshire (UNH), U.S. EPA and other stakeholders. See, e.g., New Hampshire's TSD (Tables 4A-T, pages 15-42) and the State of New Hampshire 2012 Section 305(b)/303(d) Consolidated Assessment and Listing Methodology (3.2.4 Use: Aquatic Life).

The following section of EPA's TSD explains in greater detail that NH DES's AR contains technical data and other information that reasonably supports NH DES's assessment and listing of certain segments in the Great Bay Estuary as impaired for the State's aquatic life designated use, with the presence of total nitrogen concentrations identified as the pollutant (or stressor) associated with the use impairment. In this TSD, EPA summarizes that data and information, identifies its sources, and explains why the listings in question are reasonable and consistent with 40 C.F.R. § 130.7. Before that discussion, however, included below is a short summary of certain recent developments relating to NH DES's efforts in 2009 to develop numeric nutrient criteria as part of its section 303(d) listing methodology.

New Hampshire's 2009 "Numeric Nutrient Criteria for the Great Bay Estuary"

Over the course of several years, ending in 2009, NH DES developed a document entitled "Numeric Nutrient Criteria for the Great Bay Estuary," which included a CWA section 303(d) assessment and listing methodology created for the purpose of translating the State's narrative nutrient water quality criteria into numeric values for a number of parameters relevant to the phenomenon of cultural eutrophication including, but not limited to, total nitrogen. As the NH DES's 2012 TSD[8] stated:

> "Translators are a common tool employed by state environmental agencies as a method to interpret existing narrative water quality standards so that they can be applied to specific waters. Numeric translators were developed for chlorophyll-a, light attenuation (a general measure of water clarity), total nitrogen, and eelgrass cover. Chlorophyll-a was chosen because it is an accepted indicator of algae blooms and primary productivity. Light attenuation was selected because it is a good indicator of the presence or absence of eelgrass especially in the deeper areas of the estuary. Even in shallow areas, light

[8] NH DES's 2012 Section 305(b)/303(d) List Technical Support Document, Assessments of Aquatic Life Use Support in the Great Bay Estuary for Chlorophyll-a, Dissolved Oxygen, Water Clarity, Eelgrass Habitat and Nitrogen. 2012. Page 2.

attenuation is still an important contributing factor for eelgrass viability because sufficient light is a requirement for plant survival in all areas. Total nitrogen was used because it is a stable indicator of excess nutrients, as opposed to the more reactive form of dissolved inorganic nitrogen, which is rapidly removed from the water by algae and plants. Finally, the area of estuary that is covered by eelgrass habitat was used because it is a direct measurement of the health of this keystone species. Translators were not needed for dissolved oxygen and dissolved oxygen saturation because the State already has water quality criteria for these parameters (Env-Wq 1703.07)."

NH DES applied the numeric assessment and listing methodology when listing as impaired certain segments in the Great Bay Estuary on the State's final 2008, 2010 and 2012 303(d) lists. Scientific peer review studies undertaken prior to New Hampshire finalizing its 2012 303(d) list were supportive of the NH DES's 2009 numeric criteria document. However, certain questions about particular aspects of the numeric assessment and listing methodology were raised by a newly undertaken peer review completed *after* New Hampshire finalized its 2012 303(d) list and submitted the list to EPA for review. NH DES submitted its final 2012 list to EPA on February 12, 2014. The peer review report, dated February 13, 2014, was drafted by a four-person panel and was designed to evaluate NH DES's 2009 numeric criteria document primarily in relation to whether the total nitrogen numeric target values were appropriate as threshold values, to be used in conjunction with other parameters or nitrogen enrichment response variables, for determining attainment or nonattainment of the State's water quality standards and protection of uses. It is important to note that the February 13, 2014 peer review did not conclude that total nitrogen was not a factor contributing to the symptoms of cultural eutrophication in the Great Bay Estuary.

Subsequent to issuance of the peer review panel's February 13, 2014 report, the State of New Hampshire and the NH DES entered into a settlement agreement with the Cities of Dover, Portsmouth and Rochester, New Hampshire "for the purpose of settling the claims, controversies and disputes" relating to then pending litigation between the parties in New Hampshire Supreme Court. It is important to note that the terms of the settlement agreement were limited in scope to the following:

1. NH DES agreed not to use the 0.45, 0.30, 0.27 or 0.25 mg/L total nitrogen numeric thresholds contained in the DES 2009 numeric criteria document for purposes of water quality assessments and listings under CWA sections 305(b) and 303(d) "for the Great Bay Estuary, including the Cocheco and Piscataqua Rivers, and Portsmouth Harbor"; and

2) NH DES also agreed to "modify" its January 2014 Consolidated Assessment and Listing Methodology (CALM) consistent with the agreement not to use the above-referenced total nitrogen values.

We note that NH DES has never withdrawn from EPA its February 2014, 2012 303(d) list submission, despite having entered into the above-referenced settlement agreement. EPA has reviewed the terms of the settlement agreement and has concluded that the State's agreement not to use specific total nitrogen values as thresholds for listing purposes does not prevent EPA from approving NH DES's 2012 303(d) listings related to the Great Bay Estuary. NH DES's 2009 numeric criteria document, when considered and understood in its entirety, along with the

substantial data and other information (obtained over the course of many years) documenting the phenomenon of cultural eutrophication in the Great Bay Estuary, analyzed a variety of data, other information and relevant physical factors beyond the comparatively narrow question of exactly which specific numeric values for total nitrogen should or could play a role in determining whether the State's water quality criteria are being met in the Great Bay Estuary and whether the State's designated uses are being protected. In other words, there are substantial data and other supporting information contained within the NH DES's AR for its 2012 303(d) list that fully support the NH DES's inclusion of the waters in question on the State's 2012 303(d) list. And this is true regardless of whether the judgment to list those waters as impaired due to nitrogen loadings involves application (or not) of the numeric total nitrogen values contained in NH DES's 2009 numeric criteria document. Even if the specific numeric total nitrogen values for assessment and listing purposes contained in NH DES's 2009 report are set aside, there is substantial information in the record to support the listing of the Great Bay Estuary as not meeting applicable water quality standards and that excess nitrogen concentrations are at least a cause of the State's aquatic life use impairments in the estuary.

II. Data and other information from NH DES's administrative record that support the listing of the Great Bay Estuary waters in question.

NH DES's AR contains data and other information obtained from sources that include, but are not limited to, specifically identified scientific literature; EPA-approved total maximum daily loads (TMDLs) for total nitrogen-impaired coastal embayments on Cape Cod, Martha's Vineyard and Nantucket, Massachusetts that are not meeting aquatic life designated uses in which nitrogen was the pollutant of concern; [9] scientific reports relating specifically to the Great Bay Estuary prepared by the Piscataqua Region Estuaries Partnership (PREP); and extensive monitoring data obtained over the course of several years by NH DES, EPA, UNH, and the PREP. The data relating to nitrogen enrichment response variables (e.g., eelgrass bed decline, low levels of dissolved oxygen, chlorophyll-a values, macroalgae, light attenuation values), when viewed in conjunction with the total nitrogen data obtained through monitoring, provides strong support for *continued* 303(d) listing of the Great Bay Estuary waters in question and provides a clear picture of an estuary that is facing strong eutrophication pressure. Seen from a different perspective, in the face of all of the available data and information that NH DES analyzed and that is contained in NH DES's AR, EPA cannot conclude that NH DES would have had any rational basis to de-list from NH DES's 2012 303(d) list the Great Bay Estuary water body segments in question.

For each Great Bay Estuary water body segment listed on the State's 2012 303(d) list as being impaired for the State's aquatic life designated use, the NH DES's identification of total nitrogen as a pollutant associated with such impairments is accompanied by at least one nitrogen

[9] NH DES. Numeric Nutrient Criteria for the Great Bay Estuary. 2009. Page 3. "The criteria have been used as both water quality standards and modeling targets for Total Maximum Daily Load studies. In New England, the Massachusetts Estuaries Project has established water quality thresholds for total maximum daily loads for dozens of estuaries, predominantly on Cape Cod and in Buzzards Bay (reports available at http://www.oceanscience.net/estuaries/index.htm)."

enrichment response variable; and for most segments there are two or more accompanying nitrogen enrichment response variables identified. A nitrogen enrichment response variable is a measured effect of excess nitrogen (a nutrient) and is indicative of a water body's condition, such as eelgrass bed decline, low levels of dissolved oxygen, elevated chlorophyll-a values, proliferation of macroalgae, and/or light attenuation values.[10] NH DES's AR contains many scientific references and studies supporting the fact that excess nitrogen loadings to surface waters are associated with such nitrogen enrichment responses and result in cultural eutrophication in estuarine surface waters. As discussed in more detail below, the relationships among nitrogen loadings and the above-referenced nitrogen enrichment response variables in the Great Bay Estuary are also specifically well-documented in NH DES's AR supporting its 2012 303(d) listing of the Great Bay Estuary waters in question.

For example, in the 2013 State of our Estuaries Report, PREP identifies and describes several specific areas and facts of concern related to excess nitrogen in the Great Bay Estuary. The Adams Point sampling station in Great Bay shows a significant (68%) increasing trend in Dissolved Inorganic Nitrogen (DIN) for the period from 1974 to 2011. This trend is a concern because DIN is the most reactive form of nitrogen and is easily assimilated by macroalgae and other aquatic plants, which, in turn, has an effect on the availability of light needed to protect eelgrass growth, for example. DIN is also the most prevalent form of nitrogen that is discharged from municipal wastewater treatment facilities. Discharges of DIN from wastewater treatment facilities account for 52% of the delivered DIN load to the Great Bay Estuary, while 32% of the Total Nitrogen (TN) load to the estuary is attributed to wastewater treatment facilities.[11] The Great Bay Estuary also receives significant nitrogen loading from various non-point sources of pollution such as fertilizers from lawns and agriculture, animal wastes, septic systems and nitrogen deposition from the air.

The 2013 PREP report also highlights an increasing trend in the prevalence of macroalgae, particularly several nuisance species that have the capacity to form large mats and smother native eelgrass populations. Low levels of dissolved oxygen also continues to be an area of concern, particularly in the tributary rivers to the Great Bay Estuary, and is an effect generally resulting

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[10] The selection of appropriate nitrogen enrichment response variables is discussed in the 2009 Numeric Nutrient Criteria for Great Bay document which provides the data and analyses supporting the use of these response variables (see sections on Primary Indicators and Secondary Indicators under the Methods and Results and Discussion Headings). In the case of oxygen levels, NH DES has existing numeric water quality standards for dissolved oxygen concentration and dissolved oxygen saturation. See RSA 485A:8 and Env-Wq 1703.07 at http://www.gencourt.state.nh.us/rsa/html/L/485-A/485-A-8.htm and http://des.nh.gov/organization/commissioner/legal/rules/documents/env-wq1700.pdf, respectively. The analyses that were conducted in support of the NH DES's 2009 numeric nutrient criteria document provide further support for the use of dissolved oxygen as a nitrogen enrichment response variable by correlating chlorophyll-a concentration increases with dissolved oxygen concentration decreases and percent saturation flux swings resulting from the photosynthetic production of oxygen during the day and the subsequent crash of dissolved oxygen levels due to cellular respiration during the overnight period. These conclusions are also well supported by scientific literature discussed on page 45 of the NH DES's 2009 numeric nutrient criteria document.

[11] PREP. 2013 State of our Estuaries Report. 2013. Page 13. This report was referenced in the NH DES's list of references attached to its responses to comments document relating to the 2012 303(d) list.

from excess nitrogen.[12] The Lamprey, Oyster, Squamscott and Salmon Falls Rivers periodically violate water quality standards for dissolved oxygen concentration and/or percent saturation on a daily basis.[13,25] In the biologically critical summer period, the duration of the violations can extend for several hours, to several days or even longer, depending on the severity of the problem. The lowest observed levels of dissolved oxygen have occurred in the Cocheco River (3.60 mg/L), Lamprey River (3.92 mg/L), Oyster River (3.54mg/L), South Mill Pond (3.90 mg/L), and the Winnicut River (4.20 mg/L); and there have been periodic occurrences of excessively low dissolved oxygen in the Squamscott River (3.51 mg/L) downstream of the Exeter municipal treatment facility.[14,15] In addition, studies by UNH on the Lamprey River and by the Great Bay Municipal Coalition (GBMC) on the Squamscott River have confirmed the frequency and duration of dissolved oxygen violations, as well as other contributing factors to eutrophication such as the discharge of high levels of algae from the Exeter wastewater treatment facility.[16]

Eelgrass coverage and density has been experiencing a long-term downward trend in the Great Bay Estuary since 1996.[17,18] These downward trends are attributed to declining water quality and clarity throughout the estuary, not to wasting disease.[19,20] Great Bay proper contains the largest areas of eelgrass beds and has also experienced the largest losses with a 38% decline in eelgrass since 1990.[21] Smaller, but statistically significant losses of eelgrass coverage have occurred in the Winnicut River, Little Harbor, Portsmouth Harbor and the Piscataqua River.[22] As noted earlier, water chemistry sampling conducted by NH DES in the Great Bay Estuary shows levels of total nitrogen (median values of 0.312-1.055 mg/L) well above what would be considered natural background levels (0.2 mg/L of TN) for an estuarine system.[23] The sampled values are summarized in tables 2A and 2B of the NH DES's 2009 numeric nutrient criteria document showing minimum, 10th percentile, median, 90th percentile and maximum values, many of which exceed those values that have been adopted in other estuaries.[24]

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[12] PREP. 2013 State of our Estuaries Report. 2013. Pages 18-19. This report was referenced in the NH DES's list of references attached to its responses to comments document relating to the 2012 303(d) list.
[13] Ibid.
[14] Ibid.
[15] NH DES. Numeric Nutrient Criteria for the Great Bay Estuary. 2009. Table 7: Summary Statistics for Dissolved Oxygen (mg/L) Calculated from Samples Collected in All Seasons in 2000-2008. Page 47.
[16] PREP. 2013 State of our Estuaries Report. 2013. Pages 18-19. This report was referenced in NH DES's list of references attached to its responses to comments document relating to the 2012 303(d) list.
[17] NHDES. New Hampshire's 305(b)/303(d) List Technical Support Document for Aquatic Life Use Support in the Great Bay Estuary for Chlorophyll-a, Dissolved Oxygen, Water Clarity, Eelgrass Habitat and Nitrogen. 2012. Page 7.
[18] PREP. 2013 State of our Estuaries Report. 2013. Pages 20-21.
[19] Ibid.
[20] PREP. 2013 State of our Estuaries Report. 2013. Page 41.
[21] PREP. 2013 State of our Estuaries Report. 2013. Pages 20-21.
[22] Ibid.
[23] NHDES. Numeric Nutrient Criteria for the Great Bay Estuary. 2009. Pages 17-24.
[24] Massachusetts Estuary Project. Nitrogen TMDLs for Cape Cod, The Islands and Buzzards Bay. http://www.oceanscience.net/estuaries/index.htm. Accessed on 5/5/15. This report was referenced in New Hampshire DES's 2009 report entitled "Numeric Nutrient Criteria for the Great Bay Estuary."

Great Bay Estuary Cultural Eutrophication Condition

In the 2009 State of our Estuaries Report,[25] eleven of 12 environmental indicators exhibited negative or cautionary trends – up from seven indicators classified this way in 2006. According to the 2009 PREP report, total nitrogen is increasing and eelgrass is decreasing within the Great Bay Estuary. The total nitrogen load to the Great Bay Estuary increased by 42% over the last five years evaluated in the report. In Great Bay, the concentrations of DIN, a major component of total nitrogen, have increased by 44 percent over the last 28 years evaluated in the report. Eelgrass cover in Great Bay has declined by 37% between 1990 and 2008 and has disappeared from the tidal rivers, Little Bay, and the Upper Piscataqua River. While dissolved oxygen standards are rarely violated in the bays and harbors, they are often violated in the tidal rivers. The negative effects of the increasing nutrient loads on the estuary system are evident in the decline of water clarity, eelgrass habitat loss, and failure to meet water quality standards for dissolved oxygen concentrations in tidal rivers.

The 2013 State of our Estuaries Report[26] evaluated 22 key indicators of the health of the estuary. Of the 22 indicators, 15 are classified as having cautionary or negative conditions or trends, while 7 show positive conditions or trends. The overall assessment concludes that there is reason to be concerned about the health of the Great Bay Estuary, and that increased efforts to study and restore the Estuary are needed. "At this time the Great Bay Estuary exhibits many of the classic symptoms of too much nitrogen: low dissolved oxygen in tidal rivers, increased macroalgae growth, and declining eelgrass" (pg. 12). Additionally, the report indicates that "…there have been persistent and numerous violations of the dissolved oxygen standards at stations in the tidal rivers that flow into the estuaries." (pg. 18).

The 2013 State of our Estuaries Report states that "[d]ata indicate a long-term decline in eelgrass since 1996 that is not related to wasting disease." Additionally, the report notes that "[t]here are also indications, based on estimates of the density of the eelgrass beds, that the remaining beds contain fewer plants and, therefore, provide less habitat." The report also notes that "[s]tatistically significant declines in eelgrass have also been observed in other sections of the estuary: the Winnicut River, Little Harbor, Portsmouth Harbor and the Piscataqua River" (pg. 20). The loss of eelgrass results in increased suspended sediments which block light penetration and can lead to further eelgrass losses. "When this habitat is lost, the sediments are more easily stirred up by wind and waves." (pg. 22).

Field studies have demonstrated that macroalgae has increased significantly as nitrogen has

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[25] PREP. 2009. State of our Estuaries Report. http://www.prep.unh.edu/resources/pdf/2009_state_of_the-prep-09.pdf. This report was referenced in NH DES's 2009 report entitled "Numeric Nutrient Criteria for the Great Bay Estuary." This report was also contained in the list of references appended to NH DES's response to comments documents relating to the 2012 303(d) list.

[26] PREP. 2013. State of our Estuaries Report. http://prep.unh.edu/resources/pdf/2013%20SOOE/SOOE_2013_FA2.pdf. This report was referenced and characterized by the Great Bay GBMC in comments submitted directly to EPA on August 29, 2013. This report was also contained in the list of references appended to NH DES's response to comments documents relating to the State's 2012 303(d) list.

increased in the estuary.[27,28] The well-documented increases in macroalgal growth, and the recently documented evidence of extensive epiphyte growth on eelgrass leaves, which can further attenuate light that is critical for eelgrass survival, is very concerning for the long-term health and survival of eelgrass populations.[29,30] The NH DES's 2009 numeric nutrient criteria document shows that between 1996 and 2007, the area populated by healthy eelgrass declined in Great Bay proper from 2421 acres to 1246 acres, a 48 percent loss. The 2007 information also showed 137 acres of macroalgae, predominantly in areas previously covered in eelgrass.[31]

In addition to the other data and information identified in NH DES's AR and also described or referenced throughout EPA's TSD, the various facts and assessments described in the State of our Estuaries Reports identified above, which also are contained in NH DES's AR, support NH DES's listing of the Great Bay Estuary water body segments in question and support EPA's approval of those listings. The data and other information contained in the PREP reports support the conclusion that concentrations of total nitrogen have resulted in cultural eutrophication in the estuary, as evidenced by the nitrogen enrichment response variables.

We also note that the methodology used by NH DES to support listing the Great Bay Estuary water body segments in question is consistent with the methodology used by MassDEP and documented in a 2003-report entitled "Site-Specific Nitrogen Thresholds for Southeastern Embayments: Critical Indicators" that was conducted in support of developing TMDLs for nitrogen impaired water bodies on Cape Cod, Martha's Vineyard and Nantucket. That MassDEP study included a methodology that monitored for and documented the kinds of nitrogen enrichment response variables, most notably eelgrass loss and low levels of dissolved oxygen that NH DES documented in the Great Bay Estuary. The MassDEP's methodology also documented total nitrogen levels that are similarly in excess of the background levels of total nitrogen expected to be in estuarine waters in the geographic areas in question. See, e.g., pages 17-24 of NH DES's 2009 "Numeric Nutrient Criteria for the Great Bay Estuary." Additionally, both MassDEP and NH DES analyzed the factors recommended by NOAA's conceptual model[32] when studying the effects of total nitrogen in waters in which cultural eutrophication may be occurring.

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[27] Nettleton et al. 2011. Tracking environmental trends in the Great Bay Estuarine System through comparisons of historical and present-day green and red algal community structure and nutrient content. Final Report to Great Bay National Estuarine Research Reserve System, 101p. This report was referenced in NH DES's 2009 report entitled "Numeric Nutrient Criteria for the Great Bay Estuary."

[28] Pe'eri. 2008. Macroalgae and eelgrass mapping in Great Bay Estuary using AISA hyperspectral imagery. A Final Report to the Piscataqua Region Estuaries Partnership from the University of New Hampshire, Durham, NH. December 2008. This report was referenced in NH DES's 2009 report entitled "Numeric Nutrient Criteria for the Great Bay Estuary."

[29] Short et al. 2011. Extinction risk assessment of the world's seagrass species. *Biological Conservation.* 144: 1961-1971. This report was referenced in NH DES's 2009 report entitled "Numeric Nutrient Criteria for the Great Bay Estuary."

[30] Mathieson. 2012. Nutrients and Macroalgal Problems within the Great Bay Estuary System. Comments to the Piscataqua Region Estuaries Partnership. University of New Hampshire, Durham, NH. June 11, 2012. This report was referenced in NH DES's 2009 report entitled "Numeric Nutrient Criteria for the Great Bay Estuary."

[31] NH DES. 2009. Numeric Nutrient Criteria for the Great Bay Estuary. Page 37.

[32] See reference to NOAA's conceptual model on page 27 of this TSD.

NH DES's responses to public comments received on NH DES's draft 2012 303(d) list support the listings in question.

NH DES's responses to public comments received on its draft 2012 303(d) list support listing the Great Bay Estuary waters in question by providing detailed technical analyses, and by referencing specific data, studies, and other relevant information. It is important to note that in its response to public comments on its draft 2012 303(d) list, NH DES stated that the section 303(d) listings were based on site-specific data from each of the assessment units in the Great Bay Estuary. In addition, among all other readily available data and information, the NH DES's analysis also considered data and information provided by the Great Bay Municipal Coalition, including the Coalition's Squamscott River Study report (HydroQual, 2012) submitted to NH DES *after* the State's public comment deadline. The Coalition submitted extensive comments, far more than other commenters. The Coalition also submitted comments on NH DES's final 2012 303(d) list directly to EPA, on August 29, 2013 and April 10, 2014. EPA has prepared its own written responses to those comments, and they are included in Attachment B to EPA's approval memo.

This section of EPA's TSD identifies the most salient public comments NH DES received and NH DES's responses. It is worth identifying at the outset the specific NH DES responses which highlight: 1) NH DES's technical determination that certain water body segments within the Great Bay Estuary are impaired and associated with the presence of excess total nitrogen concentrations and its resulting effects; 2) that the State's narrative nutrient criteria at Env-Wq 1703.14, aquatic life criteria at Env-Wq 1703.19, and dissolved oxygen criteria at Env-Wq 1703.07 have been and continue to be violated in the Great Bay Estuary; and 3) that the State's aquatic life designated use is not being protected as required by state law and the CWA.

NH DES's responses to public comments reference and explain the importance of data and other information that are contained in NH DES's AR, and which support NH DES's conclusion that the Great Bay Estuary is not attaining the aquatic life designated use due at least in part from the effects of cultural eutrophication. NH DES's responses address and properly respond to comments about factors in the Great Bay Estuary, such as eelgrass loss, algal growth, light attenuation, low dissolved oxygen, and total nitrogen's relationship to those nitrogen enrichment responses. The nature and content of NH DES's responses to these public comments support the NH DES's conclusion that cultural eutrophication is occurring in the Great Bay Estuary, that the State's aquatic life designated use is not being protected, and that total nitrogen is a pollutant cause of these conditions. The information contained in NH DES's responses to public comments provided EPA with additional information (beyond the information elsewhere identified in this TSD from NH DES's AR) from which to conclude that NH DES appropriately listed the Great Bay Estuary water body segments in question.

Following the 10 most salient NH DES responses identified immediately below, EPA's TSD also includes additional NH DES responses to public comments that also support the listings in question.

1. "On April 20, 2012, DES provided graphs [in response to public comments on the NH DES's Consolidated Assessment and Listing Methodology] showing that light attenuation increases

with increasing nitrogen concentrations in the Great Bay Estuary, even accounting for changes in salinity." . . . "DES showed that total nitrogen accounts for 27% of the variability in light attenuation in the tidal rivers."

2. "The same robust relationship [as in #1 above] is evident between total nitrogen and algae growth (chlorophyll-a)."

3. "The [list] impairments for light attenuation ("transparency/TN-based listings") cannot be deleted from the 303(d) list because light attenuation is a good indicator of eelgrass survival and there is a statistically significant relationship between light attenuation and total nitrogen in the estuary."

4. "[L]ight attenuation and total nitrogen have statistically significant relationships in the estuary, including the tidal rivers []. Total nitrogen concentrations are a strong indicator of human influence. Therefore, given the relationship between light attenuation and total nitrogen in the estuary, including in the tidal rivers, it cannot be justified that light attenuation is "naturally occurring," nor can it be justified that light attenuation is unrelated to nitrogen concentrations."

5. "There are multiple ways that excess nitrogen impacts eelgrass in the Great Bay Estuary."

6. "The dominant mechanism by which nitrogen affects eelgrass is different in different parts of the Great Bay Estuary and can vary over time. Light attenuation, a general measure of water clarity, is a good indicator of the presence or absence of eelgrass especially in the deeper areas of the estuary. Subtidal eelgrass beds in these areas need clear water to transmit light to the growing depths. In shallower areas, overgrowth and smothering by macroalgae and/or cellular disruption may be the immediate cause of eelgrass loss. However, even in shallow areas, light attenuation is still an important contributing factor for eelgrass viability because sufficient light is a requirement for plant survival in all areas."

7. "Eelgrass may be impacted by other factors such as sediments, dredging, and disease. However, the strong relationships between nitrogen, light attenuation and algae growth demonstrate that nitrogen is most likely the dominant cause of, and certainly contributes significantly to, eelgrass losses in the Great Bay Estuary. . . . [L]ight attenuation increases with increasing nitrogen concentrations in the Great Bay Estuary, even accounting for changes in salinity."

8. "The commenter claims that there is uncertainty about the why eelgrass populations are changing. In fact, DES has relied on its analysis of the long-term data and possible confounding factors, coupled with accepted hypotheses of the relationships between nutrients and their effects, to state with reasonable scientific certainty that anthropogenic nitrogen has caused or contributed to the observed decline in eelgrass in the Great Bay Estuary."

9. NH DES's responses to comments contained the following quotation from the Nettleton et al. (2011) study:

> "Great increases in both mean and peak Ulva and Gracilaria biomass and percent cover

have occurred in the Great Bay Estuarine System. These changes coincide with increases in water nitrogen levels observed over the past two decades. The increases in nuisance algal blooms are likely the result of increased nutrient loading in the bay, and, in the case of Gracilaria vermiculophylla, may also be a symptom of a harmful invasion."

"Current nitrogen levels in the system are substantial enough to support even larger Ulva and Gracilaria blooms than were observed in this study, based on minimum growth requirements. If efforts are not made to reduce nutrient inputs, such harmful algal blooms, and their related side effects of hypoxia and habitat alteration, should be expected in the Great Bay Estuarine System for the foreseeable future. (Nettleton et al., 2011 at 82)."

10. "The commenter claims that 'nitrogen increases have not caused excessive plant growth or any change in transparency adversely impacting eelgrass.'" NH DES responded in the following way:

"Based on the depositions cited, DES interprets this claim to refer specifically to phytoplankton, which is one of many types of algae. Similarly, location is not defined in the claim but interpreted to mean Great Bay proper because that is the only place for which phytoplankton records extend back to 1980. With those definitions, it is correct that there have been no clear trends in chlorophyll-a (a specific measurement of phytoplankton) measured in Great Bay over the full period of record from 1974 to 2011 in Great Bay (PREP, 2013 at 16). However, the statement ignores the fact that phytoplankton are not the only form of algae that is important in a shallow estuary like the Great Bay. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery et al., 2007; Valiela et al., 1997), which is what is actually happening in Great Bay. At the mouth of Lubberland Creek in Great Bay, macroalgae increased from 0.8 to 39.3 percent cover between 1980 and 2010 (PREP, 2013 at 16)."

"GBMC has previously acknowledged that macroalgae has increased in the estuary. In a letter from Dean Peschel to Harry Stewart on November 14, 2011, the GBMC stated that 'Great Bay waters (excluding the tidal rivers) should be identified as impaired due to excessive macroalgae growth, and the parameter of concern causing the impairment should be identified as DIN.'(Peschel, 2011 at 3)."

NH DES responses to additional public comments relating to the Great Bay Estuary listings.

Dr. Arthur C. Mathieson's comments on the proliferation of macroalgal growth and algae blooms in the Great Bay Estuary over the past 45 years.

NH DES received detailed supportive comments from Dr. Arthur C. Mathieson, Professor of Plant Biology, Jackson Estuarine Laboratory & Department of Biological Sciences, University of

New Hampshire. His comments focused upon the presence of nutrients and related macroalgal problems within the Great Bay Estuary system and cited to numerous references. He noted that he has worked at the Jackson Estuarine Laboratory (JEL) since its dedication in 1967 and has studied the ecology of the Great Bay Estuarine System (GBES) and its seaweed (i.e., macrolgae) populations for over 4.5 decades. He also stated that he was responsible for directing the nutrient monitoring program for JEL (1970-1981), which was the primary "bench-mark" characterizing earlier hydrographic/nutrient conditions [in the estuary]. Dr. Mathieson noted that prior to the 1980s, no major algal blooms were apparent [in the Great Bay Estuary system] and the nutrient levels [there] were much lower than today (cf. Mathieson and Hehre, 1981), but that during the past 2-3 decades the following macroalgal patterns have occurred along with an increase in the presence of nutrients:

1. "Extensive ulvoid green algae (*Ulva* spp.) or 'green tides' (Fletcher, 1996) have begun to dominate many of these estuarine areas during the past 15-20 years, particularly within Great Bay proper (Nettleton et al. 2011). Such massive blooms of foliose green algae can entangle, smother and cause the death of eelgrass (*Zostera marina*) within the low intertidal/shallow subtidal zones (pers. obs. A. C. Mathieson). They primarily represent annual populations that can also regenerate from residual fragments buried in muddy habitats."

2. "The introduced Asiatic green alga *Ulva pertusa* has recently contributed and exacerbated these 'green tide' events, along with the dominant species *U. lactuca* (sea lettuce) and *U. compressa* (Hofmann et al., 2010)."

3. "The 'guanotrophic' green alga *Prasiola stipitata* suddenly appeared in the upper intertidal zone near Dover Point. It represents a disjunct open coastal taxon that is usually found in high intertidal bird rookeries with large quantities of guano. During the mid 1980's it was not recorded inland from Fort Constitution on the Piscataqua River (Mathieson and Hehre, 1986; Mathieson and Penniman, 1986), and its sudden appearance correlates with the 'recent' transfer of Dover's sewage discharges from the Cocheco River to the Piscataqua River/Little Bay area."

4. "The Asiatic red alga *Gracilaria vermiculophylla* was recently introduced to the GBES (Nettleton et al. submitted) and is causing even greater macroalgal blooms than the 'green tide' seaweeds. In contrast to *Ulva* it is a perennial, long-lived taxon that is more tolerant to desiccation than the native species *G. tikvahiae*. As a consequence it now forms extensive wind rows 1-2 feet deep within the low intertidal and subtidal zones of many Little and Great Bay sites (pers. obs. A C Mathieson). Like *Ulva* spp. its massive blooms can entangle, smother and cause the death of eelgrass within the low intertidal/shallow subtidal zones."

5. "Extensive epiphytic growths of seaweeds on eelgrass (*Zostera marina*) have also occurred during the past 15-20 years, particularly within Great Bay proper (pers. obs. A. C. Mathieson). These epiphytes, which are mostly filamentous red algae and colonial diatoms, may completely cover the fronds of eelgrass, limiting the host's growth and photosynthesis and compromising its viability."

Dr. Mathieson's comments also referenced what he characterized as "supportive scientific studies." He noted that "Schubert (1984) states that macroalgae are good indicators of nutrient levels, as they lack roots, their tissues absorb nutrients directly, and they closely reflect water column contents (cf. Lapointe et al., 1992; Horrock et al., 1995). Goshorn et al. (2001) summarized several studies indicating that a large increase in macroalgal biomass is most often associated with eutrophication. Valiela et al. (1992, 1997) found that a rise in nutrients increased algal biomass 3-4 levels of magnitude, shading out eelgrass, creating more anoxic events, and changing benthic faunal communities. Hauxwell et al. (1998) found that as nitrogen loading increased macroalgal biomass increased by as much as 300%. Microcosm experiments by Fong et al. (1993) showed that nitrogen levels directly controlled macroalgal biomass, which in turn controlled levels of phytoplankton that were subsequently documented by enhanced chlorophyll levels."

In his own summary of his comments, Dr. Mathieson stated that "[b]ased upon the above observations and scientific data, eutrophication is creating an unstable and negative situation within the GBES, which needs to be quickly rectified. In retrospect these green and red (*Gracilaria*) algal blooms are typical of stressed estuarine systems like those found within Waquoit Bay, MA, Narragansett Bay, RI, and the middle Atlantic coastal estuaries within Delaware, Maryland, and Virginia."

NH DES's response to Dr. Mathieson's comments:

NH DES noted in its response to comments document that Dr. Mathieson's comments support NH DES's listing of many assessment units in the Great Bay Estuary on the 303d list for eutrophication-related parameters.

GBMC comments on removing segments listed in the Great Bay Estuary for eelgrass and nitrogen related impairments.

The GBMC submitted extensive comments on NH DES's draft 2012 303(d) list. NH DES's responses to these comments are reproduced below, and add to other information in NH DES's AR providing a thorough description and explanation of the relationships among nitrogen, attenuation of light in the receiving waters, and resulting declines in eelgrass survival and growth, all of which supports NH DES's decision to include the waters in question on its 2012 303(d) list.

GBMC comment #1:[33]

GBMC requested that NH DES remove from its draft 2012 303(d) list "all nitrogen-caused transparency exceedances related to eelgrass." GBMC also asserted that NH DES assumes that all eelgrass loss in the estuary is a result of nutrients.

[33] The numbering adopted here by EPA is simply for ease of presentation and does not track any numbering used in the commenters' comments or in NH DES's responses.

NH DES's response to GBMC's comment #1, included the following passages:

"The impairments for light attenuation ("transparency/TN-based listings") cannot be deleted from the 303(d) list because light attenuation is a good indicator of eelgrass survival and there is a statistically significant relationship between light attenuation and total nitrogen in the estuary. The GBMC has argued that light attenuation is naturally occurring and unrelated to nitrogen, especially in the tidal rivers.
In the N.H. Surface Water Quality Regulations, "naturally occurring" means conditions which exist in the absence of human influences (Env-Wq 1702.29)."

"Figure 2a [of the State's 2012 draft CALM] shows that light attenuation and total nitrogen have statistically significant relationships in the estuary, including in the tidal rivers (Figure 2b). Total nitrogen concentrations are a strong indicator of human influence. Therefore, given the relationship between light attenuation and total nitrogen in the estuary, including in the tidal rivers, it cannot be justified that light attenuation is "naturally occurring" nor can it be justified that light attenuation is unrelated to nitrogen concentrations."

"There are multiple ways that excess nitrogen impacts eelgrass in the Great Bay Estuary. First, like all plants, eelgrass needs light to survive. Increasing nitrogen concentrations cause algae blooms (Figure 3) and elevated primary productivity in general. The plant matter floating in the water shades the eelgrass plants so they do not get enough light to survive. Figure 4 shows that light attenuation in the Great Bay Estuary is more strongly correlated with plant/organic matter in the water than any other factor. Second, excess nitrogen creates an environment in which epiphytes can grow on the leaves of eelgrass and macroalgae can out-compete and smother eelgrass. Field studies in Nettleton et al. (2011) and Pe'eri et al. (2008) have demonstrated that macroalgae has increased, dramatically in some places, as nitrogen has increased in the estuary. Finally, excess nitrogen disrupts cellular processes for eelgrass (Burkholder et al., 2007)."

"The dominant mechanism by which nitrogen affects eelgrass is different in different parts of the Great Bay Estuary and can vary over time. Light attenuation, a general measure of water clarity, is a good indicator of the presence or absence of eelgrass especially in the deeper areas of the estuary. Subtidal eelgrass beds in these areas need clear water to transmit light to the growing depths. In shallower areas, overgrowth and smothering by macroalgae and/or cellular disruption may be the immediate cause of eelgrass loss. However, even in shallow areas, light attenuation is still an important contributing factor for eelgrass viability because sufficient light is a requirement for plant survival in all areas."

"Eelgrass may be impacted by other factors such as sediments, dredging, and disease. However, the strong relationships between nitrogen, light attenuation and algae growth demonstrate that nitrogen is most likely the dominant cause of, and certainly contributes

significantly to, eelgrass losses in the Great Bay Estuary. Figure 5 shows that light attenuation increases with increasing nitrogen concentrations in the Great Bay Estuary, even accounting for changes in salinity. The same robust relationship is evident between total nitrogen and algae growth (chlorophyll-a) (Figure 3). These figures show that the relationships are robust, not merely correlations due to salinity differences. The strong relationships between nitrogen and chlorophyll-a and light attenuation are not surprising because these factors are well established indicators of eutrophication, which is caused by excess nutrients."

Finally, in response to GBMC's claim that NH DES assumes that all loss of eelgrass is due to nutrients, NH DES stated that in its Consolidated Assessment and Listing Methodology, the protocol for assessing eelgrass loss explicitly requires a review of non-nutrient factors, such as dredging, in areas with significant eelgrass loss.

GBMC comment #2:

GBMC asserted that there is uncertainty about why eelgrass populations are changing in the estuary.

NH DES's response to GBMC's comment #2.

NH DES indicated in its response that it has "relied on its analysis of the long-term data and possible confounding factors, coupled with accepted hypotheses of the relationships between nutrients and their effects, to state with reasonable scientific certainty that anthropogenic nitrogen has caused or contributed to the observed decline in eelgrass in the Great Bay Estuary."

"One of the supporting statements relied upon by the commenter claims that: 'On Piscataqua River, eelgrass were first declining (2003-2007) where water quality was the best (Harbor mouth) and moved to upstream areas. Why this occurred is unknown (see Short dep.)'. This statement is not supported by the data. Eelgrass was completely absent in the Upper Piscataqua River in 2007, while there were still 201.3 acres of eelgrass in Portsmouth Harbor. This pattern is consistent with observations of poorer water quality in the Piscataqua River compared to Portsmouth Harbor. The commenter's claim that eelgrass was able to survive under pre-2000 conditions is unsupported and can be explained by a delayed response of eelgrass to stresses."

GBMC comment #3:

GBMC commented that water quality in the Great Bay is not limited by transparency.

NH DES's response to GBMC's comment #3.

NH DES responded that it interprets the comment "as meaning that the clarity of the water is not the major limiting factor for eelgrass survival." NH DES stated that "it agrees that one of the reasons why eelgrass still exists in Great Bay proper is the exposure of eelgrass plants to direct sunlight during low tide. However, water clarity is not the only way in which nitrogen affects eelgrass" as explained in responses to other GBMC comments. "Therefore, the claim that Great

Bay proper is not transparency limited does not mean that nitrogen does not affect eelgrass in the Great Bay proper."

GBMC comment #4:

The commenter claims that "nitrogen increases have not caused excessive plant growth or any change in transparency adversely impacting eelgrass."

NH DES's response to GBMC's comment #4, included the following:

"[] DES interprets the claim to refer specifically to phytoplankton, which is one of many types of algae. Similarly, location is not defined in the comment but DES interprets the comment to mean Great Bay proper because that is the only place for which phytoplankton records extend back to 1980. With those definitions, it is correct that there have been no clear trends in chlorophyll-a (a specific measurement of phytoplankton) measured in Great Bay over the full period of record from 1974 to 2011 in Great Bay (PREP, 2013 at 16). However, the comment ignores the fact that phytoplankton are not the only form of algae that is important in a shallow estuary like the Great Bay. For shallow systems, it is expected that changes in macroalgae will precede changes in phytoplankton (McGlathery et al., 2007; Valiela et al., 1997), which is what is actually happening in Great Bay. At the mouth of Lubberland Creek in Great Bay, macroalgae increased from 0.8 to 39.3 percent cover between 1980 and 2010 (PREP, 2013 at 16)."

"GBMC has previously acknowledged that macroalgae has increased in the estuary. In a letter from Dean Peschel to Harry Stewart on November 14, 2011, the GBMC stated that "Great Bay waters (excluding the tidal rivers) should be identified as impaired due to excessive macroalgae growth, and the parameter of concern causing the impairment should be identified as DIN." (Peschel, 2011 at 3)."

"Accordingly, the claim is only theoretically accurate if it is read as pertaining solely to phytoplankton and not to all types of algae, including some that may be more significant."

"The commenter's claim that eelgrass 'thrived' under high nutrient concentrations is unsupported and can be explained by a delayed response of eelgrass to stresses. The transparency data in Great Bay cited by the commenter was from one near-shore location that did not necessarily reflect conditions in the whole bay. Finally, the conclusions of the study by Morrison et al. (2008) regarding light attenuation factors, such as colored dissolved organic matter, were only applicable to deep areas of the estuary and did not consider all of the mechanisms by which eelgrass can be affected by nutrients (e.g., macroalgae, as discussed above)."

GBMC comment #5:

New Hampshire DES stated that GBMC commented that "application of 2009 numeric criteria in tidal rivers [is] (sic) unsupported."

NH DES's response to GBMC's comment #5, included the following:

"DES interprets this claim as specifically pertaining to the question of whether reducing nitrogen concentrations in the tidal rivers will allow for eelgrass re-establishment. DES does not dispute that colored dissolved organic matter (CDOM) and turbidity are important factors related to water clarity in the tidal rivers. However, eelgrass was mapped in significant quantities in the tidal rivers in 1948. Average CDOM levels in the tidal rivers are not expected to have changed over time. Therefore, if naturally occurring CDOM and turbidity were the only factors controlling transparency (and presumably eelgrass survival) in the rivers, it would not have been possible for eelgrass to have existed in these areas at any point in history."

"The commenter's claim that eelgrass restoration in the tidal rivers will be unsuccessful is predicated on the assumption that the only way that nitrogen affects eelgrass is through phytoplankton blooms that cause shading. In fact, there are several other ways that excess nitrogen can affect eelgrass. In response to similar comments from the GBMC on the 2012 Consolidated Assessment and Listing Methodology, DES showed that total nitrogen accounts for 27% of the variability in light attenuation in the tidal rivers."

"It must also be recognized that eelgrass has been present in New Hampshire's tidal rivers in recent times. The fact that eelgrass has been detected in the tidal portions of the Winnicut, Lamprey, Oyster, Bellamy, and Upper Piscataqua Rivers in recent years (i.e., since 1981 when the first modern comprehensive mapping was conducted) demonstrates that it should be possible to restore eelgrass in these areas."

GBMC comment #6:

GBMC commented that there is uncertainty about the cause of macroalgae growth.

NH DES's response to GBMC's comment #6, included the following:

"[C]omments provided by Dr. Art Mathieson of the University of New Hampshire clearly link increases in macroalgae blooms to increased nutrients." See Dr. Mathieson's comments above, earlier in this EPA TSD.

GBMC comment #7:

GBMC commented that eelgrass restoration is occurring under existing conditions.

NH DES's response to GBMC's comment #7:

NH DES indicated that it "interprets this comment to refer specifically to eelgrass in Little Bay...."

"The eelgrass data for Little Bay were recently reviewed by the PREP Technical Advisory Committee for the 2013 State of Our Estuaries report. The recent data were summarized in the following way.

> "The new eelgrass bed in Little Bay may be a positive sign. Starting in 1996, eelgrass has declined in this area over time and was essentially absent from 2007 through 2010. However, in 2011, a 48-acre eelgrass bed was observed in this area. The large variance in eelgrass cover in this area shows the variability of eelgrass recovery. Data from 2012 and future years are needed to determine if this bed will persist showing an improving trend in Little Bay. (PREP, 2013 at 20)."

NH DES further responded to the comment by stating that "[t]herefore, based on the available data, it is premature to conclude that 'eelgrass restoration is occurring under existing conditions' in Little Bay specifically. The data for the Great Bay Estuary as a whole continue to show decreasing trends for eelgrass habitat (PREP, 2013 at 20)."

GBMC comment #8:

NH DES stated that GBMC commented "that the report by Jones (2007) 'confirmed that nitrogen is not the cause of the impairments EPA is intending to address.'"

NH DES's response to GBMC's comment #8:

NH DES indicated in its response that GBMC's representation of the Jones report "is not an accurate representation of the report." NH DES stated in response that "[t]he Jones (2007) report actually concludes with the following statement, which is far from confirming that nitrogen is not the cause of the impairments:

> "Despite being a consistently significant source of nutrients to the river, DO conditions at the outfall pipe were never below target levels. However, the oxygen demanding processes that are stimulated by nutrients may not take place immediately at the outfall pipe. Thus, the widespread low DO levels on 8/19/05 downstream of the WWTF may have been caused by discharged nutrients, as well as the more confined low DO levels observed on 8/5/05. The elevated chlorophyll-a levels observed downstream of the Exeter WWTF on two dates also supports this scenario. (Jones, 2007 at 37)."

GBMC comment #9:

GBMC commented that phytoplankton concentrations in the estuary are low and not increasing and, therefore, could not have affected eelgrass populations.

NH DES's response to GBMC's comment #9:

NH DES responded to the comment by stating that

"[P]hytoplankton blooms are not the only way in which nitrogen can affect eelgrass populations. Second, the phytoplankton data cited by GBMC in support of the comment are only from open bays where concentrations are low. In the tidal rivers, the 90th percentile concentrations of

chlorophyll-a are much higher, ranging from 8 to 30 ug/L in tidal rivers with sufficient data. [citation omitted]."

NH DES also stated that GBMC "misrepresents several pieces of supporting evidence." For one example, NH DES indicated that in the "2009 PREP report, Figure NUT3-5 actually demonstrates an *increasing* trend for chlorophyll-a in Great Bay."

GBMC comment #10:

NH DES stated that GBMC commented "that data from the estuary's tidal rivers do not show any significant relationship between algal levels and minimum DO occurrence."

NH DES's responses to GBMC's comment #10:

NH DES responded to this comment first by stating that "Figure 27 from the DES 2009 numeric criteria document, which includes data from the tidal rivers, shows such a relationship."

NH DES also responded that certain exhibits submitted by GBMC:

"[A]ttempt[] to show that chlorophyll-a was not well correlated with water clarity and, therefore, that other factors such as turbidity and colored dissolved organic matter (CDOM) must be controlling light attenuation. The exhibits contain different types of graphs for the different rivers and, in the case of the Upper Piscataqua River graph, unproven assumptions about Secchi disk measurements were used. DES does not dispute that CDOM and turbidity are important factors related to water clarity in the tidal rivers. However, eelgrass was mapped in significant quantities in the tidal rivers in 1948 (DES, 2012 at 14). Average CDOM levels in the tidal rivers are not expected to have changed over time. Therefore, if naturally occurring CDOM and turbidity were the only factors controlling transparency (and presumably eelgrass survival) in the rivers, it would not have been possible for eelgrass to have existed in these areas at any point in history."

GBMC comment #11:

GBMC commented that the Squamscott River study (HydroQual, 2012) confirmed that elevated algae was not an indicator of poor dissolved oxygen.

NH DES's responses to GBMC's comment #11:

In its responses, NH DES stated:

"This comment mischaracterizes a study of dissolved oxygen in Squamscott River by GBMC (HydroQual, 2012). The commenter argues that the report findings disprove DES's understanding that instream nitrogen concentrations result in algal growth which causes periodic low dissolved oxygen and that reducing algal and nitrogen levels will result in attainment of the dissolved oxygen standard. In fact, the actual conclusions of the report confirm the DES understanding. On Page 14 of the report, HydroQual states that 'best professional judgment

indicate that with an upgrade of the Exeter WWTP to an activated sludge system with a monthly TN limit of 8 mg/L there will be a substantial reduction in Squamscott River chl-a levels and an increase in river DO.' (HydroQual 2012 at 14) This conclusion contradicts the conclusions attributed to the report by the commenter."

"[T]he commenter claims that the Squamscott River study confirmed that elevated algae was not an indicator of poor dissolved oxygen. In fact, as discussed above . . . the Squamscott River study, funded by GBMC, concluded the opposite. The commenter repeats a misrepresentation of the findings from the study of the Squamscott River by Jones et al. (2007). (references omitted). The commenter argues that the impact of algal growth on dissolved oxygen is negligible. However, the long-term average values presented underestimate the scale of day-to-day impacts during blooms and the effects of sediment oxygen demand. Finally, the commenter misrepresents the data from the 2009 PREP State of the Estuaries report (PREP, 2009). These data show the percent of days during summer months with violations of the dissolved oxygen standard relative to the number of days in that year with valid data. The number of days with valid data varies across years. Therefore, comparisons cannot be made between two years with different nitrogen loading unless the amount of valid dissolved oxygen data is the same for the two years. The same data are presented in a clearer format in the 2013 PREP report (PREP, 2013)."

GBMC comment #12:

GBMC submitted comments relating to a 2011 study conducted by Nettleton et al.

NH DES's responses to GBMC's comment #12:

NH DES responded that GBMC misrepresents the actual conclusions of the Nettleton et al. (2011) study. The study concluded that:

> Great increases in both mean and peak Ulva and Gracilaria biomass and percent cover have occurred in the Great Bay Estuarine System. These changes coincide with increases in water nitrogen levels observed over the past two decades. The increases in nuisance algal blooms are likely the result of increased nutrient loading in the bay, and, in the case of Gracilaria vermiculophylla, may also be a symptom of a harmful invasion.
>
> Current nitrogen levels in the system are substantial enough to support even larger Ulva and Gracilaria blooms than were observed in this study, based on minimum growth requirements. If efforts are not made to reduce nutrient inputs, such harmful algal blooms, and their related side effects of hypoxia and habitat alteration, should be expected in the Great Bay Estuarine System for the foreseeable future. (Nettleton et al., 2011 at 82).

"Moreover, the 'physical evidence' allegedly contradicting the Nettleton et al. (2011) study are only photographs taken from shore on one day in the fall of 2012 at some of the sites evaluated by Nettleton. The observations were not documented or reviewed by anyone else and autumn is not the worst case season for macroalgae biomass. In contrast, the Nettleton study consisted of

five sites that were each visited 10 times over two years covering all seasons. During each site visit, macroalgae was measured at 40 locations along standardized transects. Therefore, it cannot be argued that a handful of photographs from one day disprove the 2,000 careful observations summarized in the Nettleton study."

October 19, 2012 letter from NH DES Commissioner Thomas S. Burack addressed to the Mayors of Rochester, Dover and Portsmouth, New Hampshire, who submitted comments on behalf of the Great Bay Municipal Coalition.

To illustrate even further how NH DES's AR supports the Great Bay Estuary listings in question, the NH DES's AR also included the above-referenced letter as an attachment to NH DES's responses to public comments document. Commissioner Burack's letter consisted of a cover letter and a detailed attachment that comprehensively refuted the Mayors' assertions about the water quality conditions, and the cause of those conditions, of the Great Bay Estuary. Commissioner Burack's letter (and technical attachment) contained many technical explanations, including narratives and graphs, in response to various technical assertions made by the three Mayors. Commissioner Burack's responses also clearly support New Hampshire's 303(d) listings of the water body segments in question in the Great Bay Estuary because they explain the evidence demonstrating that the listed segments "contain . . . nitrogen in such concentrations that" impair the aquatic life use (see Env-Wq 1703.14) and do not "support and maintain a balanced, integrated, and adaptive community of organisms . . ." (see Env-Wq 1703.19) and/or that the listed segments "contain . . . nitrogen in such concentrations that" impair the aquatic life use (see Env-Wq 1703.14) due to monitored levels of dissolved oxygen that do not meet the NH DES's dissolved oxygen criteria (see Env-Wq 1703.07) and/or contain high concentrations of chlorophyll-a (see Env-Wq 1703.19).

Commissioner Burack's letter states at the outset that "[a]s described in more detail in the attached document, DES refutes the various claims and allegations in your August 14, 2012 letter. In summary, DES maintains that the Great Bay estuary exhibits all the classic signs of eutrophication and that excessive nitrogen is causing or contributing to the water quality problems in the estuary." Other statements in Commissioner Burack's cover letter include the following examples, each of which supports Commissioner Burack's initial statement above about the cultural eutrophication of the estuary caused by the presence of excess concentrations of total nitrogen:

1. "The Coalition claims that eelgrass is recovering. This claim is based on an incomplete and inaccurate subset of the data. In fact, eelgrass is not 'rebounding.' The total eelgrass cover in the estuary in 2009, 2010, and 2011 was essentially unchanged and was still 35% below earlier levels. Looking at the whole dataset, it is unfortunate but indisputable that the 15-year trend for eelgrass remains downward."

2. "The Coalition claims that algal levels have not increased since 1980. This claim focuses on one type of algae (phytoplankton) and only in certain areas of the estuary, and ignores the information provided by respected UNH scientists about increasing macroalgae. In fact, the Coalition has already stated in writing that 'Great Bay waters (excluding the tidal rivers) should

be identified as impaired due to excessive macroalgae growth.' (See November 14, 2011 letter from Dean Peschel to Harry Stewart.)"

3. "The Coalition claims that nitrogen levels have returned to 1970-1980 levels. DES agrees that average annual dissolved inorganic nitrogen (DIN) concentrations in some parts of the estuary have fallen in recent years. However, [DIN] is highly variable because it is rapidly taken up by plants. Total Nitrogen (TN) concentrations show a more complete picture of nitrogen levels in the Estuary. Total Nitrogen concentrations show either no or increasing trends in locations across the estuary."

4. "There is strong evidence that the state's narrative water quality standard for nutrients is violated in most parts of the Great Bay Estuary."

The totality of Commissioner Burack's responses and the explanations contained in his October 19, 2012 letter refute the three Mayors' assertions, and demonstrate the relationship between and among excess concentrations of total nitrogen in the Great Bay Estuary and the resulting nitrogen enrichment response variables. These conditions have been documented over a long period of time in the estuary and have been demonstrated to be evidence of the cultural eutrophication that is impairing the NH DES's aquatic life designated use. As noted earlier in this TSD and in NH DES's AR, this impairment is most notably evidenced by significant declines in eelgrass and by low levels of dissolved oxygen, in violation of NH DES's water quality criteria designed to protect aquatic life (see e.g., pages 3 and 4 of this TSD). Accordingly, among the other information identified throughout this TSD and in NH DES's AR, the content of Commissioner Burack's October 19, 2012 letter further supports EPA's approval of NH DES's listing of the Great Bay Estuary water body segments in question.

III. EPA's conclusion regarding NH DES's 2012 303(d) listing of the Great Bay Estuary water body segments in question.

Section 303(d) of the Clean Water Act requires states to identify water body segments for which designated uses and water quality criteria are not being met as a result of pollution, and to establish total maximum daily loads (TMDLs) for pollutants causing the impairments of the designated uses and criteria. 40 C.F.R. 130.7.

Forty C.F.R. §130.7(b)(4) requires that a section 303(d) list of impaired waters shall, among other things, identify the pollutants causing or expected to cause violations of the applicable water quality standards. Forty C.F.R. §130.7(b)(3) states, among other things, that for purposes of establishing a section 303(d) list, the term "applicable water quality standards" refers to water quality standards established under section 303 of the Clean Water Act, including numeric criteria, narrative criteria, waterbody uses, and antidegradation requirements.

EPA's regulations provide that EPA shall approve such listing if it meets the requirements of 40 C.F.R § 130.7(b) and 40 C.F.R. § 130.7(d)(2). EPA's role in the 303(d) listing process is one of oversight and is oriented towards ensuring that a state meets the minimal requirements and does not fail to list waters. See 40 C.F.R. § 130.7(b)(6)(iv) ("Upon request by the Regional

Administrator, each State must demonstrate good cause for not including a water or waters on the list."). EPA's regulations do not impose any similar regulatory requirement that a state provide good cause for including a water on the list.

As discussed throughout this TSD and in NH DES's AR, substantial evidence exists from a variety of sources that the Great Bay Estuary is exhibiting clear signs of cultural eutrophication. The available data and other information demonstrate that the excess concentrations of total nitrogen in the Great Bay Estuary are having an adverse effect on eelgrass health, dissolved oxygen levels, water clarity, chlorophyll-a concentrations in the water column, and contributing to the proliferation of macroalgae on eelgrass beds and along the shoreline. The aquatic life use impairments that have been documented in the Great Bay Estuary by an analysis of total nitrogen concentrations and nitrogen enrichment response variables are consistent with the biological responses that are expected to result from excess inputs of nitrogen into estuarine waters and are also consistent with the NOAA conceptual model that NH DES used in its assessment of the Great Bay Estuary.

We also note that NH DES's decision to list the Great Bay Estuary waters in question not only is supported by Great Bay Estuary specific data, analyses and scientific literature contained in NH DES's AR, but also is consistent with, and reasonable in light of, the body of scientific knowledge and literature that has been developed by the scientific community and which has been referenced in EPA's nutrient criteria development documents relevant to the phenomenon of cultural eutrophication,[34] including EPA's guidance entitled "Criteria Development Guidance:

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[34] See e.g.,

a) EPA Nutrient Pollution Website. http://www2.epa.gov/nutrientpollution/problem. Accessed 4/30/15;

b) Bricker, S., B. Longstaff, W. Dennison, A. Jones, K. Boicourt, C. Wicks, and J. Woerner. 2007. Effects of Nutrient Enrichment In the Nation's Estuaries: A Decade of Change. NOAA Coastal Ocean Program Decision Analysis Series No. 26. National Centers for Coastal Ocean Science, Silver Spring, MD. 328 pp. Published Online: http://ccma.nos.noaa.gov/publications/eutroupdate/;

c) National Oceanic and Atmospheric Administration (NOAA). 2007. Effects of Nutrient Enrichment in the Nation's Estuaries: A Decade of Change;

d) Environmental Protection Agency (EPA). 2001. Nutrient Criteria Technical Guidance Manual Estuarine and Coastal Marine Waters;

e) Environmental Protection Agency (EPA). Mississippi River Gulf of Mexico Watershed Nutrient Task Force Website. http://water.epa.gov/type/watersheds/named/msbasin/zone.cfm. Accessed 5/13/15;

f) State-EPA Innovations Task Group. 2009. An Urgent Call to Action, Report of the State-EPA Innovations Task Group. August, 2009;

g) Burkholder et al. 2007. Seagrasses and eutrophication. *Journal of Marine Biology and Ecology*. 350: 47-72;

h) Short and Wyllie-Echeverria. 1996. Natural and human-induced disturbances of seagrass. *Environmental Conservation*. 23: 17-27;

Estuarine and Coastal Waters" (October 10, 2001). In evaluating NH DES's listing of the Great Bay Estuary waters on its 2013 303(d) list, EPA also analyzed NH DES's AR through the "lens" of EPA's own relevant guidance. The analyses contained in NH DES's AR are consistent with the general approaches to assessing the causes and effects of cultural eutrophication contained in EPA's guidance and the scientific references therein, including the NOAA conceptual model referenced in EPA's "Criteria Development Guidance: Estuarine and Coastal Waters" (October 10, 2001). NH DES's AR also contained the kinds of data and other information that should be collected and evaluated.

As noted earlier in this TSD, for each of the listed segments in the Great Bay Estuary, the NH DES documented the presence of excess total nitrogen and one or more nitrogen enrichment response variables at levels of concern, such as dissolved oxygen concentration, dissolved oxygen percent saturation, chlorophyll-a, eelgrass estuarine bioassessments and light attenuation coefficient (water clarity). We noted earlier that among these nitrogen enrichment response variables, key evidence identified in NH DES's AR demonstrated that the listed segments "contain . . . nitrogen in such concentrations that" impair the aquatic life use (see Env-Wq 1703.14), do not "support and maintain a balanced, integrated, and adaptive community of organisms . . ." (see Env-Wq 1703.19), show significant amounts (greater than 20%) of eelgrass loss occurring over time in the segments where eelgrass had historically grown, or consist of recent annual trends showing greater than 20% eelgrass loss. And for the listed segments where eelgrass historically has not grown, key evidence identified in NH DES's AR demonstrating that the listed segments "contain . . . nitrogen in such concentrations that" impair the aquatic life use (see Env-Wq 1703.14) are the monitored levels of dissolved oxygen that do not meet the State's dissolved oxygen criteria (see Env-Wq 1703.07) and/or contain high concentrations of chlorophyll-a (see Env-Wq 1703.19).

In summary, EPA concludes that NH DES properly listed the relevant Great Bay Estuary water bodies as not supporting the State's aquatic life designated use. EPA's conclusion is based upon all of the reasons set forth in NH DES's AR as described and identified in this TSD, including, but not limited to, the measured parameters of total nitrogen concentrations, dissolved oxygen, chlorophyll-a, light attenuation coefficient and eelgrass areal extent loss. NH DES explained and

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i) McGlathery et al. 2007. Eutrophication in shallow coastal bays and lagoons: the role of plants in the coastal filter. *Marine Ecology Progress Series*. 348: 1-18;

j) Fox et al. 2008. Macrophyte abundance in Waquoit Bay: Effects of land-derived nitrogen on seasonal and multi-year biomass patterns. *Estuaries and Coasts*. 31: 532-541;

k) Hauxwell et al. 2001. Macroalgae canopies contribute to (Zostera marina) decline in temperate estuarine ecosystems. *Ecology*. 82: 1007-1022;

l) Hauxwell et al. 2003. Eelgass *Zostera marina* loss in temperate estuaries: relationship to land-derived nitrogen loads and light limitation imposed by algae. *Marine Ecology Progress Series*. 247: 59-73;

m) Short and Burdick. 1996. Quantifying eelgrass habitat loss in relation to housing development and nitrogen loading in Waquoit Bay, Massachusetts. *Estuaries*. 19: 730-739; and

n) Environmental Protection Agency. 2000. Nutrient Technical Guidance Manual: Rivers and Streams.

demonstrated that the aquatic life use is not being met as evidenced by nonattainment of the State's dissolved oxygen criteria at Env-Wq 1703.07, the narrative nutrient water quality standard at Env-Wq 1703.14 and its narrative biological and aquatic community water quality standard at Env-Wq 1703.19. The measured total nitrogen values, combined with the documented nitrogen enrichment response variables, provide substantial evidence from which NH DES and EPA may reasonably conclude that total nitrogen levels in the listed segments of the Great Bay Estuary are associated with and are a pollutant cause of the impairments of the State's aquatic life designated use. EPA therefore concludes, consistent with 40 C.F.R. §130.7(b), that based on NH DES's AR record for its 2012 303(d) list, including the data and information contained in and referenced in this TSD, NH DES's TSD and certain of the information contained in the State's 2009 numeric nutrient criteria document, that NH DES's listing of the Great Bay Estuary waters in question with total nitrogen as a pollutant cause is appropriate, reasonable, and supported by the available data and other information. (As noted earlier in this TSD, see Table 4A-T of NH DES's TSD for a list of the specific Great Bay Estuary water body segments in question.)

Attachment B to EPA's memorandum approving NH DES's 2012 303(d) list

EPA's responses to comments submitted directly to EPA by the Great Bay Municipal Coalition (GBMC).

Introduction

By letters dated August 29, 2013 and April 10, 2014 (this second letter is actually dated April 10, 2013, but that is obviously is a typographical error), Hall & Associates, on behalf of the GBMC, submitted comments directly to EPA after New Hampshire's initial, final July 19, 2013, submittal of its 2012 303(d) list.

To fully understand and evaluate these additional comments and place them in context, it is helpful to note the timeline of New Hampshire's submission to EPA of its final 2012 303(d) list. As noted above, New Hampshire initially submitted its final 2012 list to EPA on July 19, 2013. New Hampshire's public comment period on its draft 2012 list lasted from April 20, 2012 through July 5, 2012. Subsequent to its July 19, 2013 submittal, New Hampshire decided that it should open a second public comment period relating to certain changes made to the State's list between issuance of the April 20, 2012 draft list and July 19, 2013 final list. Accordingly, New Hampshire held a second public comment period relating only to those specific changes from November 18, 2013 through December 20, 2013. None of the changes or water bodies in question related to the Great Bay Estuary waters that were the subject of the GBMC's comments. NH DES specifically noted that the additional comment period related only to the small subset of changes for which a comment period had not earlier been provided. New Hampshire eventually submitted its final 2012 303(d) list to EPA on February 12, 2014, which is the version of New Hampshire's list on which EPA is taking action.

The GBMC's August 29, 2013 letter to EPA states "[a]s the GBMC's objections are not reflected in the final 2012 list §303(d) list submitted to EPA, the GBMC hereby incorporates all of our objections [submitted to NH DES]." The wording of the August 29, 2013 letter also implies that it contains additional objections not submitted to NH DES before August 29, 2013.

Without conceding that EPA is legally required to respond to the issues raised in the GBMC's August 29, 2013 and April 2014 letters, EPA nonetheless hereby provides its responses to the GBMC's comments. EPA also notes that much of the GBMC's additional comments, beyond those submitted to NH DES, are based on statements or documents that did not exist at the time New Hampshire's relevant public comment period closed on July 5, 2012. And the comments contained in GBMC's April 2014 letter were submitted to EPA after New Hampshire's revised final list was submitted to EPA on February 12, 2014.

I. EPA's responses to summary comments contained in the cover letter to GBMC's August 29, 2013 communication to EPA.

GBMC's cover letter summary comments

In the cover letter to the GBMC's August 29, 2013 comments, the GBMC asserts in summary fashion broad objections to New Hampshire's final 2012 303(d) list, as follows:

> As the GBMC's objections are not reflected in the final 2012 § 303(d) list submitted to EPA, the GBMC hereby incorporates all of our objections contained within our submission to DES on the draft 2012 § 303(d) list. In addition to our previous objections, for the reasons stated below, we object to these impairment listings as technically and legally flawed. The primary legal and technical errors are:
>
> 1) DES applied its 2009 document entitled "Numeric Nutrient Criteria for the Great Bay Estuary" ("2009 Numeric Nutrient Criteria") for total nitrogen ("TN"), light attenuation, and chlorophyll 'a' related to transparency and dissolved oxygen ("DO") as if those were the "applicable standards" although the 2009 Numeric Nutrient Criteria has never been adopted. DES' decision to apply the TN/light attenuation criteria for eelgrass protection was based on two factors: (a) eelgrass levels were below the desired level and (b) TN levels were above 0.3 mg/l or light attenuation was below 0.5 – 0.75 m^{-1}. This assessment was not based on a "weight of evidence" demonstration that TN or light attenuation caused the eelgrass decline and was the rote application of a numeric criterion. The data from the Estuary confirms that healthy eelgrass populations exist with TN > 0.3 mg/l and light attenuation less than the proscribed values. Therefore, the approach plainly did not implement the applicable state narrative standard that requires such demonstrations.
>
> 2) DES admitted under oath that the 2009 Numeric Nutrient Criteria are not based upon a demonstrated "cause and effect" relationship for this estuary. As a narrative criteria violation under state law must be based on a cause and effect demonstration and no such demonstration has been made in this case, the 2009 Numeric Nutrient Criteria cannot be used to implement the current narrative criteria or claim a narrative criteria violation exists.
>
> 3) All relevant, site-specific studies for this system confirmed that (a) TN did not cause excessive algal growth impairing system transparency, (b) existing transparency is sufficient to allow eelgrass regrowth in the system and (c) no studies have shown that TN concentrations had anything to do with the fluctuating eelgrass populations anywhere in the system or was the cause of low DO found in the tidal rivers. *See, e.g.,* Attachment D (discussing the results of the University of New Hampshire studies performed through the Jackson Laboratory). In fact, eelgrass populations were higher from 1996-2005 with higher TN and TIN concentrations than they are today, with the lowest TN/TIN levels present in decades. *See, e.g.,* 2013 State of the Estuaries Report. Thus, the occurrence of elevated TN levels does not even correlate with the eelgrass declines reported by DES as the basis for these listings.

4) The 2009 Numeric Nutrient Criteria assumed that algal growth above 10 µg/l would impair minimum DO levels. However, all of the Great Bay DO studies confirm that DO conditions have worsened with lower algal levels. Thus, the claim that algal growth/increased TN was the cause of or significantly contributed to low DO in the tidal rivers is demonstrably incorrect.

When developing a § 303(d) list, the State must consider "all existing and readily available water quality-related data and information" (40 C.F.R. § 130.7(b)(5)) to determine if a water body is impaired, *i.e.*, is violating the applicable water quality standard. 40 C.F.R. § 130.7(a). Since DES has not considered all existing data and information (site-specific study results) and is applying the unadopted 2009 Numeric Nutrient Criteria as if it were the applicable water quality standard (regardless of the available data and studies), we request that EPA not approve the New Hampshire 2012 § 303(d) list with respect to eelgrass and DO impairments specified for the Great Bay Estuary as follows:

1) Remove all DO-based chlorophyll "a" violations and DO-based nitrogen violations.
2) Remove all nitrogen-caused transparency exceedances related to eelgrass.
3) Transparency (light attenuation) should be eliminated as a cause of impairment in Great Bay, Little Bay, the Piscataqua River and Portsmouth Harbor.
4) The designation of eelgrass loss as an impairment in the Squamscott, Lamprey, and Piscataqua Rivers should be eliminated because it appears to be the result of a natural condition caused by elevated levels of color, as DES itself has admitted.

EPA's response to GBMC's cover letter summary comments identified immediately above:

The GBMC's summary of its objections above contain: 1) assertions or conclusions that are more fully described in the attachments to the August 29, 2013 communication to EPA; or 2) broad conclusory statements without citations to supporting evidence. As such, EPA's responses below to the more detailed descriptions of the GBMC's comments contained in the attachments to the August 29, 2013 communication are intended to address these opening assertions as well.

II. EPA's responses to the more detailed comments contained in the first section of the attachment to GBMC's August 29, 2013 communication to EPA.

The attachment to the GBMC's August 29, 2013 communication is organized into two main comment sections, citing to other attached information that the GBMC asserts supports its comments. The first section of the letter is entitled "Evaluation of all existing and readily available information." As noted above, however, much of the information referenced in the GBMC's comments was created or generated after the close of the State's public comment period relating to the portion of the New Hampshire list that addressed listings in the Great Bay Estuary. Nonetheless, EPA's responses to the GBMC's specific comments are set forth below.

GBMC's comment: The GBMC references selected statements from the 2013 State of our Estuaries Report. The GBMC claims that the most recent scientific information for the estuary plainly does not support the need for stringent [total nitrogen] reductions at this time, that there is therefore no credible scientific basis to assert that extremely restrictive total nitrogen reduction requirements are mandated to abate a documented nutrient impairment, and that any claim that [total nitrogen] has caused major increases in algal (phytoplankton) blooms or excessive macroalgae growth is either demonstrably incorrect or premature speculation.

EPA's response:

EPA does not agree that the 2013 State of our Estuaries Report (SOE), when read in its entirety and without selecting individual statements taken out of their broader context, supports the GBMC's claims and conclusions. The GBMC's comment consists of its conclusions, not the SOE's conclusions. For example, the 2013 SOE evaluated 22 key indicators of the health of the estuary. Of the 22 indicators, 15 are classified as having cautionary or negative conditions or trends, while 7 show positive conditions or trends. The overall assessment concludes that there is reason to be concerned about the health of the estuary, and that increased efforts to study and restore our estuaries are needed. "At this time the Great Bay Estuary exhibits many of the classic symptoms of too much nitrogen: low dissolved oxygen in tidal rivers, increased macroalgae growth, and declining eelgrass." (SOE, pg. 12). Additionally, the report indicates that "...there have been persistent and numerous violations of the dissolved oxygen standards at stations in the tidal rivers that flow into the estuaries." (SOE, pg. 18).

According to the 2013 SOE (pg. 20), "[d]ata indicate a long-term decline in eelgrass since 1996 that is not related to wasting disease." Additionally, the 2013 SOE notes that "[t]here are also indications, based on estimates of the density of the eelgrass beds, that the remaining beds contain fewer plants and, therefore, provide less habitat." (SOE, pg. 20). Statistically significant declines in eelgrass have been observed in the Piscataqua River as well as downstream in Little Harbor and Portsmouth Harbor (SOE, pg. 20). The loss of eelgrass results in increased suspended sediments which block light penetration and can lead to further eelgrass losses. "When this habitat is lost, the sediments are more easily stirred up by wind and waves." (SOE, pg. 22).

GBMC's comment: The GBMC commented, in essence, that an affidavit of Dr. Steven Chapra's, dated February 27, 2013, identified serious technical errors and scientific flaws in NH DES's 2009 Numeric Criteria analyses used to assess and list Great Bay Estuary waters as "impaired for eelgrass and DO due to [total nitrogen] levels present in the estuary."

EPA's response: EPA's technical support document, Attachment A to EPA's memorandum approving NH DES's 2012 303(d) list, explains that NH DES's administrative record adequately supports the State's listing of the Great Bay Estuary waters in question, notwithstanding any criticisms of New Hampshire DES's 2009 Numeric Nutrient Criteria document or analyses. In

light of EPA's basis for approving those listings, i.e., on grounds that do not rely upon the specific total nitrogen values contained in NH DES's 2009 Numeric Nutrient Criteria document or analyses, the GBMC's comment speaks to a point that is not pertinent or relevant to EPA's decision to approve New Hampshire's Great Bay Estuary listings. For further explanation, please refer to EPA's technical support document, Attachment A to EPA's memorandum approving NH DES's 2012 303(d) list.

GBMC's comment: This comment relates to communications between GBMC and Drs. Richard Langan and Stephen Jones from the University of New Hampshire, which GBMC asserts confirm that EPA misinterpreted the available studies. More specifically, the GBMC asserts that a letter written by Drs. Langan and Jones in response to a letter written to them by the Mayors of the cities of Portsmouth, Dover and Rochester, "confirm that DES has misapplied and misinterpreted [certain studies] when listing these waters as nutrient impaired and EPA should not approve the 2012 [section] 303(d) list."

EPA's response: EPA disagrees with the GBMC's comment that the letter from Drs. Langan and Jones should result in a conclusion that "DES has misapplied and misinterpreted [certain studies] when listing these waters as nutrient impaired and EPA should not approve the 2012 [section] 303(d) list."

First, it is notable that the Mayors' letter to Drs. Langan and Jones focuses not on the NH DES 2012 303(d) list, but, rather, on EPA's regulatory decisions in the NPDES permit context regarding effluent limits on total nitrogen. On the second page of the letter, the Mayors identify six different "claims" allegedly made by EPA, relating to total nitrogen, phytoplankton, transparency, macroalgae, dissolved oxygen and eelgrass populations in the Great Bay Estuary. The letter then contains a section seeking answers from Drs. Langan and Jones about eight specific questions.

Second, Drs. Langan and Jones noted that the Mayors cite to claims attributed to the US EPA regarding conditions and cause and effect scenarios in the estuary. The response letter written by Drs. Langan and Jones stated that they are curious how the claims were expressed by EPA and that they would be interested in seeing the original documents from which the claims were excerpted. EPA notes that this statement by the doctors implied that they had some question about whether the alleged statements by EPA were, or may have been, taken out of context or might even have been inaccurate.

Third, the letter contains an important qualification. It states that the form of its "answers" to the Mayors' specific questions, was determined by the precise wording of the questions themselves. The important point to note here is that the Mayors' letter is designed to suggest that NH DES must rigorously "prove" (as one might design a study in a scientific laboratory) cause and effect relationships before listing waters as impaired. That is an erroneous assertion or premise in the manner intended by the Mayors' letter, and so the Mayors were asking Drs. Langan and Jones to answer the wrong question (see, for example, the quote from the Langan and Jones letter on the following page regarding the nature of data obtained by monitoring programs). EPA notes that 40 CFR 130.7(b)(4) requires that a section 303(d) list of impaired waters shall, among other

things, identify the pollutants causing *or expected to cause* violations of the applicable water quality standards (emphasis added). In any event, as indicated in EPA's technical support document, Attachment A to EPA's memorandum approving NH DES's 2012 303(d) list, NH DES's administrative record for its 2012 303(d) list adequately supports the State's conclusion that total nitrogen is a cause of the conditions of cultural eutrophication in the Great Bay Estuary waters listed as impaired.

In fact, the letter written by Drs. Langan and Jones stated:

> [B]ecause of the way your questions are worded and your request that they focus solely on studies that have been conducted in 'this system,' e.g., the Great Bay Estuary, the answers for most of the questions would be "no" with some qualifiers for a few of them. This is a function of two facts, the first of which is that most data used to frame our understanding of how nutrient dynamics in the estuary works and what causes changes in water quality conditions are generated by monitoring programs. The purpose of monitoring programs is generally to assess the status, and when extended over time and space, the trends for whatever is of concern and is being measured. Data generated from this framework are not designed to answer questions of cause and effect, source identification and other 'why' and 'how' questions; these require specific studies designed to answer them or to address hypotheses. The second fact is that there have been few or no published studies designed to answer these questions.

Fourth, the letter is, in any event, of limited value based on the admitted cursory review undertaken by Drs. Langan and Jones, as their letter included this qualifying statement:

> The comments below have been generated from our collective memory, or a quick reference to existing studies. We will not respond to these questions in depth because it would take significant time and effort to provide more thorough answers.

Finally, as noted in EPA's technical support document, Attachment A to EPA's memorandum approving NH DES's 2012 303(d) list, NH DES's administrative record contains substantial data and other information, including but not limited to thorough written explanations in response to public comments, addressing the various aspects of cultural eutrophication as they pertain to the Great Bay Estuary waters listed as impaired. NH DES's administrative record fully explained the roles of, and relationships among, total nitrogen, phytoplankton, macroalgae, transparency (or light attenuation), eelgrass populations, and dissolved oxygen in the context of waters in the estuary listed as impaired. NH DES's administrative record thus addresses the issues raised in the Mayors' letter and the response letter drafted by Drs. Langan and Jones.

GBMC's comment: The GBMC claims that certain excerpts from deposition testimony of NH DES officials and Dr. Fred Short undermine, in a variety of ways, NH DES's listing of the Great Bay Estuary waters in question. The testimony in question was provided in the context of a lawsuit filed in state court. *City of Dover v. N.H. Dep't of Envtl. Services*, Docket No. 217-2012-

CV-00212. It is EPA's understanding that the GBMC brought the lawsuit to, in essence, challenge the validity and use by the NH DES of its 2009 Numeric Nutrient Criteria document.

EPA's response: EPA disagrees that the referenced deposition testimony, understood in its entirety and along with all of the data and other available information contained in the State's administrative record, supports the GBMC's assertion that EPA "should not approve the [state's] 2012 [section] 303(d) list as it stands." In fact, NH DES prepared detailed substantive responses to certain of the GBMC's references to these depositions in the course of responding to the GBMC's comments on the State's draft 2012 303(d) list. Moreover, to the extent that the GBMC's comments submitted directly to EPA may in certain instances cite to different selected excerpts than those cited to when the GBMC commented on NH DES's draft 2012 303(d) list, EPA has concluded that the NH DES's administrative record also addressed and adequately responded to those substantive scientific, technical and legal issues which the GBMC asserts about the selected deposition excerpts. Moreover, it is important to note a number of aspects of the GBMC's comments about the deposition testimony in question, as explained below.

First, the GBMC's comments reference selected, isolated statements taken out of the overall context of the deponent's complete testimony. This, in itself, results in misleading impressions about what those individuals actually said and think about eutrophication in the Great Bay Estuary waters. Second, it should also be noted that the GBMC's specific comments consist of the GBMC's, not the deponents', characterizations and conclusions about what the selected deposition statements mean (or support) from a scientific perspective about eutrophication in the Great Bay Estuary waters. That is, the broad scientific conclusions asserted by the GBMC in its comments are the GBMC's own conclusions drawn from selected statements in the depositions taken out of context, but are not the deponents conclusions about the water quality status of the waters in question or their views about the complete set of factors playing a role in that water quality. For only one illustrative example, the first two deposition excerpts cited by the GBMC address the issue of the relationship between total nitrogen and its impact on phytoplankton growth in Great Bay, and the related scientific impact of transparency (or light attenuation) in those waters which, in turn, impacts eelgrass populations. The GBMC draws its own overly broad and inaccurate conclusion from the cited deposition testimony in stating that the testimony establishes that total nitrogen is not adversely impacting water quality in Great Bay. However, as NH DES simply and directly stated about this phenomenon in its responses to the GBMC's comments on the State's draft 2012 303(d) list:

> The [GBMC's] main claim from this section is that phytoplankton concentrations in the estuary are low and not increasing and, therefore, could not have affected eelgrass populations. First, as stated previously [in this response to comments document], phytoplankton blooms are not the only way in which nitrogen can affect eelgrass populations. Second, the phytoplankton data cited in support of the claim are only from open bays where concentrations are low. In the tidal rivers, the 90th percentile concentrations of chlorophyll-a are much higher, ranging from 8 to 30 ug/L in tidal rivers with sufficient data (DES, 2012). Third, the commenter misrepresents several pieces of supporting evidence. In PREP (2009), Figure NUT3-5 actually demonstrates an increasing trend for chlorophyll-a in Great Bay. The EPA Peer Review of the DES 2009

Report was generally supportive (EPA, 2010). One of the peer reviewers made one statement regarding low levels of chlorophyll-a. The commenter has misrepresented the overall conclusions of the peer review by implying that this one statement was the conclusion of the peer review.

The comment assumes that the only way in which nitrogen can affect eelgrass is through phytoplankton blooms that cause a reduction in water column transparency. In fact, there are multiple ways that excess nitrogen impacts eelgrass in the Great Bay Estuary. See response to comment 5- 6 [of NH DES's responses to comments document]. The transparency data in Great Bay cited by the commenter was from one nearshore location that did not necessarily reflect conditions in the whole bay. The commenter also references two EPA figures ("Figure 5-Gradient of Light Attenuation and Figure 4-Gradient of Chlorophyll-a") which do not appear in the DES 2012 303(d) Report. Finally, the commenter claims that [the] difference in median chlorophyll-a concentrations across the estuary is negligible. In fact, the data used for the 2012 assessments (DES, 2012) shows that the median chlorophyll-a concentration assessment units with sufficient data [for statistical analysis] ranged from 1.5 to 7.1 ug/L. The 90th percentile chlorophyll-a concentration ranged from 2.7 to 30 ug/L.

As stated above, EPA has concluded that when the totality of NH DES's responses to comments are considered and evaluated, NH DES responded adequately during its 2012 list public comment period to the scientific, technical and legal issues raised by the GBMC's comments relating to the deposition testimony provided by these persons. The various substantive technical issues alleged by the GBMC to be addressed in the deposition testimony were exhaustively responded to throughout the NH DES's responses to the GBMC's full set of comments provided during the State's public comment period; e.g. total nitrogen's relationship to algal growth, transparency or light attenuation, dissolved oxygen and eelgrass loss in the waters in question. EPA believes that NH DES's responses to the GBMC's submitted comments and the State's administrative record as a whole adequately refuted the GBMC's assertions and claims and supports listing the Great Bay Estuary waters in question.

GBMC's comment: This comment relates to certain Freedom of Information requests submitted by GBMC to EPA Region 1 and EPA Headquarters. The comment refers to the GBMC's May 4, 2012 scientific misconduct allegation asserted against EPA Region 1 in relation to the development of NH DES's 2009 Numeric Nutrient Criteria document. Although the GBMC recognized in its comment that EPA's Office of Water concluded there was no evidence of such misconduct, in its comment the GBMC points to the fact that the GBMC submitted requests to EPA under the Freedom of Information Act (FOIA) seeking records demonstrating that such misconduct did not occur and seeking scientific studies relating to nitrogen's effect on light attenuation and eelgrass population in the Great Bay Estuary. The comment concludes that EPA has no analyses or documents showing that total nitrogen caused a violation of narrative standards, was responsible for eelgrass decline, or caused low DO to occur in the tidal rivers.

Therefore, the GBMC concludes, the State's 2012 303(d) list is in error and unsupported by substantial evidence.

EPA's response: As set forth in detail in EPA's technical support document, Attachment A to EPA's memorandum approving NH DES's 2012 303(d) list, EPA disagrees with the GBMC's assertions that there is insufficient evidence to list the Great Bay Estuary waters as impaired and to identify total nitrogen as a pollutant cause of the impairments. More specifically, EPA disagrees that its responses to the GBMC's FOIA requests establish such lack of evidence.

EPA responded adequately to the GBMC's FOIA request by providing responsive documents. As noted in the GBMC's comment, EPA disagrees with the GBMC's allegations of scientific misconduct, and EPA also does not agree with the GBMC's characterization that EPA Region 1's FOIA response demonstrates that EPA has no analyses or documents showing nitrogen's relationship to nutrient-related impairments in the Great Bay Estuary and that the State's 2012 303(d) list is in error and not supported by substantial evidence. As explained in EPA's technical support document, Attachment A to EPA's memorandum approving NH DES's 2012 303(d) list, EPA has concluded that the State's administrative record contains substantial evidence of nitrogen's role in the cultural eutrophication of the listed waters in the Great Bay Estuary. Additionally, it is not clear how the GBMC expected that NH DES would consider or evaluate the nature of EPA's response to the GBMC's FOIA requests in relation to development of its 2012 303(d) list. Moreover, issues surrounding the FOIA requests that sought information relating to the GBMC's scientific misconduct allegations were litigated in federal district court. As to the nature and intent of the GBMC's FOIA requests, the United States District Court for the District of Columbia stated "[a]t best, the October 22 Requests as originally written could be construed as questions or interrogatory-like requests, asking EPA to agree or disagree with the various contentions of the GBMC under the guise of a FOIA request. At worst, the requests were designed as a trap: either EPA produced or created documents disproving the GBMC's accusations, or the GBMC would assume based on the lack of response that EPA could not disprove them. While the requests nominally requested documents, EPA properly construed them as not adequately describing the records sought, and EPA thus had no obligation to process the October 22 Requests as originally worded." See *Hall & Associates v. United States Environmental Protection Agency*, Civil Action No. 13-cv-823 (TSC), at 13, 14 (March 2015).

III. EPA's responses to the more detailed comments contained in the second section of the attachment to GBMC's August 29, 2013 communication to EPA.

The second part of the attachment to GBMC's August 29, 2013 letter is entitled "2012 [section] 303(d) List Based Upon An Unadopted Water Quality Standard."

GBMC's comment: In essence, this comment asserts that the NH DES's 2009 Numeric Nutrient Criteria document constitutes a revised water quality standard for federal Clean Water Act purposes and it was therefore "clear error" for New Hampshire to use the criteria document for assessment and listing purposes because its content was not adopted into state law. The comment asserts that an EPA Region 4 letter, dated June 27, 2013, supports the GBMC's

assertion that application of EPA's four-part test for determining whether certain language or information constitutes a water quality standard demonstrates that NH DES's 2009 Numeric Nutrient Criteria document constitutes a water quality standard.

EPA's response: First, EPA disagrees with the GBMC's comment that application of EPA's four-part test results in a conclusion that NH DES's 2009 Numeric Nutrient Criteria document constitutes a water quality standard. Most critically, one part of that test requires that the language in question be legally binding. EPA disagrees with the GBMC's assertion that the numeric criteria document constitutes a water quality standard because it is being used "as though it was adopted" even though it has not been adopted into state law. NH DES's 2009 Numeric Nutrient Criteria document is in essence a guidance document that is not legally binding. In any event, the GBMC litigated in federal district court the question whether NH DES's 2009 Numeric Nutrient Criteria document constitutes a water quality standard, and the court held that the document was not a water quality standard. In *City of Dover v. United States Environmental Protection Agency*, 36 F. Supp. 3d 103, 110 (Dist. Court, Dist. Of Columbia 2014), the Court stated:

> After conducting a site-specific water quality analysis of the Great Bay Estuary waters (the waters at issue here), working closely with EPA, and receiving public comments, the New Hampshire Department of Environmental Services ("NHDES") published a report ("the 2009 Document") "contain[ing] proposals for numeric nutrient criteria for different designated uses in the Great Bay Estuary." Ex. 1 to Compl. [ECF No. 1-1] 74 ("2009 Document"). Put differently, the 2009 Document contains proposed translations of New Hampshire's narrative standards into numeric values. As explained in the Court's previous opinion, however, the 2009 Document is not itself a state water quality standard. Mem. Op. at 10.

In that previous opinion, *City of Dover v. United States Environmental Protection Agency*, 956 F. Supp. 2d 272, 281 (Dist. Court, Dist. Of Columbia 2013), the Court stated that "[t]he decision not to promulgate the 2009 Document into law hence is not an "illegal procedure" for amending a water quality standard, but something that precludes the report from being a revised water quality standard in the first instance." The Court also stated that "[t]he 2009 Document is a report by an agency without binding effect, rather than a statute or a regulation."

Second, as explained in EPA's technical support document, Attachment A to EPA's memorandum approving NH DES's 2012 303(d) list, EPA's approval does not rely on the use of the total nitrogen values contained in the NH DES's 2009 Numeric Nutrient Criteria document.

IV. EPA's responses to comments contained in GBMC's April 10, 2014 communication to EPA.

This letter of GBMC's consists of comments relating to certain developments that occurred in relation to the NH DES's 2009 Numeric Nutrient Criteria for the Great Bay Estuary, subsequent to New Hampshire submitting its revised final 2012 303(d) list to EPA in February 2014.

GBMC's comment: The GBMC asserted that it would be improper for EPA to approve the [total nitrogen] impairment designations for the Great Bay Estuary contained in the New Hampshire

2012 § 303(d) list as submitted. Subsequent information and analyses, as well as the settlement agreement, confirms that the listing is not properly based. As DES (the author of the 2009 Criteria document) has acknowledged that, given the 2104 peer review report, the 2009 Criteria document should no longer be used as the basis for deriving and developing its Section 305(b) and 303(d) water quality assessments for the Great Bay Estuary, it would be arbitrary and capricious for EPA to approve the New Hampshire 2012 § 303(d) lists based upon application of the 2009 Criteria document.

EPA's response: Over the course of several years, ending in 2009, NH DES developed a document entitled "Numeric Nutrient Criteria for the Great Bay Estuary," which included a CWA section 303(d) assessment and listing methodology created for the purpose of translating the State's narrative nutrient water quality criteria into numeric values for a number of parameters relevant to the phenomenon of cultural eutrophication including, but not limited to, total nitrogen. As the NH DES's 2012 TSD[1] stated:

> "Translators are a common tool employed by state environmental agencies as a method to interpret existing narrative water quality standards so that they can be applied to specific waters. Numeric translators were developed for chlorophyll-a, light attenuation (a general measure of water clarity), total nitrogen, and eelgrass cover. Chlorophyll-a was chosen because it is an accepted indicator of algae blooms and primary productivity. Light attenuation was selected because it is a good indicator of the presence or absence of eelgrass especially in the deeper areas of the estuary. Even in shallow areas, light attenuation is still an important contributing factor for eelgrass viability because sufficient light is a requirement for plant survival in all areas. Total nitrogen was used because it is a stable indicator of excess nutrients, as opposed to the more reactive form of dissolved inorganic nitrogen, which is rapidly removed from the water by algae and plants. Finally, the area of estuary that is covered by eelgrass habitat was used because it is a direct measurement of the health of this keystone species. Translators were not needed for dissolved oxygen and dissolved oxygen saturation because the State already has water quality criteria for these parameters (Env-Wq 1703.07)."

NH DES applied the numeric assessment and listing methodology when listing as impaired certain segments in the Great Bay Estuary on the State's final 2008, 2010 and 2012 303(d) lists. Scientific peer review studies undertaken prior to New Hampshire finalizing its 2012 303(d) list were supportive of the NH DES's 2009 numeric criteria document. However, certain questions about particular aspects of the numeric assessment and listing methodology were raised by a newly undertaken peer review completed *after* New Hampshire finalized its 2012 303(d) list and submitted the list to EPA for review. NH DES submitted its final 2012 list to EPA on February 12, 2014. The peer review report, dated February 13, 2014, was drafted by a four-person panel and was designed to evaluate NH DES's 2009 numeric criteria document primarily in relation to whether the total nitrogen numeric target values were appropriate as threshold values, to be used in conjunction with other parameters or nitrogen enrichment response variables, for determining attainment or nonattainment of the State's water quality standards and protection of uses. It is

[1] NH DES's 2012 Section 305(b)/303(d) List Technical Support Document, Assessments of Aquatic Life Use Support in the Great Bay Estuary for Chlorophyll-a, Dissolved Oxygen, Water Clarity, Eelgrass Habitat and Nitrogen. 2012. Page 2.

important to note that the February 13, 2014 peer review did not conclude that total nitrogen was not a factor contributing to the symptoms of cultural eutrophication in the Great Bay Estuary.

Subsequent to issuance of the peer review panel's February 13, 2014 report, the State of New Hampshire and the NH DES entered into a settlement agreement with the Cities of Dover, Portsmouth and Rochester, New Hampshire "for the purpose of settling the claims, controversies and disputes" relating to then pending litigation between the parties in New Hampshire Supreme Court. It is important to note that the terms of the settlement agreement were limited in scope to the following:

1. NH DES agreed not to use the 0.45, 0.30, 0.27 or 0.25 mg/L total nitrogen numeric thresholds contained in the DES 2009 numeric criteria document for purposes of water quality assessments and listings under CWA sections 305(b) and 303(d) "for the Great Bay Estuary, including the Cocheco and Piscataqua Rivers, and Portsmouth Harbor"; and

2) NH DES also agreed to "modify" its January 2014 Consolidated Assessment and Listing Methodology (CALM) consistent with the agreement not to use the above-referenced total nitrogen values.

We note that NH DES has never withdrawn from EPA its February 2014, 2012 303(d) list submission, despite having entered into the above-referenced settlement agreement. EPA has reviewed the terms of the settlement agreement and has concluded that the State's agreement not to use specific total nitrogen values as thresholds for listing purposes does not prevent EPA from approving NH DES's 2012 303(d) listings related to the Great Bay Estuary. NH DES's 2009 numeric criteria document, when considered and understood in its entirety, along with the substantial data and other information (obtained over the course of many years) documenting the phenomenon of cultural eutrophication in the Great Bay Estuary, analyzed a variety of data, other information and relevant physical factors beyond the comparatively narrow question of exactly which specific numeric values for total nitrogen should or could play a role in determining whether the State's water quality criteria are being met in the Great Bay Estuary and whether the State's uses are being protected. In other words, there are substantial data and other supporting information contained within the NH DES's administrative record for its 2012 303(d) list that fully support the NH DES's inclusion of the waters in question on the State's 2012 303(d) list. And this is true regardless of whether the judgment to list those waters as impaired due to nitrogen loadings involves application (or not) of the numeric total nitrogen values contained in NH DES's 2009 numeric criteria document. Even if the NH DES's 2009 report's specific numeric total nitrogen values for assessment and listing purposes are set aside, there is substantial information in the record to support the listing of the Great Bay Estuary as not meeting applicable water quality standards and that excess nitrogen concentrations is at least a cause of the State's aquatic life use impairments in the estuary.