EXHIBIT– 22

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Cc:	"Peter H. Rice"; dean_peschel@yahoo.com; Sean Greig (sgreig@newmarketnh.gov); "Jennifer Perry"; "David Green (david.green@rochesternh.net)"; jpeltonen@sheehan.com; Robert R. Lucic; Dana Bisbee; E Tupper Kinder (ekinder@NKMLawyers.com); smwoodland@cityofportsmouth.com; John Hall; Tonja Scott
Subject:	Supplemental Comments by the Great Bay Coalition re: draft NPDES permits No. NH0101311 (Dover), No. NH0100871 (Exeter), and No. NH0100196 (Newmarket)
Date:	Thursday, November 08, 2012 4:00:00 PM
Attachments:	Burack Letter 10.19.12.pdf DES slides from EPA Meeting on 9-28-12 (M2157867).pdf Great Bay Municipal Coalition Supplemental Comments 11.8.12.pdf

Dear Mr. Perkins,

Attached, please find an electronic copy of supplemental letter comments submitted on behalf of the Great Bay Municipal Coalition. In addition, please find attached a letter from New Hampshire Department of Environmental Services' Commissioner Burack dated October 19, 2012 and slides submitted by DES to EPA and to the town of Exeter at a meeting on September 28, 2012 confirming DES/EPA new basis for imposing stringent nitrogen limits has switched from the need to improve water column transparency to macroalgae control.

Thank you for your consideration of this information and we look forward to your response,

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November 8, 2012

VIA E-MAIL

Mr. Harry T. Steward, P.E.
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Stephen S. Perkins, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency Region I
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Re: Supplemental Comments Regarding Confirmation of Major Scientific Errors/Uncertainties Regarding Proposed TN Reduction for Great Bay Estuary by DES and Request for Reopening Public Comment Period

Dear Messrs. Stewart and Perkins:

As you know, at the meeting with the Town of Exeter on September 28, 2012, DES presented a number of slides that were intended to provide the technical basis on the need for nitrogen reduction. A copy of those slides is included for reference. (see attached). Based on the discussion during that meeting and a recent letter from Commissioner Burack dated October 19, 2012 (see attached), it is apparent that the rationale for seeking to impose stringent nitrogen limitations has changed and that the parties have overlooked several critical admissions made under oath during the depositions in *Dover et al. v New Hampshire Department of Environmental Services*, Docket No. 217-2012-CV-00212. It has become clear that macroalgae growth in Great Bay is now DES' primary concern associated with nutrient loadings. As the permit rationale appears to be shifting and the Great Bay Municipal Coalition ("the Coalition") did not have a prior opportunity to comment on these latest bases for regulatory action, the following (including the more detailed discussion of the slides presented at the Exeter permit meeting and the October 19, 2012 letter as discussed in the attachments) provides our supplemental comments on these issues.

DES Confirms Major Scientific Errors/Uncertainties Related to Proposed TN Limitations

On October 19, 2012, Commissioner Burack responded to the Coalition's request for a meeting to discuss new information regarding nutrient effects on the Great Bay Estuary and the Coalition's request for an independent peer review. In that letter, DES agreed with the Coalition that water column transparency is not the main ecological concern, as follows:

- Algal levels in the system [the Great Bay Estuary] did not change materially from 1980 to present, despite an increase in TN levels between 1980 and 2004.
- Transparency in the major tidal rivers (Squamscott, Lamprey, Upper Piscataqua) is poor, but the available data (not previously analyzed by DES) shows that (a) the effect of algal growth on transparency is negligible, (b) naturally occurring CDOM[1] and turbidity are the key factors controlling transparency in the system.
- Great Bay itself is generally not a transparency limited system because eelgrass receive sufficient light during the tidal cycle.
- The various DES/PREP analyses that evaluated whether (a) TN increases had caused changes in transparency, algal levels or DO and (b) a "cause and effect" relationship between TN and transparency/DO existed, were excluded from the technical information presented in the 2009 numeric nutrient criteria document and, therefore, were never presented to EPA's internal peer review panel.
- Dissolved nutrient concentrations (which directly effect macroalgae growth) have now returned to 1970-1980 levels. This dramatic change in ambient DIN levels appears to be the result of reduced rainfall and increased eelgrass growth.

In addition, DES did not deny that the following statements are correct:

- TN inputs could not have caused changed water column transparency in the system and reducing TN inputs will not materially improve system transparency as is assumed by DES.
- Regulating point source TN discharges to the tidal rivers will not result in any demonstrable improvement in the transparency or allow for eelgrass re-establishment in those areas.

[1] Previously submitted photograph taken on October 31, 2012 at Salmon Falls River in Rollinsford, NH confirming CDOM has a major impact on water column transparency in the tidal rivers of the Great Bay Estuary.

In the letter, DES disagreed with statements the Coalition made concerning conclusions drawn from DES/PREP analyses and DES' failure to consider natural conditions as a cause for declining eelgrass populations. In its explanation for why it disagrees with the Coalition's statement, DES has cited new information and analyses compiled or developed by DES after the public comment period closed.[2] The new information and analyses are being used by DES to stand for the proposition that macroalgae growth is the primary concern for eelgrass protection in the Great Bay Estuary; not water column transparency.

DES New Concern: Macroalgae Growth

Previously, DES and EPA indicated that eelgrass restoration related to improving transparency in the Great Bay Estuary was the primary basis for imposing nitrogen limitations. Given that the focus is now on macroalgae in Great Bay, it is inappropriate for EPA to calculate permit limits based on achieving transparency criteria for eelgrass growth. We presume that the focus has shifted to macroalgae because Mr. Trowbridge acknowledged that the existing data show TN reductions will not materially improve transparency in the major tidal rivers (Squamscott, Lamprey, Upper Piscataqua) due to naturally poor transparency caused by turbidity and CDOM (Trowbridge Dep. @ 421-434). Likewise, under those circumstances, Mr. Currier testified that application of the transparency-based 2009 numeric criteria to the major tidal rivers was inappropriate (Currier Dep. @ 88, 136-7). Because the macroalgae "criteria" for Great Bay, as published by DES, is substantially less restrictive than the 0.3 mg/l TN criteria used by EPA for permit evaluations, reconsideration of the stringent nitrogen limits should occur.

To have a narrative criteria violation it must be demonstrated that the degree of macroalgae growth occurring is ecologically detrimental, in addition to demonstrating that excessive nutrient levels caused this condition to occur. Regarding the ecological concerns presented by macroalgae there are several factors that should be considered:

1. Mr. Trowbridge previously testified that macroalgae are not identified as an ecological problem in any of the tidal rivers. (Trowbridge Dep. 380-381). It is not apparent that the existing macroalgae growth is impairing the bays ecological resources. (Trowbridge Dep. @ 104-5, 149-57, 259-62).

2. Mr. Trowbridge did not oppose Dr. Short's findings that current macroalgae growth has not been demonstrated to prevent eelgrass restoration anywhere in Great Bay (Trowbridge Dep. at 104-105). It should be noted further, that macroalgae in Great Bay, grow predominantly on tidal flats that do not support eelgrass. Regardless of macroalgae levels, eelgrass populations in Great Bay rebounded roughly 40% from 2007-2011 (Trowbridge Dep. at 156-157, 240-241).

[2] DES relies on new information/studies provided by Mathieston and Nettleton, et. al. See Mathieson, A.C. 2012. Nutrients and Macroalgal problems within the Great Bay Estuary System. Comments provided to the Piscataqua Region Estuaries Partnership and New Hampshire Department of Environmental Services from Arthur Mathieson, Jackson Estuarine Laboratory & Department of Biological Sciences, University of New Hampshire, Durham, NH. June 11, 2012; Nettleton, J.C., C.D. Neefus, A.C. Mathieson, and L.G. Harris. 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. A final report to the National Estuarine Research System under Graduate Research Fellowship Award NA08NOS4200285. University of New Hampshire, Department of Biological Sciences, Durham, NH.

3. In the past 4 years, macroalgae growth has apparently begun to increase in the intertidal areas (mud flats exposed at low tide) but eelgrass population regrowth, occurring in deeper waters, does not appear to be materially impacted (Trowbridge Dep. at 104-105, 156-157, 240-241).

4. How to control macroalgae growth is not well understood. Simply presenting data on changing macroalgae growth provides little insight on options for controlling macroalgae growth. If these are invasive species, it may not be possible to limit their growth. In fact, we now appear to have more macroalgae growth at *lower* nitrogen levels than occurred in the mid-1990s when eelgrass growth was robust. Unless the relationship between TN levels and macroalgae growth is adequately defined, the utility of controlling point source TN is simply unknown.

5. More recent physical evidence (pictures of sites addressed by Nettleton in 2008) shows far less, if not minimal, macroalgae growth in the same locations in the fall of 2012. (Copies of the 2012 macroalgae pictures for Lubberland Creek, Depot Road and Wagon Hill Farm were previously submitted to EPA). Why this change has occurred is unknown but certainly underscores that the 2009 Nettleton report and pictures therein, cannot be used as evidence nitrogen has caused dramatic changes in macroalgae. Such growth is plainly ephemeral, changes year to year and its significance needs to be studied further.

6. The 2009 Criteria document, relied upon by EPA to develop the TN limitations, addresses the problem of macroalgae proliferation effecting eelgrass populations in Great Bay in less than one page of this 120 page document, showing that DES did not believe macroalgae growth was a primary concern for eelgrass protection in the Great Bay Estuary. Moreover, the 2012 draft 303(d) list does not claim there is an existing macroalgae impairment anywhere in the Great Bay system. If there was a clear, scientific basis showing macroalgae growth in Great Bay is an ecologically detrimental, then presumably the 2012 draft 303(d) list would have shown macroalgae impairments in the Great Bay Estuary.

Given these circumstances, it is inappropriate for EPA to seek imposition of very stringent TN reduction requirements based on macroalgae growth, as both the level of control necessary and the ecological need for macroalgae reduction are unknown at this time. In particular, the 2012 macroalgae pictures show such plant growth has greatly decreased since the 2008 Nettleton survey. Again, this counsels for an iterative approach to nutrient management lead by further scientific investigation, not the implementation of stringent nitrogen limitations.

Thank you for considering these comments as well as those in the attachments. If you have any questions please do not hesitate to contact me.

Sincerely,

/s/ *John C. Hall*

JOHN C. HALL

CC: Great Bay Coalition Members

Enclosures:

Attachment 1

Supplemental Comments on the Additional Slides (New Information) Presented to Town of Exeter on September 28, 2012

The following provides additional comments for the proposed Exeter NPDES permit based on the specific slides relied on by EPA and DES in our meeting.

Slide 1 – DO Squamscott River: While is it apparent that DO is periodically low in the Squamscott River, there is no information explaining why this is occurring. The HydroQual report, like prior UNH studies, found lower DO with *lower* algal growth. Other reports (Pennock 2005) found low DO due to hydrologic conditions (stratification). Therefore, claiming that low algal growth will solve (or is required to significantly improve) low DO conditions in the Squamscott River or elsewhere (as presumed by the 2009 criteria) is not defensible.

Slide 2 – Eelgrass Cover: Basing eelgrass restoration targets for this system on the maximum eelgrass growth found in 30 years of record is not reasonable for defining impaired conditions. Of course, any comparison to the maximum value will show a decline. Moreover, claiming an extensive eelgrass population based on uncertain photographs from 1981 is even less defensible when such information was not designed to ensure an accurate assessment of eelgrass populations and contrary to the underlying reports cited. The 1981 Nelson survey found a major *decrease* in eelgrass biomass and it is not apparent how the eelgrass acres for this period were determined to increase from 1980, given this information. In any event, the real question is what caused the change in eelgrass populations and DES should have presented the TN levels (or closest surrogate) versus eelgrass population, to see if changing TN levels are even remotely correlated with the changing eelgrass populations. Both Dr. Short and Mr. Trowbridge stated the level of TN present in the estuary prior to 2005 was protective of eelgrass populations. This level of TN is in the range of 0.45 mg/l, not 0.3 mg/l.

Lastly, it would seem time to focus on what caused the dramatic eelgrass acreage decline that occurred in 2006 – the triggering event for claiming eelgrass impairments in the estuary. It is simply not physically possible that nutrients caused this event, nor is it ever explained by EPA or DES precisely how nutrients could have caused this rapid decline that led to the changed impairment listings. The available data indicate no significant change in nutrient levels occurring in prior years with healthy eelgrass growth. As acknowledged by Mr. Trowbridge under deposition, the extreme weather events of that year could have been the root cause of the decline. Our consultants have previously provided analyses supporting that hypothesis and that information needs to be considered.

Slide 3 – Picture of Eelgrass: One cannot draw any conclusion from the photos presented, as they are obviously taken under radically different settings (low tide, exposed eelgrass, bright sunshine, dense floating beds versus, thinned bed submerged under water) and the locations are unknown. There is simply no way to compare these photographs or to conclude that TN caused the differing conditions represented by these photos. In fact, the TN levels occurring at these two locations are not even presented. It should be noted that Dr. Short, in July 2011 and again under deposition in May 2012 said epiphytes are not a significant concern in this system.

Slides 4, 5 Macroalgae: As noted earlier, both Dr. Short and Mr. Trowbridge testified that whatever level of macroalgae growth that was occurring in the system in 2007, it did not prevent subsequent expansion of eelgrass beds. This is probably because macroalgae are transient and do not "bloom" until after the peak eelgrass growing season, as demonstrated by Nettleton. Moreover, Dr. Short informed Mr. Trowbridge that macroalgae were not smothering out eelgrass in Great Bay as had occurred in other systems. This was documented in various email exchanges. Finally, the Nettleton pictures are from areas where eelgrass growth *does not occur*. Thus, they are irrelevant for predicting macroalgae impacts on eelgrass beds (the focus of the 2009 numeric nutrient criteria). If EPA is now stating the mere presence of expanded macroalgae growth (wherever it occurs) constitutes impairment, the scientific basis of that position has never been presented to the public and such a position is not consistent with the burden of proof required to assert a narrative criteria violation due to nutrients exists. Finally, the degree of macroalgae growth has changed, once again, significantly since the Nettleton pictures in 2008. Therefore, the 2008 pictures do not prove macroalgae growth is currently excessive or at impairment levels.

Slide 6 Changing TN/DIN level: It is expected that DIN and TN will vary by month for a number of reasons. This does not "prove" that DIN is not the primary pollutant form of concern. The proper comparison should be TN/TIN levels present when healthy eelgrass existed versus current levels. Those data and that analysis support a position that existing TN or TIN levels are not currently impairing eelgrass growth.

Slide 7/8 Changing Nitrogen Levels: These graphs were presented to support a position that nitrogen is still a problem (and increasing) in the system. These positions are patently false. First, Mr. Trowbridge was roundly criticized by the PREP Technical Advisory Committee for drawing lines through long term data and in particular, for failing to recognize the major downturn in TN and TIN levels at Adams Point occurring after 2008. It is well understood that since 2008, rainfall has decreased, (still above normal) therefore nitrogen levels in the system had to decrease. Ignoring the primary factors driving the shifting TN/TIN levels (e.g., weather patterns) renders the graph's projections essentially worthless. Please note that annual average and growing season TIN levels are now below the levels EPA said were considered sufficient to protect eelgrass – 0.15 mg/l. Regarding data from Chapman's Landing – this has never been used as an indicator for system health before. While the very limited TN data appear to show an increase – the TIN data do not show any change given the longer period of record. In any event, these data are also affected by system hydrologic conditions, but differently than Great Bay/Adams Point which is a more complete mixed location. Unless the changing dilution is accounted for, one could not reach any firm conclusions on changing system conditions from Chapman's Landing data.

Slide 9 Secchi Disc Data – Harbor at High Tide: These data were presented to demonstrate that transparency is apparently influencing eelgrass populations in the Harbor and apparently support the need to reduce TN to improve transparency. To the contrary, these limited data, do not support such conclusions regarding either the need for TN reduction at Exeter or the cause of eelgrass population changes in the harbor area, as follows:

- These are charts are misleading since different time periods are covered. Eelgrass coverage in the Harbor was not considered impaired in 2008 (end of secchi data) and rebounded in 2011 when no secchi data are available. Thus, the “cause” of the eelgrass population downturn in 2009-2010 is completely unexplained by this data.

- These data have little to do with transparency in Great Bay or the Squamscott River. The data reflect high tide readings in the harbor that mirrors Gulf of Maine water quality – not the water quality entering, not exiting the estuary. Moreover, it is questioned why all data (high and low tide) were not averaged, as that is the more relevant indictor of light transmission affecting eelgrass. DES’s prior review of high and low tide data through 2007 (presented to EPA in March 2008) did not indicate any significant trend in transparency for the lower Piscataqua River.

- The trend lines are developed in a misleading fashion. Secchi depth data from 1992-1995 are driving the “significant” slope of trend line – even though there is no available eelgrass data during that period. Plotting only 1996 forward data would likely reveal no “significant” trend for secchi depth even for the high tide data.

- To have any relationship to transparency and nitrogen, the eelgrass losses would need to be occurring primarily from the deeper beds and the change in transparency would need to be caused by increased algal growth. No data are presented on either of these critical factors, rendering the analysis pure speculation.

In summary, the charts implying a relationship between eelgrass declines at the mouth and Gulf of Maine and water quality are incomplete, misleading and not relevant to the Exeter permitting decision.

Slide 8 – Eelgrass cover for different zones: We have seen this chart on a number of occasions. More recent analysis of the claimed eelgrass population in 1980-1981 and 1981 indicate that these values are not based on any reliable eelgrass surveys. In particular, it is not apparent from the referenced literature (1980/1981 Nelson -Fish and Game Survey) that eelgrasses increased from 1217 to 2130 acres in Great Bay. The reports indicated a major decline in eelgrass biomass in 1981 and no reliable eelgrass acreage maps are contained therein. The radical drop in eelgrass for the Upper Piscataqua (42 acres to 0.5 acres) is not explained by these reports. If the reported eelgrass decline is accurate, it clearly demonstrates that nutrients are not a main concern, given the enormous change in eelgrass that may occur, year to year, with no significant change in nutrient inputs.

In summary, the new data presented by DES at our meeting does not demonstrate that TN reductions at Exeter, are necessary to improve eelgrass populations anywhere in this system or to control macroalgae growth. Such contentions continue to be based on speculative and incomplete analyses of the relevant data.

Attachment 2

Supplemental Comments on New Assertions made by DES in a Response Letter from Commissioner Burack to the Coalition dated October 19, 2012

The following provides additional comments for the proposed Exeter, Newmarket, and Dover NPDES permits based on the response letter sent from Commissioner Burack (DES) to the Coalition on October 19, 2012 about a request for a meeting to discuss new information regarding nutrient effects on the Great Bay Estuary and Independent Peer Review.

Claim #1

1.A. "Algal levels in the system did not change materially from 1980 to present, . . ."

DES' use of Dr. Art Mathieson's comments to stand for the proposition that macroalgae populations have increased in Great Bay thereby causing a decrease in eelgrass populations is misplaced. DES Head Scientist, Mr. Philip Trowbridge, under oath admitted there is no evidence (including Mathieson's comments) that shows (1) nitrogen caused increase macroalgae growth in the Great Bay Estuary and (2) macroalgae growth caused the decline in eelgrass populations in Great Bay.

Additionally, DES' reference to Lubberland Creek in Great Bay fails to point out in 2012 the macroalgae cover was almost zero at Lubberland Creek showing that macroalgal levels in the system did not change materially from 1980 to present. If nitrogen was the only parameter controlling macroalgae growth, then it would be expected as nitrogen levels have increased since 1980, the macroalgae levels would have increased instead of stayed virtually the same.

1.B. ". . . despite an estimated 59% increase in TN levels between 1980 and 2004."

DES' allegation that TN and TIN are not correlated is plainly refuted by available data. See Figures 1 and 7 plainly showing TIN increases are typically associated with TN increase and TIN decreases are typically associated with TN decreases. In addition, DES has made the claim that TN and TIN are correlated in the MOA group meetings.

DES should have plotted average TN and DIN concentrations by growing season and year-to-year instead of by month (Figure 1) because as DES rightfully points out, "TN that consists of DIN varies widely during the year." It is irrelevant to look at seasonal variation because it is known to vary widely.

The claim TIN is an inferior indicator of nitrogen pollution compare to TN cannot be true since Mathieson's comments informed DES/EPA that TIN is a better indicator for macroalgae than TN.

1.C. "Therefore, TN inputs could not have caused changed transparency in the system and reducing TN inputs will not improve system transparency as is assumed by DES."

While there are multiple ways nitrogen can affect transparency in the system, DES has not demonstrated any of these ways has done so in Great Bay, as confirmed by Trowbridge's deposition testimony. Moreover, DES is citing to the DES CALM analyses claiming light attenuation is strongly correlated to plant/organic matter which has no credible scientific basis and has already been shown not to be the "cause and effect" in Great Bay. It is impossible to be strongly correlated if plant growth did not respond to increased nitrogen levels in to the system.

Claim #2

2.A. "Transparency in the major tidal rivers (Squamscott, Lamprey, Upper Piscataqua) is poor, but the available data (not previously analyzed by DES) shows that (a) the effect of algal growth on transparency is negligible."

The Coalition and DES agree that the effect of algal growth on water column transparency is negligible; therefore, regulating nitrogen from point sources will have a negligible effect on water column transparency.

2.B. "(b) natural occurring CDOM and turbidity are the key factors controlling transparency in the system, and"

DES' claim that the CDOM in Great Bay is not from naturally occurring sources is refuted by prior studies done for Great Bay and DES' acknowledgement that controlling nitrogen will not control CDOM.

2.C. "(c) regulating TN in the tidal rivers will not result in any demonstrable improvement in transparency or allow for eelgrass re-establishment."

DES asserts that regulating TN on tidal rivers may improve transparency allowing for eelgrass re-establishment which is simply not true. Figure 2 does not demonstrate nitrogen controls 27% of variation in light attenuation in the tidal rivers. Instead, Figure 2 implies, at most, that nitrogen is correlated with the change in water column transparency, which in turn is caused by other factors. As acknowledge by Trowbridge in his deposition testimony nitrogen is a component of CDOM and turbidity, although not biologically active in those two forms. Meaning in CDOM, for instance, the nitrogen molecule does not stimulate, in anyway, a poorer system transparency or reduced light attenuation. This was specifically covered in Trowbridge's deposition. There is no credible scientific information that controlling nitrogen in runoff, septic systems or point source discharges will affect either CDOM or turbidity, though nitrogen is an elemental component of these parameters.

Claim #3

"Great Bay itself is generally not a transparency limited system because eelgrass populations receive sufficient light during the tidal cycle."

Since DES has agreed that Great Bay is not a transparency limited system, it is completely inappropriate for DES or EPA to assert that water column transparency-based limitations must be established for the system. DES' reference to impacts on eelgrass is completely theoretical and not based on demonstrable scientific evidence for the system.

Claim #4

4.A."A large increase in rainfall and major floods occurring from 2006-2008 (a natural condition) could be the primary cause of significant eelgrass declines that occurred in

Great Bay during that period due to salinity changes, increased turbidity and increased colored dissolved organic matter (CDOM)."

The analysis provided by DES that rainfall and major floods occurring from 2006-2008 could not be the primary cause of significant eelgrass declines that occurred in Great Bay at that time, is completely without scientific merit for the follow reasons:

1. Regarding Figure 3, there is no demonstrable decrease or impairment in eelgrass cover in Great Bay through 2005, as acknowledged by DES. Additionally, the trend line is dominated by the post-2006 data meaning that whatever happened post-2006 is the reason for the decline in eelgrass cover in Great Bay. All of these data were influenced by the flooding events of 2006.

2. Eelgrass cover was in the normal range for coverage in Great Bay in 2005 and there was no impairment to eelgrass cover in 2005. See Figure 3.

3. DES ignored the fact that eelgrass populations decreased everywhere in the Great Bay Estuary post-2006 which can only be explained by an area wide event that caused the impact to eelgrass populations in the whole Great Bay Estuary.

4. DES' speculation that eelgrass population decreases were caused by more nitrogen being delivered to Great Bay during heavy rainfalls is demonstratively wrong because there was no significant change in algal growth in the system during this time period.

5. Stating that CDOM is not independent parameter from nitrogen grossly misstates the ecological and chemical significance of nitrogen within CDOM. As stated above, the nitrogen within a CDOM molecule is, for all ecological purposes, inert.

4.B. "DES failed to assess the importance of these events in triggering the eelgrass decline in the system despite the obvious temporal correlation."

DES' statement that "even if the presumed wet years of 2006 to 2008 were disregarded, there would still be a statistically significant declining trend in eelgrass since 1990" ignores the obvious fact that eelgrass recovery takes multiple years. The eelgrass population improved from 2009 to 2011 even though the population was still suffering from the adverse effects of the massive eelgrass decline in 2006.

Claim #5

"The various DES/PREP analyses confirmed (a) TN increases did not cause changes in transparency, algal levels or DO and (b) a "cause and effect" relationship between TN and transparency/DO did not exist, were excluded from the technical information presented in the 2009 numeric nutrient criteria document and, therefore, were never presented to EPA's internal peer review panel."

DES prior analysis did not demonstrate "cause and effect" as thoroughly reviewed by Trowbridge in his deposition testimony. Trowbridge acknowledged the DES analyses on the effect of nitrogen stimulated algal growth on transparency were accurate and the assumed model (nitrogen causes algal growth which in turn causes a decrease in transparency) was demonstrated to be not relevant to the Great Bay Estuary. DES ignored its own analysis and reported the opposite which is not a technically justification for DES'actions but rather an indictment of its actions.

Figure 6 provides no probative value to whether or not a material relationship exists between nitrogen, algal growth, and water column transparency. However, the Morrison report does provide probative value finding no material relationship exists between nitrogen, algal growth and water column transparency. DES previously acknowledged that the results of that study were accurate.

Claim #6

6.A. "Dissolved nutrient concentrations have now returned to 1970-1980 levels. This dramatic change in ambient DIN levels appears to be the result of reduced rainfall and increased eelgrass growth."

DES agrees that DIN levels have returned to 1970-1980 levels. As noted earlier, DIN and TN track each other as demonstrated in Figure 7. Comparing DIN and TN concentrations in Figure 7, it is obvious that both parameters decreased from 2006-2008 and 2009-2011. Given DES acknowledgment that DIN levels have returned to 1970-1980 levels and there was no excessive macroalgae growth in the 1970's, there is no reason to believe that today's concentrations will stimulate excessive macroalgae growth.

A relationship cannot be drawn between Chapmans Landing and Great Bay, as suggested by DES, because there is no macroalgae in Chapmans Landing, therefore the conditions between the locations are not similar.

Given that the rainfall was akin to a once in a 100 year rainfall event, it is inappropriate to establish regulatory requirements based on data collected during an abnormally high rainfall year.

6.B. "These results indicate that natural processes were primarily controlling eelgrass populations and variations in nitrogen levels in the system."

Having admitted changes in rainfall is the most logical explanation for the decrease DIN levels, DES cannot then refuse to acknowledge natural processes were primarily controlling eelgrass populations and variations in nitrogen levels in the Great Bay Estuary. DES reference to the long term trend is irrelevant and it is clearly erroneous for DES to assert that the trend is affected by rainfall leading to a decrease in TN (maybe DIN) and characterize this as standing for the proposition that natural processes do not affect nitrogen levels and eelgrass populations in the estuary. This trend shows the opposite.

The State of New Hampshire
Department of Environmental Services
Thomas S. Burack, Commissioner

Celebrating 25 Years of Protecting
New Hampshire's Environment

October 19, 2012

Thomas J. Jean, Mayor
City of Rochester
31 Wakefield Street
Rochester, NH 03867

Dean Trefethen, Mayor
City of Dover
288 Central Avenue
Dover, NH 03820

Eric Spear, Mayor
City of Portsmouth
1 Junkins Avenue
Portsmouth, NH 03801

Re: Request for Meeting to Discuss New Information Regarding Nutrient Effects on the Great Bay Estuary and Independent Peer Review

Dear Mayors Jean, Trefethen, and Spear:

On August 14, 2012, the Department of Environmental Services received letters from your offices, on behalf of the Great Bay Municipal Coalition, asserting certain "new" facts regarding nitrogen pollution in the Great Bay Estuary. In addition, you requested that the Department conduct an additional peer review of the relevant scientific information. We also received a follow-up letter from you on October 4, 2012 that reiterated these claims and this request. The Department has carefully reviewed your letters, developed a detailed response, and arranged for a face-to-face meeting with you to discuss your concerns.

The Department appreciates and shares your interest in basing restoration decisions on a sound scientific footing. We also recognize the potential high costs to your respective communities for wastewater treatment to remove nitrogen. As 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. Many of the claims in your letter over-simplify the situation, exclude key information, or extrapolate site-specific results to the whole estuary. Some key points from our response include:

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, dissolved inorganic nitrogen 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.

Full responses, including detailed citations and supporting information, to the claims in your letters are provided in the attached document. There is strong evidence that the state's narrative water quality standard for nutrients is violated in most parts of the Great Bay Estuary. It is the hope of the Department of Environmental Services that all interested parties can all put any disagreements aside and begin to work together to develop effective solutions to this problem.

Your letters also request that the Department conduct an additional review of the scientific information. Please be reminded that the nitrogen thresholds developed by the Department in 2009 were peer reviewed by two independent experts from Cornell University and the University of Maryland. Both reviewers found the thresholds to be reasonable and well-supported by the data presented. The reviewers were privy to all the comments and criticisms provided by the municipalities at the time. For the reasons stated in the attached document, DES does not believe that any of the "new" information or additional information developed by the Coalition since that time would lead to a change in findings from those of the initial peer reviewers. Nonetheless, the Department is not opposed to another peer review, on the conditions that all parties, including EPA, agree to the need, the guidelines in the EPA Peer Review Handbook are followed, the charge questions are reasonable, the reviewers are objective, and the requesting communities are able to find a source of funding for the peer review. In our opinion, however, the considerable funds required for an additional peer review would be better spent on enhanced monitoring and site-specific nutrient threshold development.

Thank you for your letter and for your efforts to restore the Great Bay Estuary. If you have any questions, please feel free to contact Harry Stewart, Water Division Director, at 271-3308 or Harry.Stewart@des.nh.gov; Vicky Quiram, Assistant Commissioner, at 271-8806 or Vicki.Quiram@des.nh.gov; or me at 271-2958 or Thomas.Burack@des.nh.gov.

Sincerely,

Thomas S. Burack
Commissioner

Enc.

Responses of the New Hampshire Department of Environmental Services (DES) To Claims of New Information Regarding Nutrient Effects on the Great Bay Estuary Included in Letters to Commissioner Burack dated July 20, 2012 From the Mayors of Rochester, Portsmouth, and Dover

October 19, 2012

Note: The three letters from the mayors of Rochester, Portsmouth, and Dover contained the same six claims of new information regarding nutrient effects on the Great Bay Estuary. The claims from these letters appear below in bold, followed by DES's responses. Many of the claims contain multiple aspects, and these have been parsed to facilitate the DES response. The referenced figures appear at the end of this document.

Claim #1

1.A "Algal levels in the system did not change materially from 1980 to present, ..."[1]

DES Response:

> "Algal levels" is a broad term. The depositions cited refer specifically to phytoplankton, which is one of many types of algae. Similarly, "the system" is not defined but assumed 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, 2012 at 90).
>
> 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, 2012 at 86). Dr. Art Mathieson provided comments to DES and PREP stating that macroalgae populations in the estuary have increased:
>
> > *"Prior to the 1980s no major algal blooms were apparent and the nutrient levels were much lower than today (cf. Mathieson and Hehre, 1981). During the past 2-3 decades the following macroalgal patterns have occurred along with increased nutrients:*
> >
> > - *"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.*

[1] Citation listed as "Trowbridge deposition - June 21, 2012" (no page numbers provided). After reviewing the transcript, the relevant section is likely pp. 132-137 which discusses trends in phytoplankton levels. During the second Trowbridge deposition on July 11, 2012, the same topic was discussed and is covered in pp. 343-345. In both cases, it is clear that the discussion is about phytoplankton levels only.

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.

- "*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.*" (Mathieson, 2012 at 1)

The Great Bay Municipal Coalition (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, 2011b at 3)

Accordingly, the statement that "algal levels in the system did not change" 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.

1.B "...despite an estimated 59% increase in TN levels between 1980 and 2004."[2]

DES Response:

This statement is incorrect. Total Nitrogen (TN) was first measured in the Great Bay Estuary starting in 2003. There are no known measurements of TN in the Great Bay Estuary from the 1970s, 1980s, or the 1990s. For the TN data that exist, for the period starting in 2003 and running through 2011, there has been no trend in TN at Adams Point in Great Bay (PREP, 2012 at 69). TN has been measured routinely since 2003 at eight trend stations, as well as occasionally at other stations across the estuary.

This incorrect statement seems to refer back to the 2006 State of the Estuaries report (NHEP, 2006 at 12), which was superseded by a 2009 report and is now six years out-of-date. The 2006 report showed that Dissolved Inorganic Nitrogen (DIN) had increased by 59 percent between the year periods of 1974-1981 and 1997-2004. Apparently, the GBMC is assuming that DIN concentrations are the equivalent of TN concentrations. HydroQual, consultants for the GBMC, have specifically advised against making this assumption, stating: "The use of inorganic nitrogen as an indicator of total nitrogen trends can be inaccurate" (HydroQual, 2011 at 4).

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[2] The source of this fact is cited as the 2006 State of the Estuaries report from the New Hampshire Estuaries Project (NHEP, 2006 at 12).

DES uses TN for surface water quality assessments of the estuary. DIN is an inferior indicator of nitrogen pollution compared to TN. DIN does not include nitrogen that is incorporated into plants and organic matter and is a more reactive and unpredictable form of nitrogen. For example, DIN concentrations in the water can be very low during periods of high plant growth because the DIN is pulled out of the water and incorporated into phytoplankton, macroalgae, and other plants. As shown in Figure 1, the percent of TN that consists of DIN varies widely during the year.

DES concurs that TN concentrations have likely increased over time as the population in the watershed has increased. However, the statement quoted in the claim is incorrect and, at best, out-dated.

1.C "Therefore, TN inputs could not have caused changed transparency in the system and reducing TN inputs will not improve system transparency as is assumed by DES."[3]

DES Response:

The assumption underlying this statement is that the only way for nitrogen to affect eelgrass is by causing phytoplankton blooms that shade eelgrass so that there is not enough light for eelgrass to survive. This assumption is incorrect. In fact, there are multiple ways in which excess nitrogen can affect eelgrass. In response to comments from the GBMC on the 2012 Consolidated Assessment and Listing Methodology, DES provided the following explanation.

"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

[3] This statement has been assumed to be a conclusion drawn by the letter's author. The only section of the deposition transcripts related to this topic is on July 11, 2012 pp. 345-348. This deposition date was not cited with the claim.

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."
(DES, 2012b at 8)

Because the assumption underlying the above GBMC statement on transparency is incorrect and invalid, the statement is also not correct. The opposite is, however, a well accepted scientific conclusion: reduced TN levels can only help to improve the light available to eelgrass, reduce the growth of macroalgae, and reduce direct nitrogen toxicity to submerged aquatic plants (Burkholder et al., 2007).

<u>Claim #2</u>

2.A "Transparency in the major tidal rivers (Squamscott, Lamprey, Upper Piscataqua) is poor, but the available data (not previously analyzed by DES) show that (a) the effect of algal growth on transparency is negligible,"[4]

DES Response:

> The portion of the July 11, 2012 deposition relevant to this statement is based on a series of graphs created by the GBMC that relate phytoplankton as chlorophyll-a to water clarity in the Squamscott, Lamprey, and Upper Piscataqua Rivers. The graphs used in the deposition show data from each river separately. Different types of graphs were used for the different rivers and, in the case of the Upper Piscataqua River graph, unproven assumptions about Secchi disk measurements were used. The point of the graphs was to attempt 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. During the deposition, DES staff agreed that the graphs supported those conclusions.

2.B "(b) naturally occurring CDOM and turbidity are the key factors controlling transparency in the system, and"[5]

DES Response:

> 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 (DES, 2012 at 14). 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 all.

2.C "(c) regulating TN in the tidal rivers will not result in any demonstrable improvement in transparency or allow for eelgrass re-establishment."[6]

DES Response:

> The assumption that regulating TN will not have any "demonstrable improvement in transparency or allow for eelgrass re-establishment" is a conclusion that 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 (see explanation in response to Claim #1).

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[4] Citation listed as "Trowbridge deposition – July 11, 2012" (no page numbers provided). The relevant section of the deposition transcript is pp. 421-434. The following graphs were discussed in this section: Short Exhibit 18, Short Exhibit 21, and Short Exhibit 22.
[5] Same citation as previous.
[6] Same citation as previous.

In response to similar comments from the GBMC on the 2012 Consolidated Assessment and Listing Methodology, DES showed that TN accounts for 27% of the variability in light attenuation (see Figure 2) in the tidal rivers and provided the following explanation:

> *"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 Great Bay Municipal Coalition 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 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."* (DES, 2012b at 8)

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 (DES, 2012 at 14).

<u>Claim #3</u>

"Great Bay itself is generally not a transparency limited system because eelgrass populations receive sufficient light during the tidal cycle."[7]

DES Response:

DES assumes that the term "transparency limited" in the claim was intended to mean that the clarity of the water is not the limiting factor for eelgrass survival. DES 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 (see response to Claim #1). 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.

In response to similar comments from the GBMC on the 2012 Consolidated Assessment and Listing Methodology, DES provided the following explanation of why water clarity is still important even in shallow areas:

> *"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."* (DES, 2012b at 8)

[7] Citation listed as "Trowbridge deposition – June 21, 2012 and Short deposition – May 14, 2012, as discussed in numerous emails between DES, EPA, and Dr. Short" (no page numbers listed). The relevant section of the transcript appears to be pp. 177-178. Transcript pp. 360-364 from the July 11, 2012 deposition also appear to be retevant.

Claim #4

4.A "A large increase in rainfall and major floods occurring from 2006-2008 (a natural condition) could be the primary cause of significant eelgrass declines that occurred in Great Bay during that period due to salinity changes, increased turbidity and increased colored dissolved organic matter (CDOM)."[8]

DES Response:

The actual data for eelgrass in the Great Bay do not support this claim (see Figure 3). The data show a steady decline over time with the 2006-2008 years falling slightly below the regression line and the last three years unchanged and slightly above the line. The odds of this trend occurring by chance are less than 1 in 15,000, which, for such a complicated ecosystem, demonstrates a very robust trend. Eelgrass cover in the entire estuary is still 35% below its extent in 1996 (PREP, 2012 at 126). It is not "rebounding". Even if the 2006-2008 years were disregarded, there would still be a statistically significant declining trend in eelgrass since 1990. Finally, it is not possible that heavy rainfalls in 2006-2008 could have caused the eelgrass declines that were evident in 2005 when DES initiated the study of nitrogen in the Great Bay.

DES agrees that changes in CDOM (colored dissolved organic matter), turbidity, and salinity during floods can affect eelgrass. However, another explanation for the worse conditions during heavy rainfall years is that more nitrogen is delivered from the watershed during those years as shown by Figure 4. CDOM itself is organic matter typically exported from wetlands in the watershed. Organic matter necessarily contains a certain fraction of nitrogen. Therefore, CDOM is not an independent parameter from nitrogen. Moreover, delivery of nitrogen from human sources in the watershed is not a "natural process".

4.B "DES failed to assess the importance of these events in triggering the eelgrass decline in the system despite the obvious temporal correlation."[9]

DES Response:

DES protocols for assessing eelgrass populations for the 303d report use eelgrass data from all years and look at trends over the full period of record and averages from the most recent three years (DES, 2012 at 67). Multiple years are used to make assessments to account for year-to-year variability in weather and other factors. It is not clear what is meant by the statement: "DES failed to assess the importance of these events". As stated above, even if the presumed wet years of 2006-2008 were disregarded, there would still be a statistically significant declining trend in eelgrass since 1990.

[8] The citation for this claim is "Trowbridge deposition – July 11, 2012" (no page numbers provided) and "charts: CDOM changes from 2004-2010 and eelgrass changes with freshwater inputs". The relevant sections of the deposition transcript are likely pp. 381-384.

[9] Same citation as previous.

The attachments to the July 20, 2012 letter supporting these claims contain invalid data and are, therefore, incorrect. The GBMC figure showing eelgrass cover versus precipitation shows nearly 2,000 acres of eelgrass in Great Bay in 2010 and no data for 2011 (see Figure 5). The correct values are 1,722 and 1,623 acres for 2010 and 2011, respectively. Despite repeated reports provided by DES and PREP to the GBMC transmitting the correct eelgrass data for 2010, the GBMC continues to use the wrong numbers for eelgrass in the Great Bay. In addition to using the incorrect eelgrass data, the figure presented by the GBMC showing CDOM measurements at the Great Bay Buoy is based on unverified, raw data that have not been quality assured by the UNH researchers.

<u>Claim #5</u>

"The various DES/PREP analyses that confirmed (a) TN increases did not cause changes in transparency, algal levels or DO and (b) a "cause and effect" relationship between TN and transparency/DO did not exist, were excluded from the technical information presented in the 2009 numeric nutrient criteria document and, therefore, were never presented to EPA's internal peer review panel."[10]

DES Response:

Estuaries are very complicated environments. Consequently, the DES study of the impacts of nutrients in the estuary considered multiple approaches and evolved over four years. Some of the initial analyses done by DES at the beginning of the five years of research between 2005 and 2009 failed to show simple relationships between nitrogen and transparency, phytoplankton, or dissolved oxygen. However, these analyses did not prove that relationships between these parameters did not exist. The initial methods and datasets used were simply inadequate for the task. Therefore, the analyses that the GBMC uses to demonstrate the absence of cause-and-effect relationships, do not prove anything.

For the final report in 2009 (DES, 2009), DES ultimately adopted an approach that used long-term averages to take into account delays in the biological response and nonlinear feedback in the complicated estuarine system. Published papers by Burkholder et al. (2007) and Li et al. (2008) demonstrate that eelgrass loss and algae blooms are not expected to directly follow nitrogen concentrations and that plots of monthly data will not illustrate relationships in estuaries. The approach used by DES in the final report was able to illustrate the underlying relationships between nutrients and their effects. The initial analyses that had not been effective were not included in the final report, as was appropriate.

After the 2009 report was completed, DES continued to refine the methods for analyzing data. In response to comments by the GBMC, DES demonstrated that the relationships between TN and chlorophyll-a and transparency were independent of salinity effects (see Figure 6). This result confirmed that the approach taken by DES in the 2009 report to aggregate data from different parts of the estuary, with different salinities, was appropriate.

Finally, the GBMC claims that the 2009 DES report was reviewed by "EPA's internal peer review panel". This is not correct. The peer review of the 2009 report was performed by two <u>independent</u> university professors, not a panel of EPA employees. The two professors who conducted the peer review are widely recognized as being among the top estuarine researchers in the world.

[10] The citation is listed as "Trowbridge deposition – July 11, 2012" (no page numbers provided). The relevant section of the transcript appears to be pp. 436-440. This topic was also discussed on June 21, 2012 as recorded on pp. 232-241.

<u>Claim #6</u>

6.A "Dissolved nutrient concentrations have now returned to 1970-1980 levels. This dramatic change in ambient DIN levels appears to be the result of reduced rainfall and increased eelgrass growth."[11]

DES Response:

DES agrees that average annual DIN concentrations at Adams Point have decreased in the last few years and are similar to concentrations measured in the 1970s. However, as discussed previously, DIN is an inferior indicator of nitrogen pollution compared to TN because DIN is a subset of TN that is the most reactive in the environment. DIN does <u>not</u> include nitrogen that is incorporated into plants and organic matter. DIN concentrations in the water can be very low during periods of high plant growth because the DIN is pulled out of the water and incorporated into phytoplankton, macroalgae, and other plants. TN concentrations in the Great Bay have been measured since 2003. There are no known measurements of TN taken in the 1970s, 1980s, or the 1990s. For the TN data that exist, starting in 2003 and continuing through 2011, there has been no trend in TN at Adams Point (Figure 7). The average TN concentration in 2009-2011 is only 14% lower than in 2006-2008, which is most logically explained by reduced nitrogen loads as a result of more normal rainfall amounts during this period (PREP, 2012 at 30).

While Adams Point is a good location for monitoring, trends at this site do not necessarily reflect changes throughout the estuary. Complex interactions at this location add variability to the dataset. At Chapmans Landing, which is close to nitrogen sources in the Squamscott River, there are increasing trends for nitrate+nitrite, total dissolved nitrogen, and total nitrogen (PREP, 2012 at 35).

6.B "These results indicate that natural processes were primarily controlling eelgrass populations and variations in nitrogen levels in the system."[12]

DES Response:

Since the first part of this claim is not correct, as noted above, this conclusion is not supported. Moreover, the DIN data cited by the GBMC show a long-term increasing trend. The long-term trend for eelgrass is downward, even if the heavy rainfall years were disregarded. Macroalgae abundance is increasing in the estuary, as GBMC consultants have already acknowledged (Peschel 2012 at 1). These facts do not support the conclusion that "natural processes" are the sole factors affecting nitrogen levels and eelgrass populations in the estuary.

[11] The citation listed for the first sentence are charts from the PREP 2013 State of the Estuaries report (draft).
[12] No citation provided.

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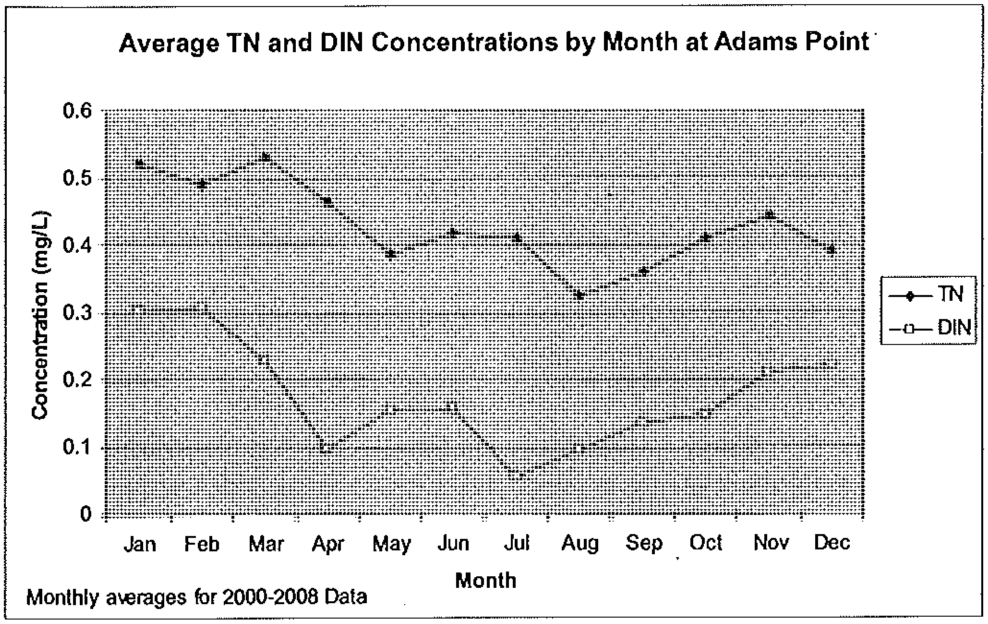
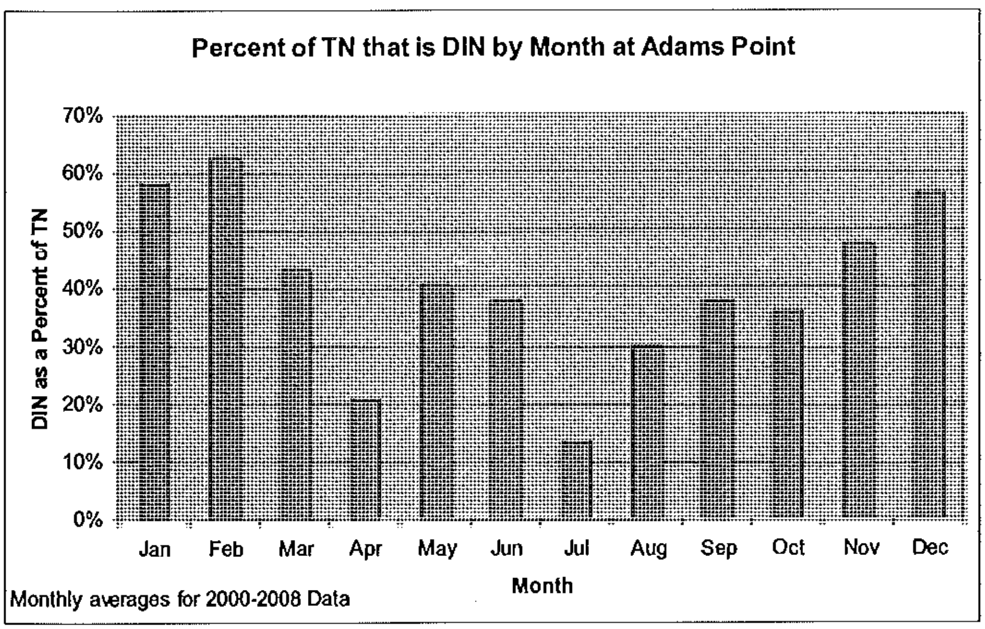
Exhibits

Figure 1: Monthly Average TN and DIN Concentrations at Adams Point in Great Bay

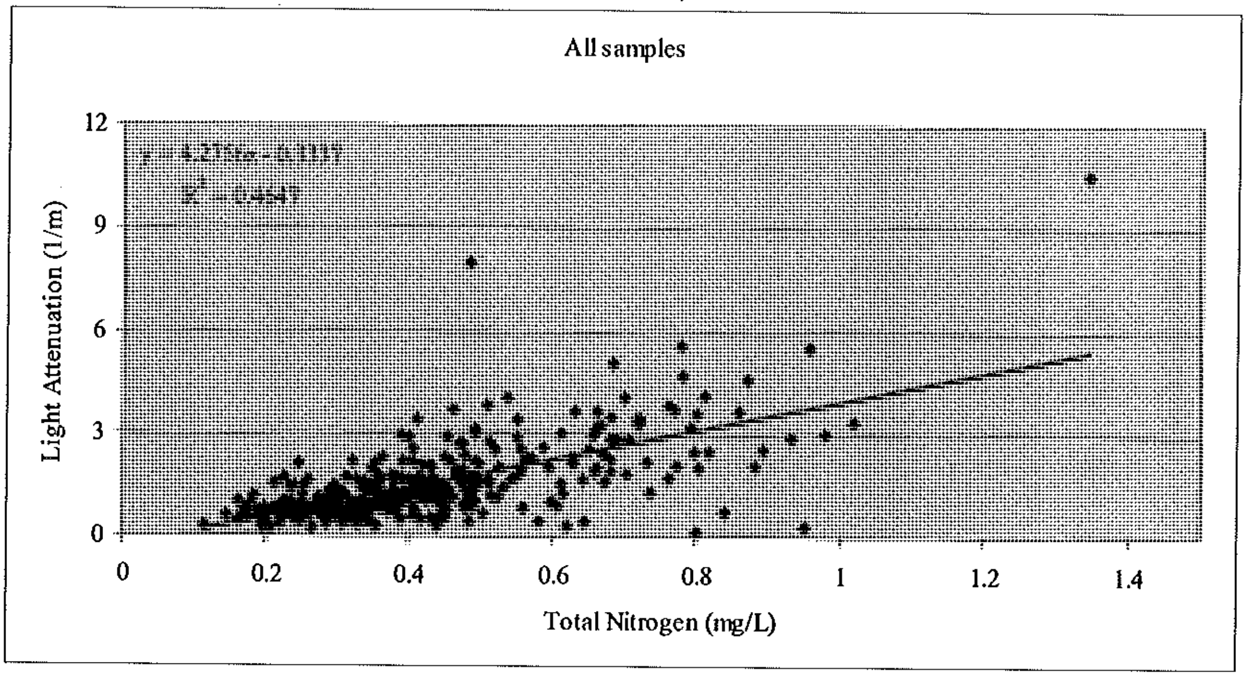




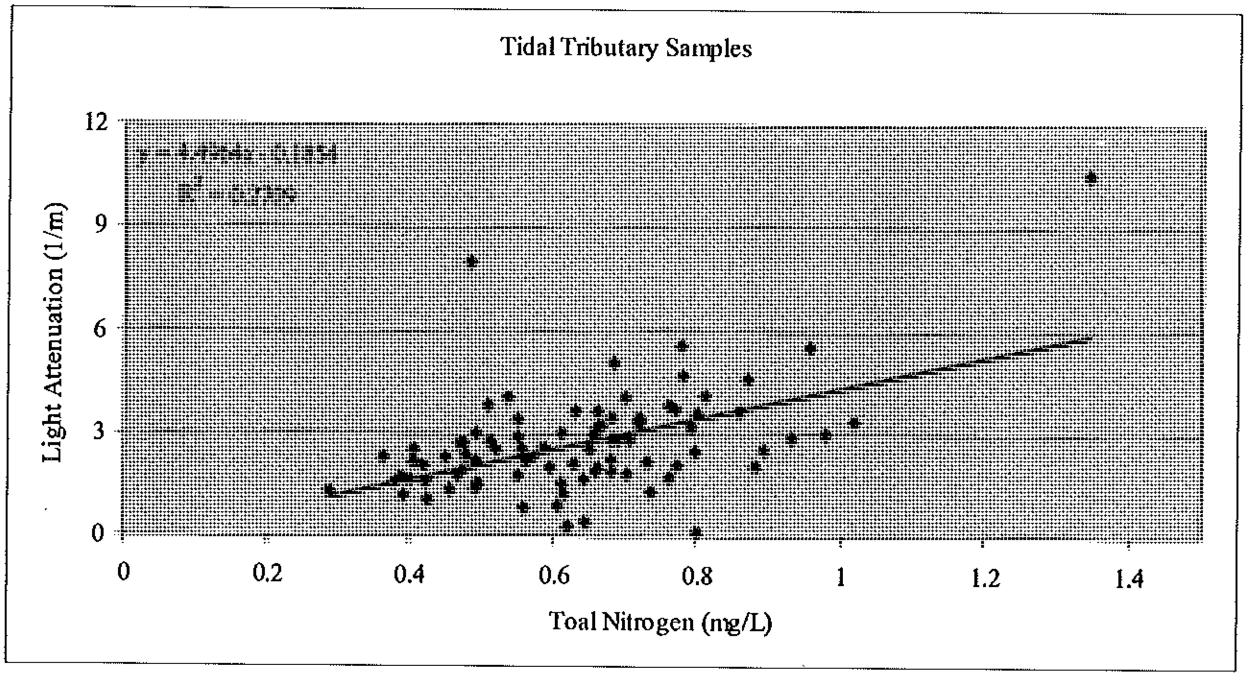
Source: DES (2009) at 22-23 (reformatted)

Figure 2: Statistically-significant relationships between light attenuation and total nitrogen concentrations in the Great Bay Estuary

(a) All samples in all parts of the estuary (2003-2010)

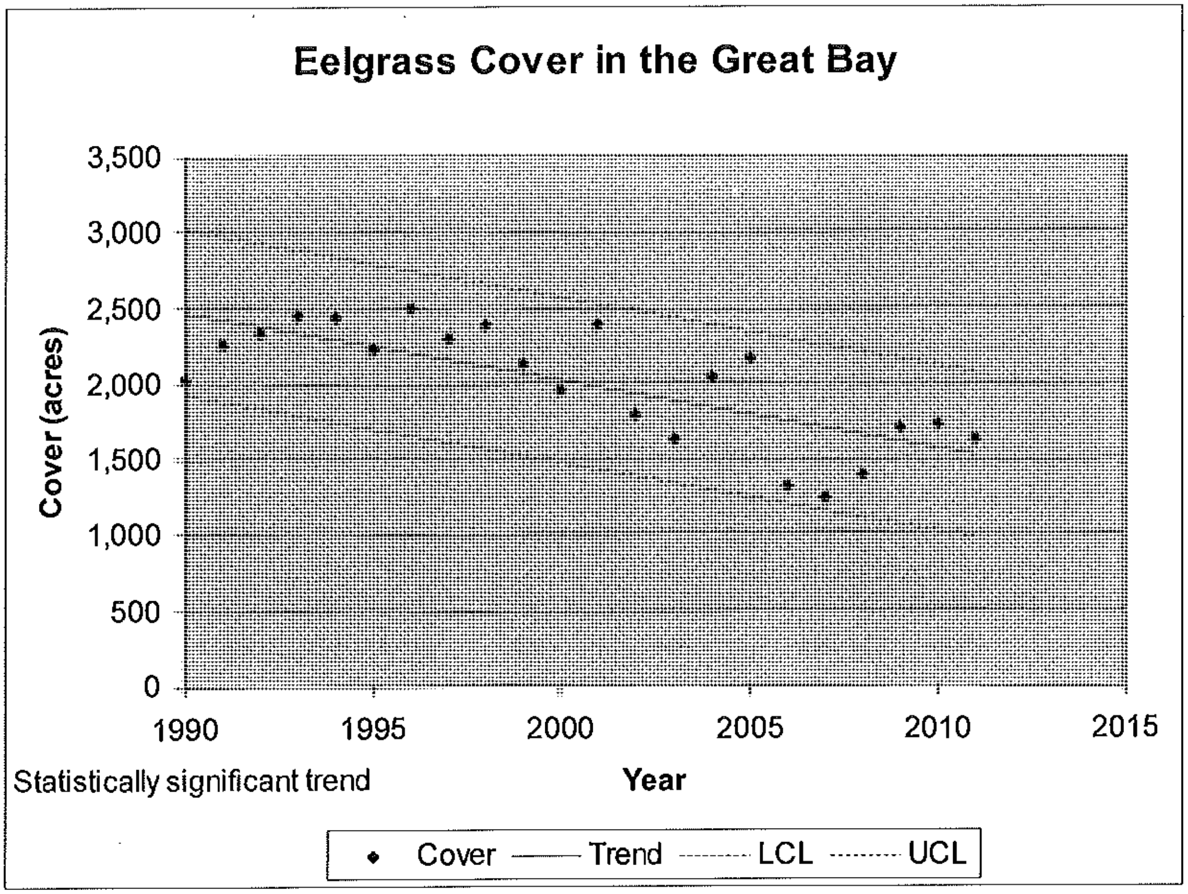


(b) Samples from tidal rivers (2003-2010)



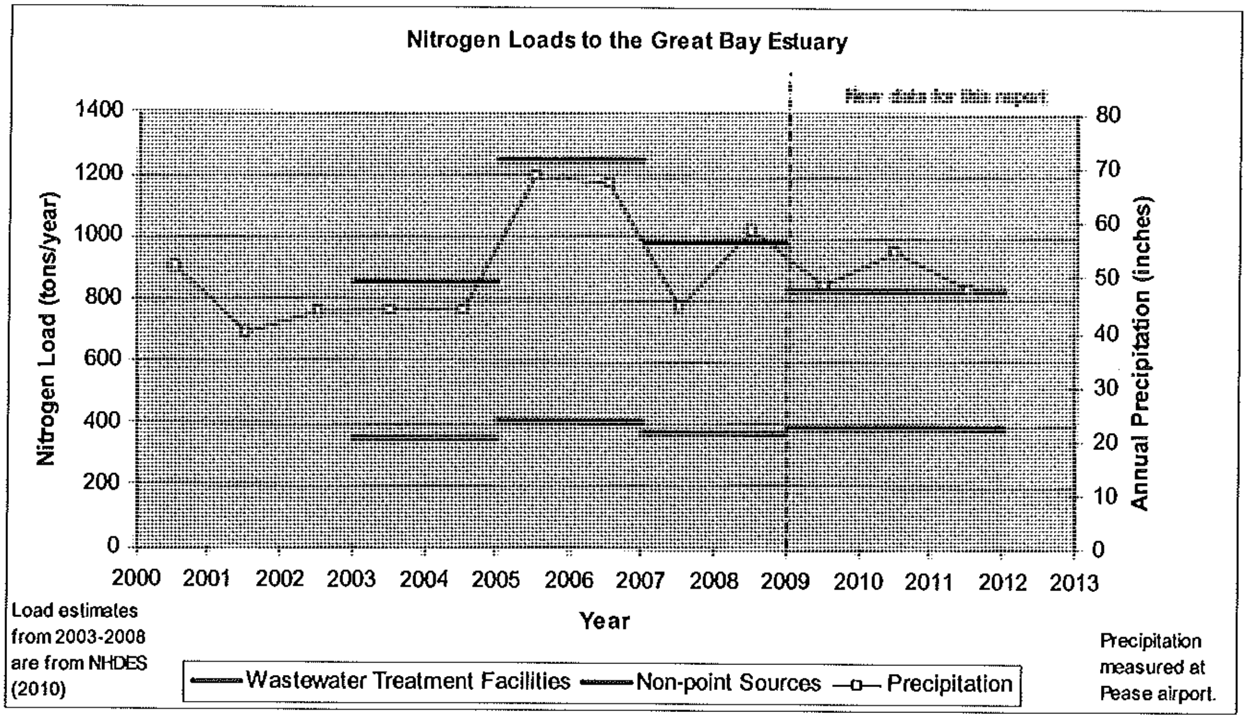
Source: DES (2012b) at 10.

Figure 3: Eelgrass cover in the Great Bay proper



Source: PREP (2012) at 128

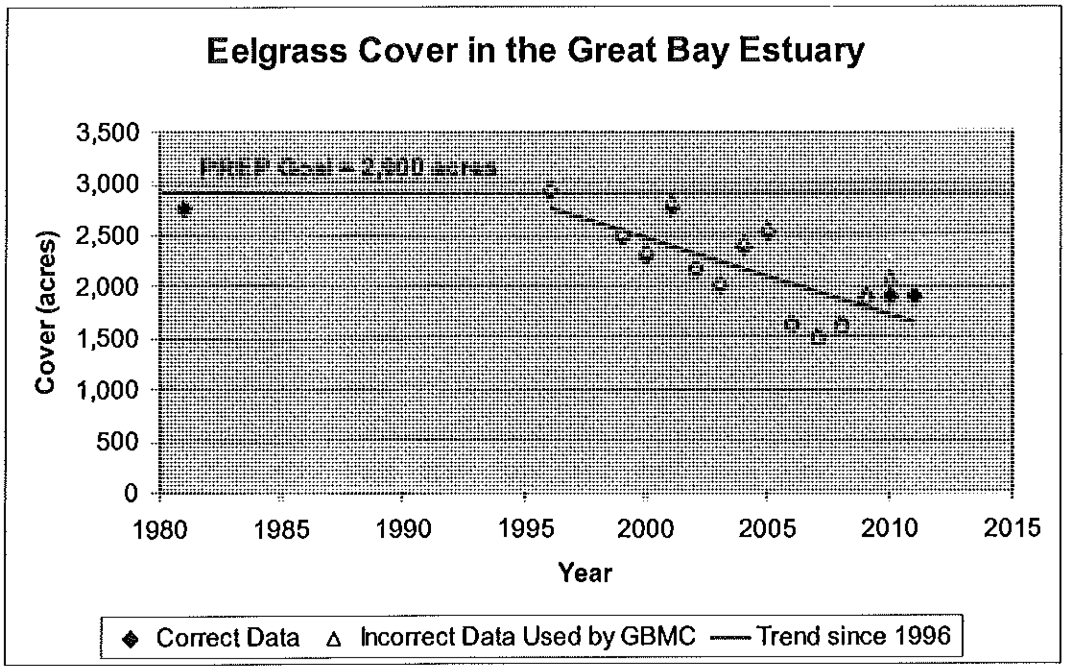
Figure 4: Nitrogen loads to the Great Bay Estuary



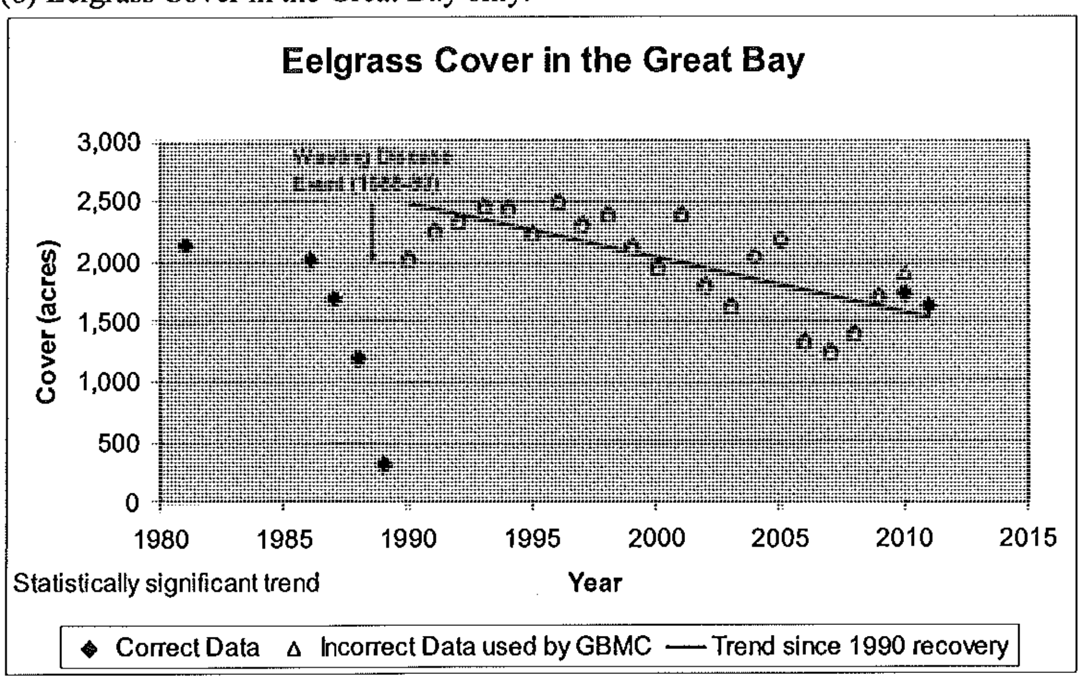
Source: PREP (2012) at 30

Figure 5

(a) Eelgrass Cover in the whole Great Bay Estuary, including Great Bay, Little Bay, Piscataqua River, Little Harbor, and Portsmouth Harbor



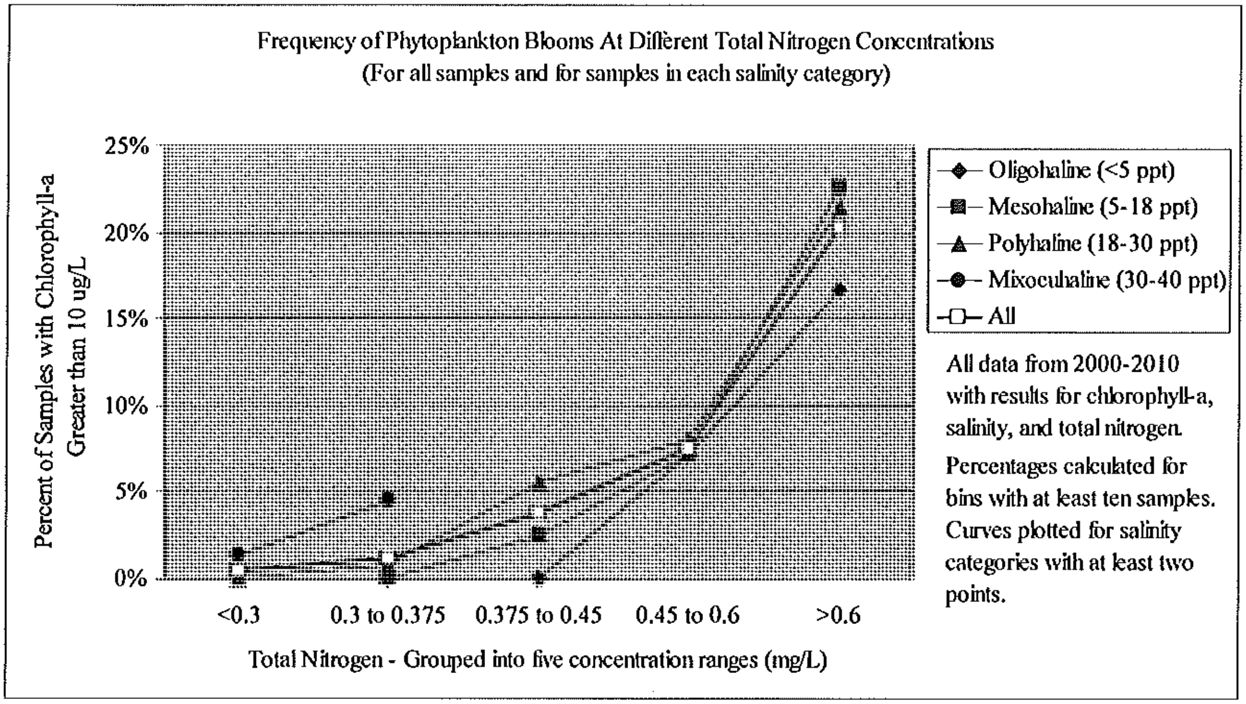
(b) Eelgrass Cover in the Great Bay only.



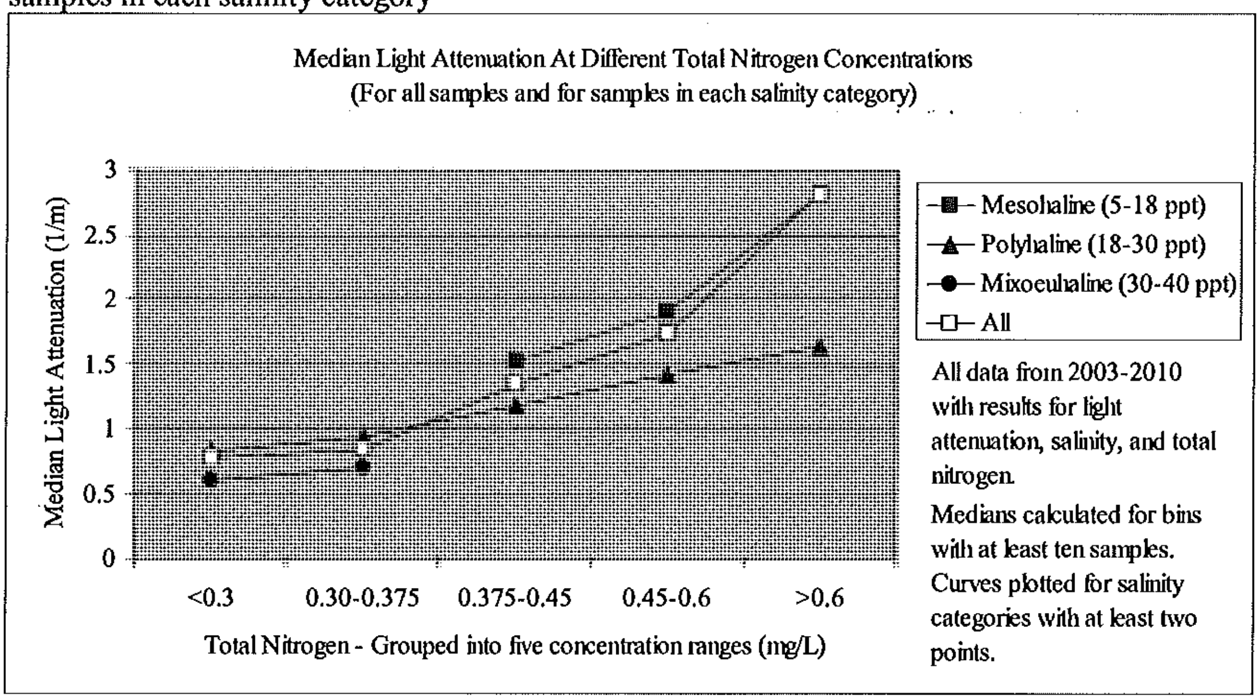
Source: Eelgrass data from Dr. Fred Short, UNH.

Figure 6

(a) Frequency of Phytoplankton Blooms at Different Total nitrogen Concentrations (for all samples and for samples in each salinity category)

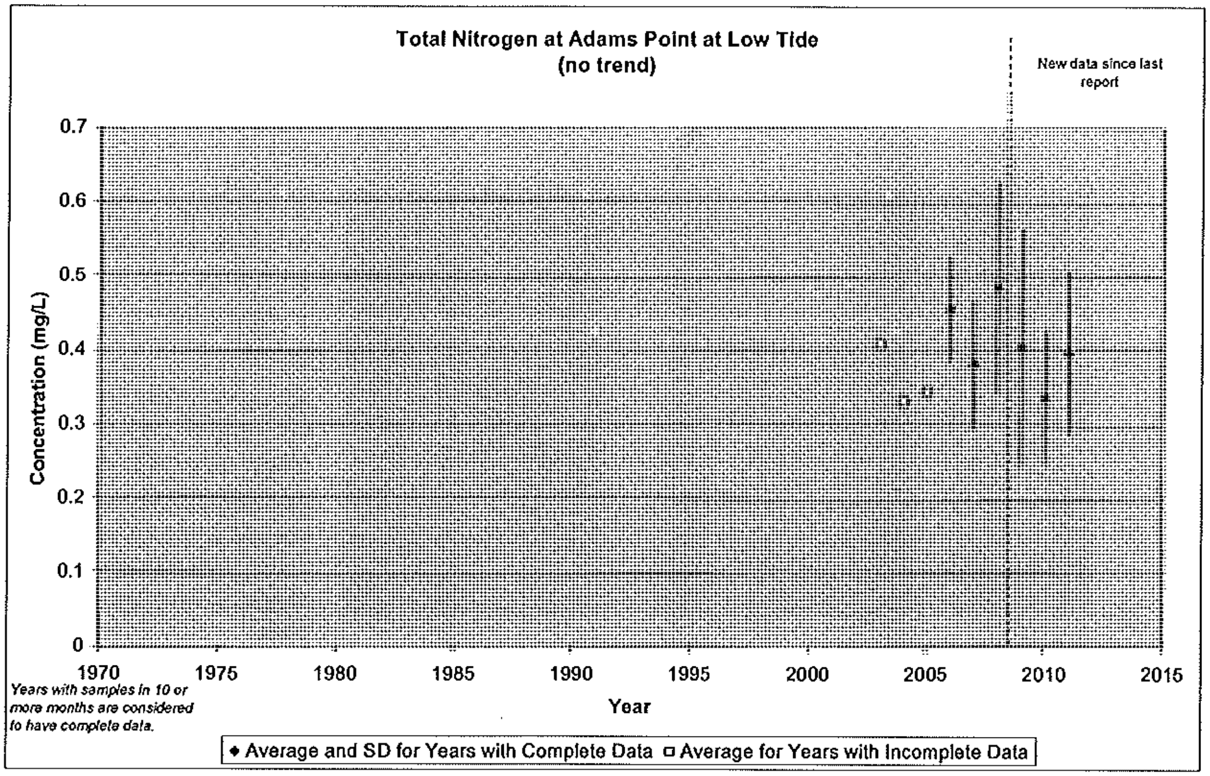


(b) Median Light Attenuation at Different Total nitrogen Concentrations (for all samples and for samples in each salinity category

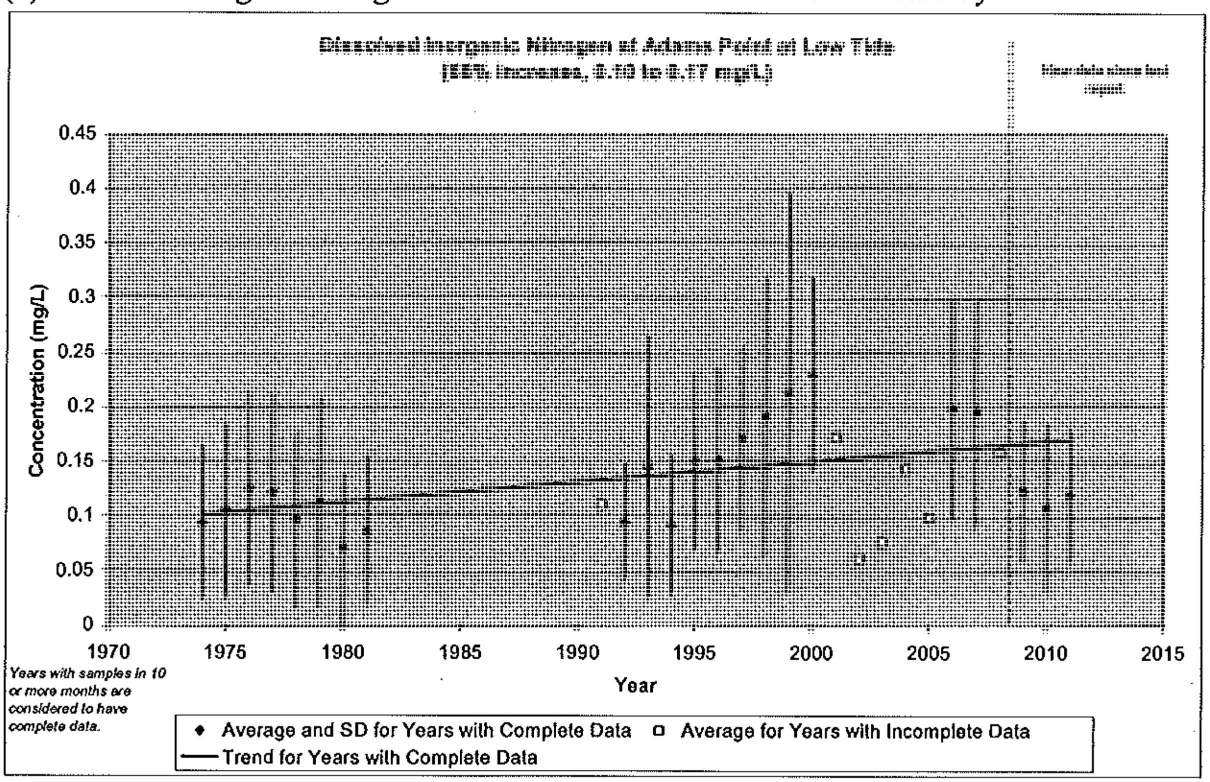


Source: DES (2012b) at 11, 13

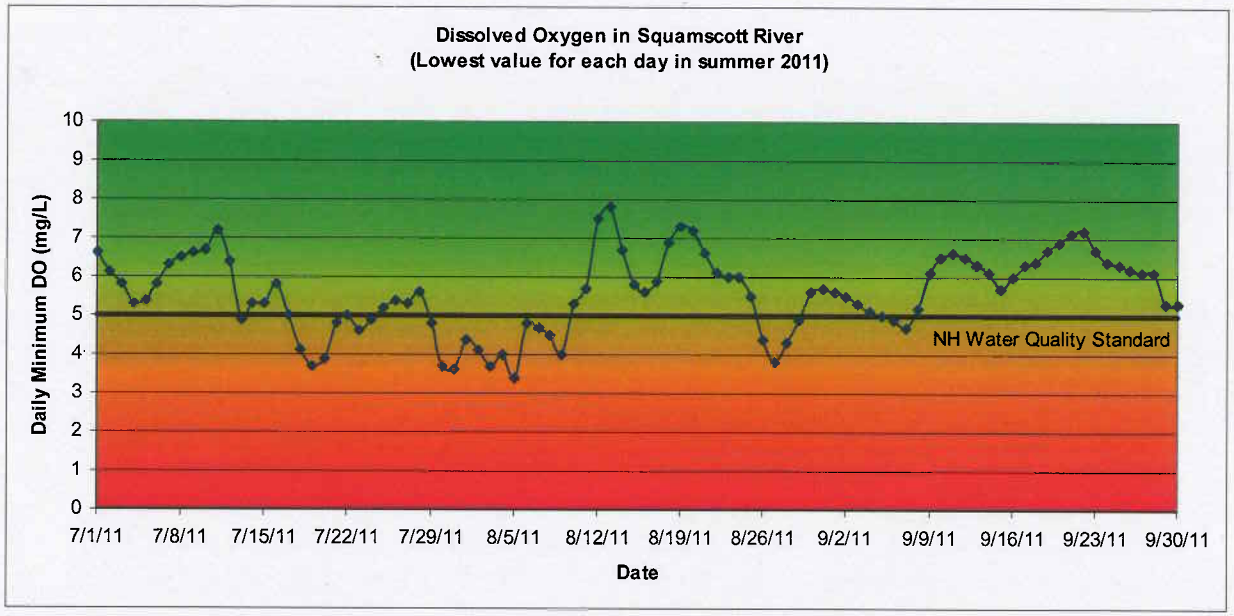
Figure 7:
(a) Total nitrogen concentrations at Adams Point in Great Bay



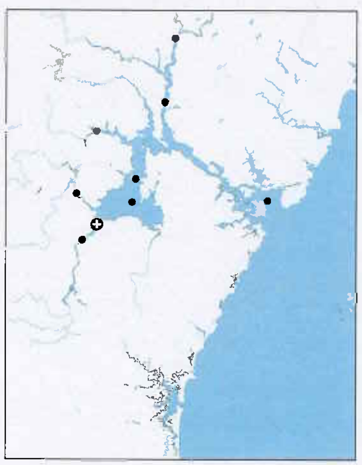
(b) Dissolved inorganic nitrogen concentrations at Adams Point in Great Bay

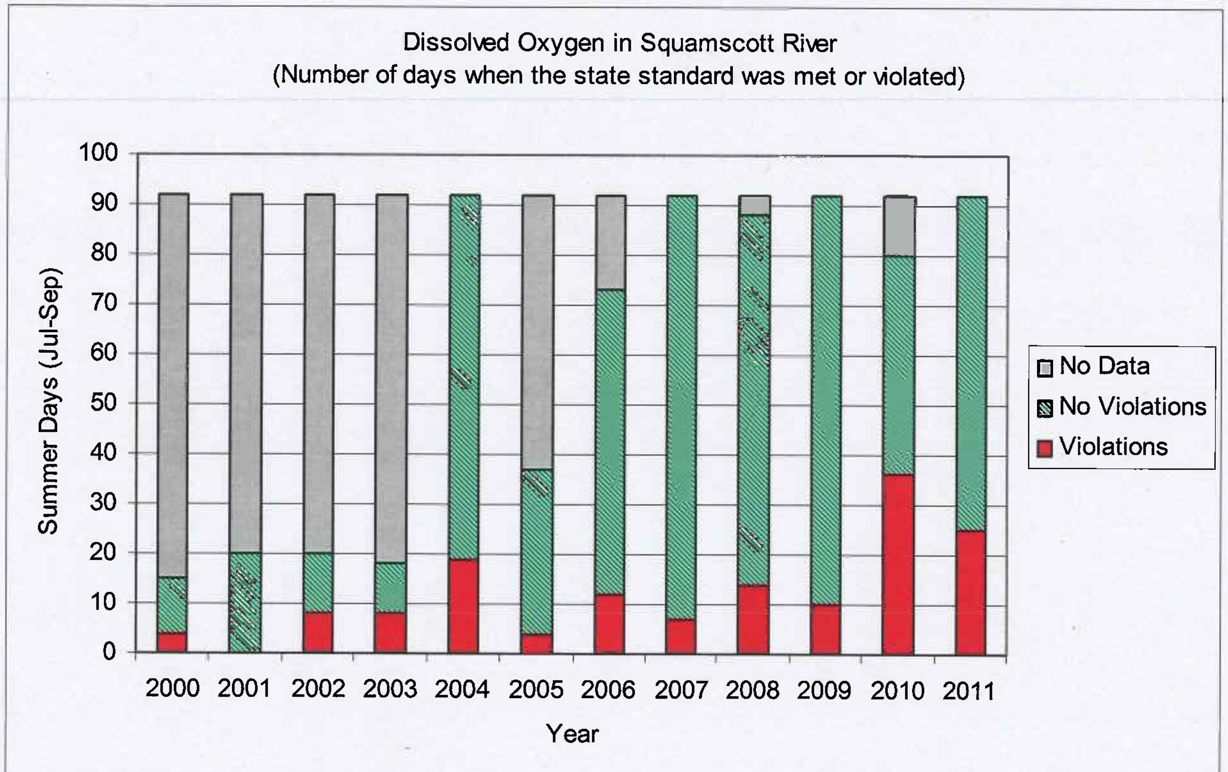


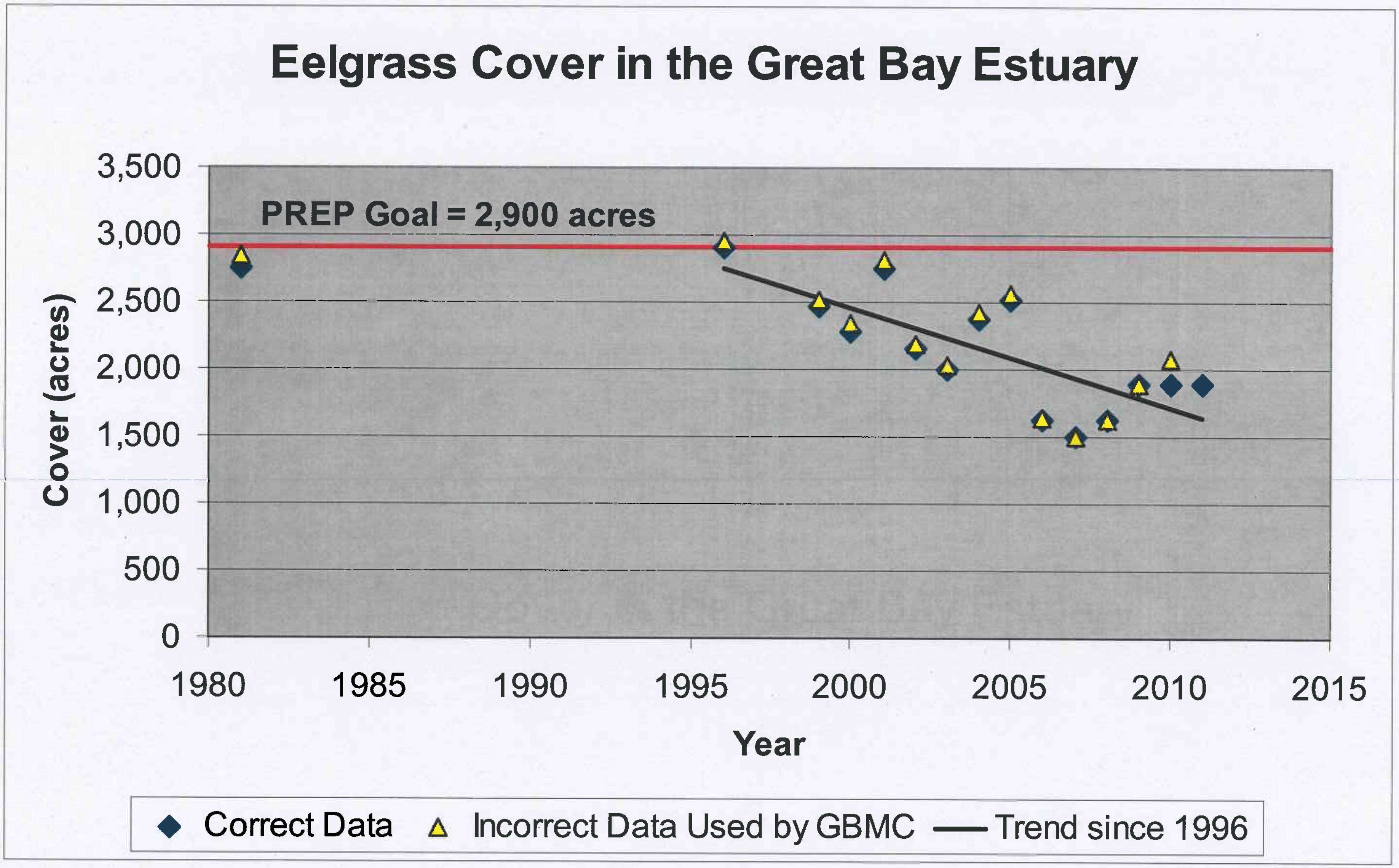
Source: PREP (2012) at 53, 69



Station Location

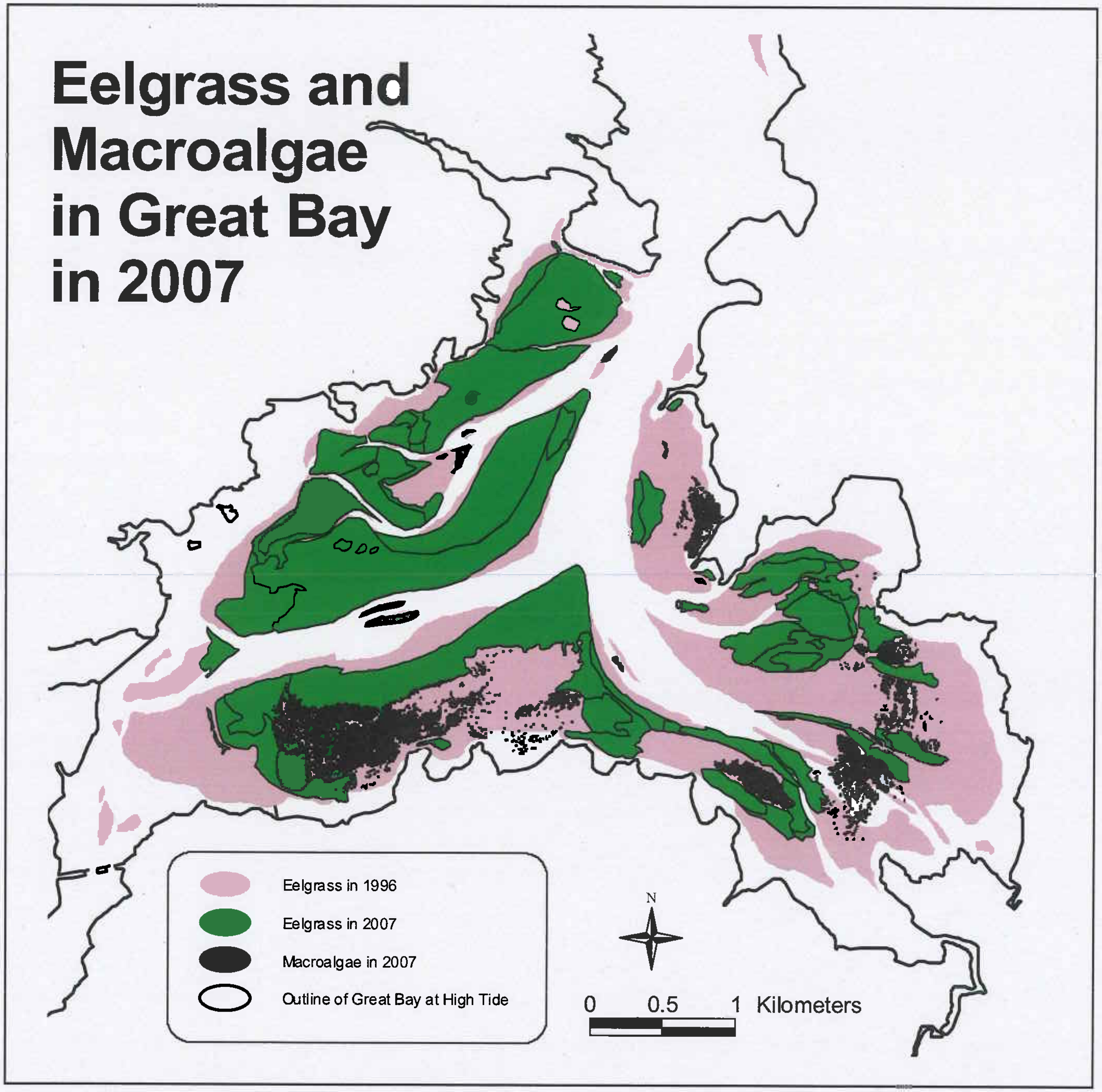





Eelgrass Cover in the Great Bay Estuary
PREP Goal = 2,900 acres
Cover (acres)
3,500
3,000
2,500
2,000
1,500
1,000
500
0
1980
1985
1990
1995
2000
2005
2010
2015
Year
Correct Data
Incorrect Data Used by GBMC
Trend since 1996

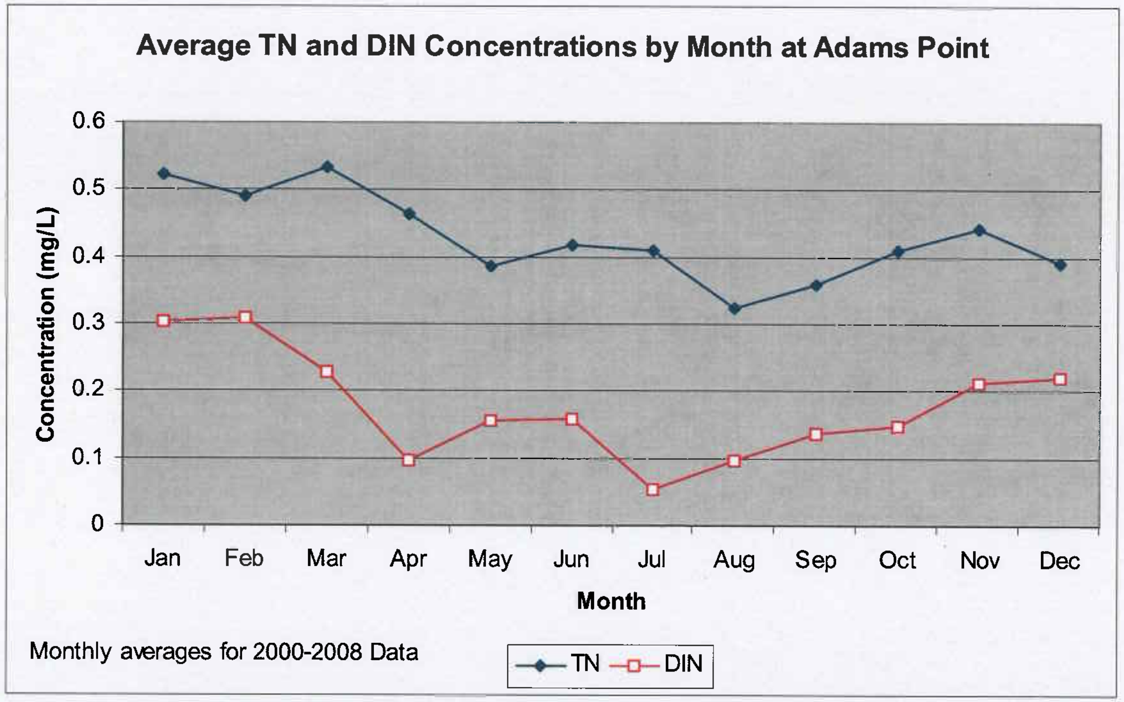
Close up of healthy eelgrass bed in Great Bay. Photo Credit: Fred Short (mid-1990s).

Close up of eelgrass bed in Great Bay showing epiphytes and macroalgae (*Gracilaria tikvahiae*). Photo Credit: Fred Short (2009).

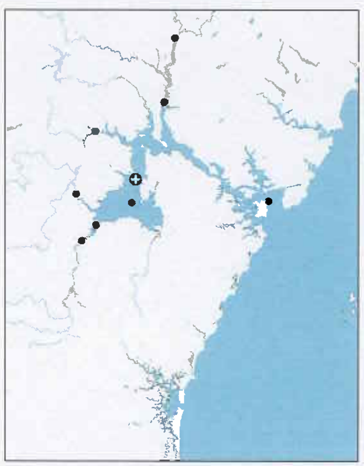

Eelgrass and Macroalgae in Great Bay in 2007
Eelgrass in 1996
Eelgrass in 2007
Macroalgae in 2007
Outline of Great Bay at High Tide
N
0
0.5
1 Kilometers

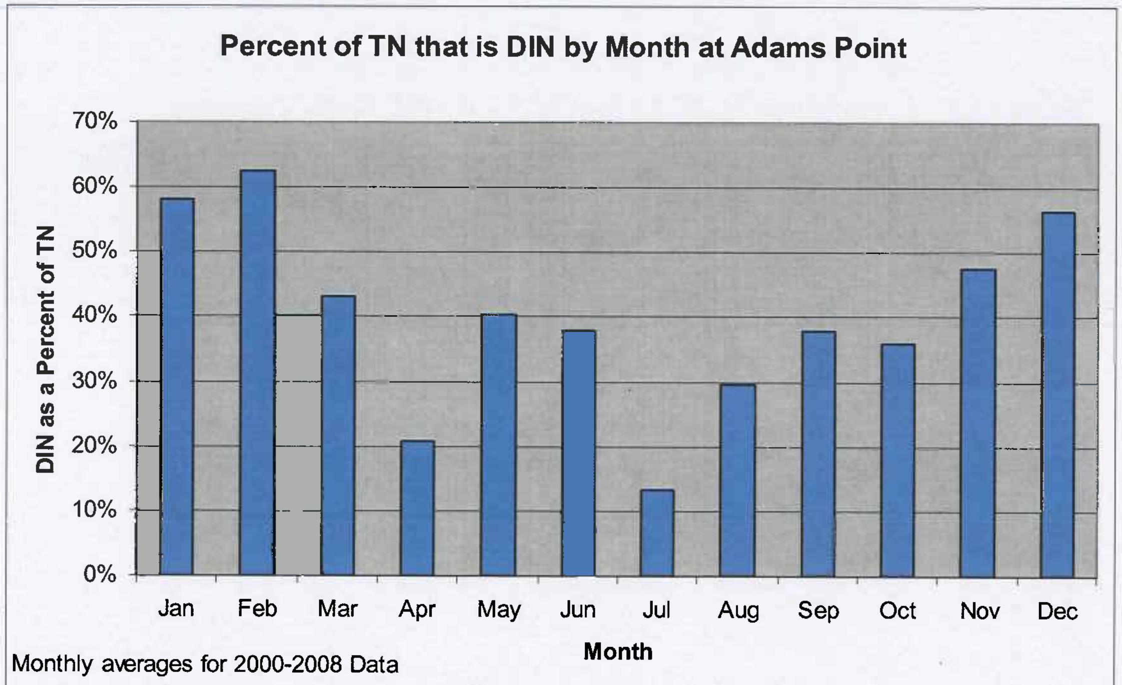
Station Location

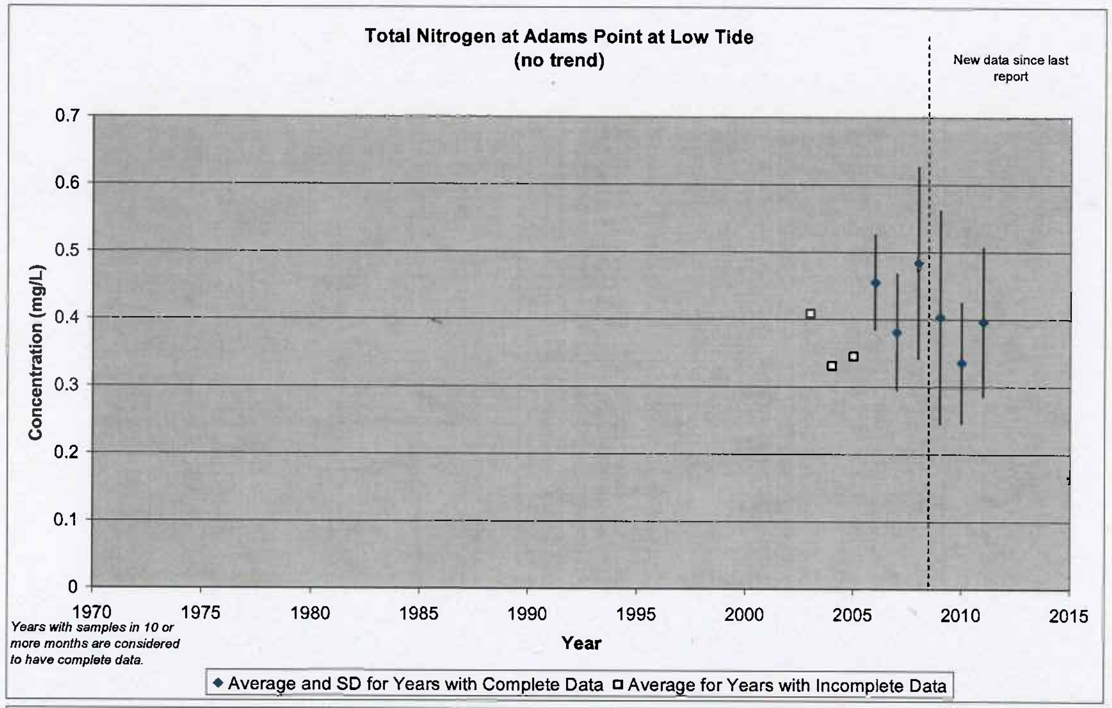
Macroalgae mats *(Ulva* and *Gracilaria)* in Great Bay near Lubberland Creek. Photo credit: Jeremy Neddleton (2008).



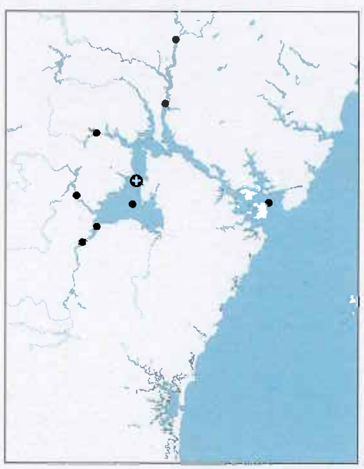
Station Location

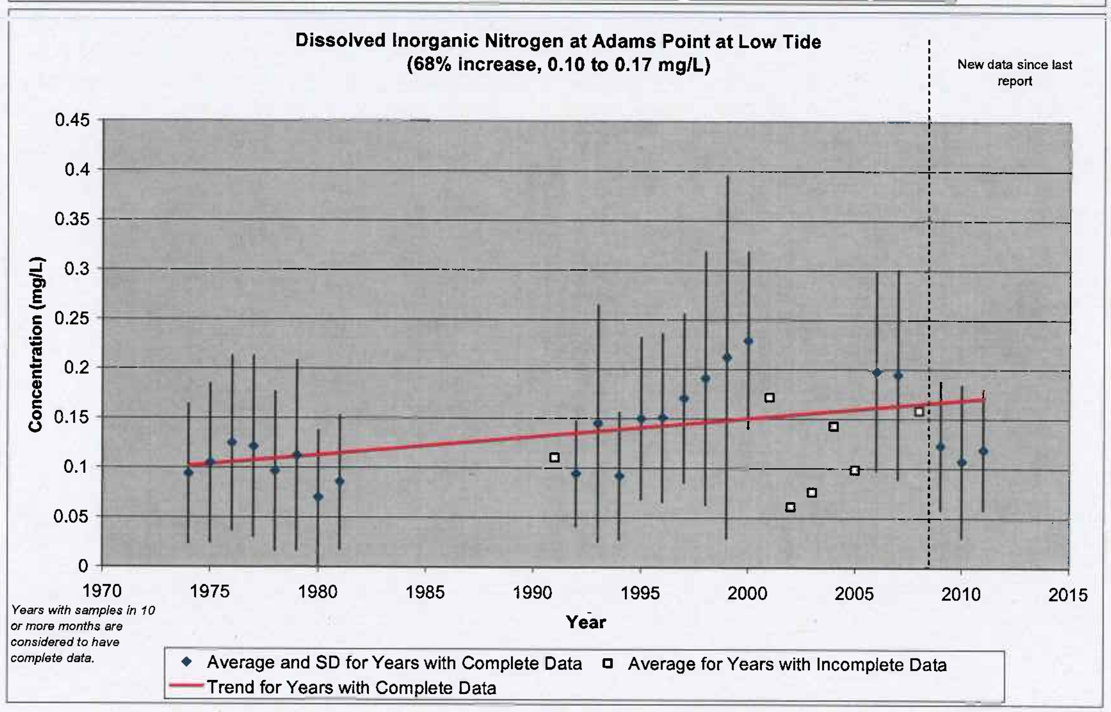


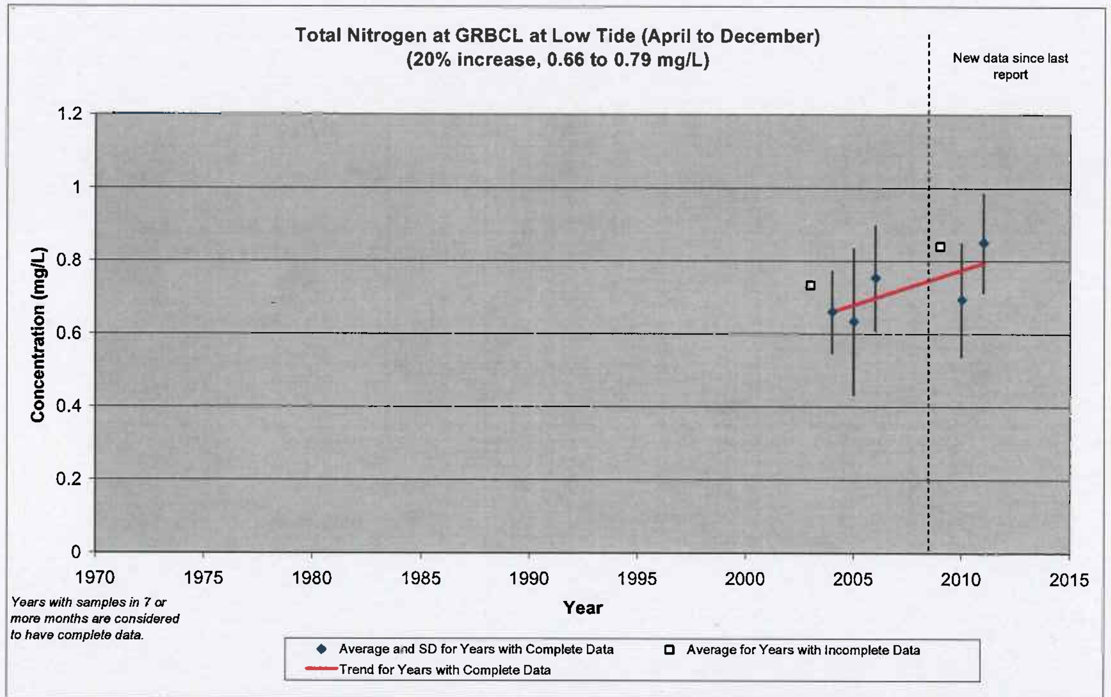




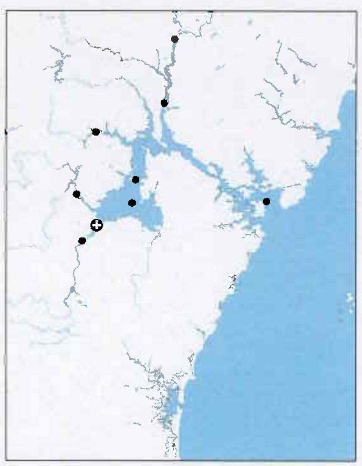
Station Location

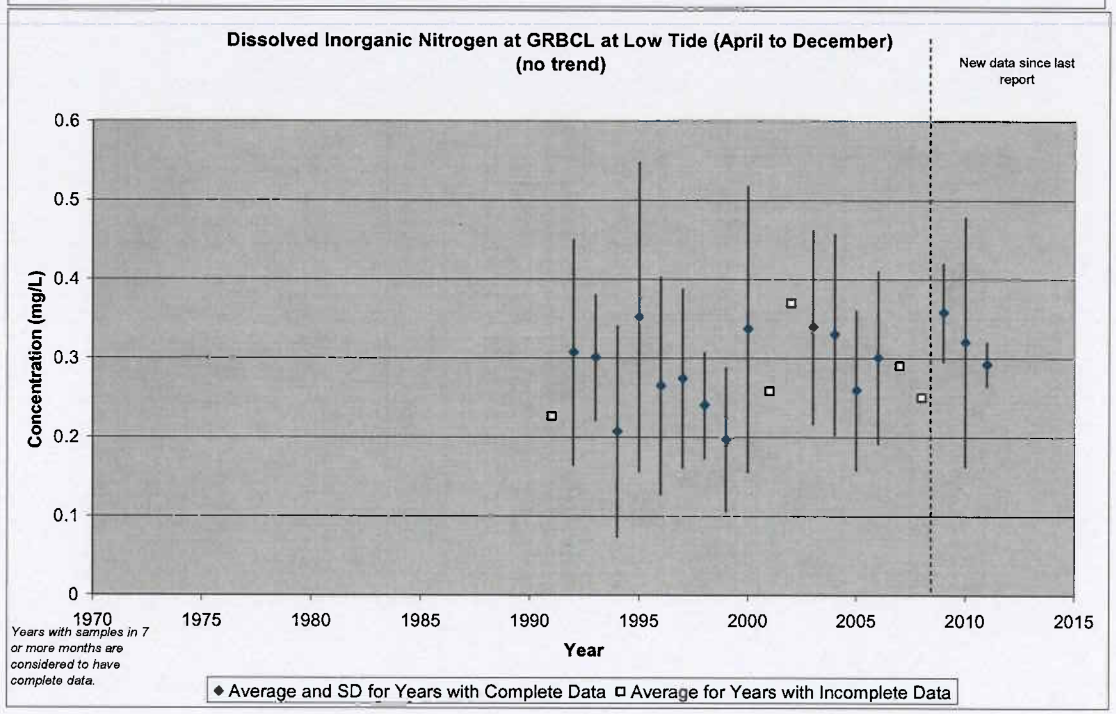


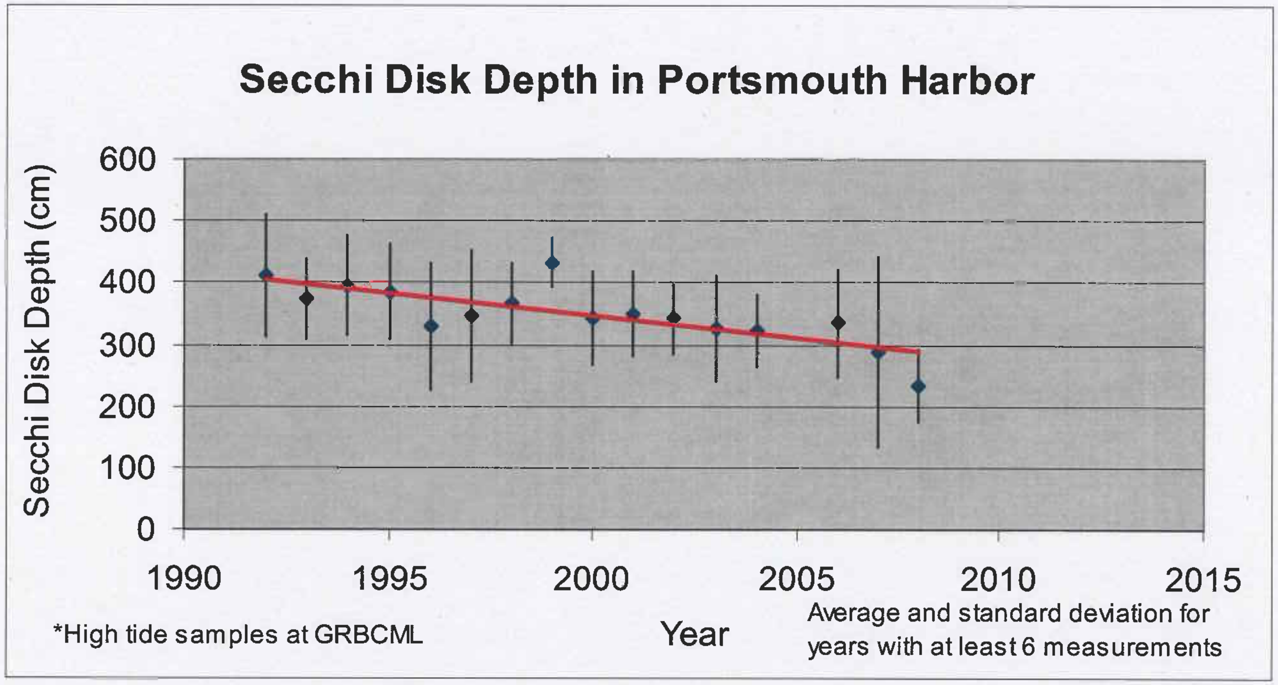




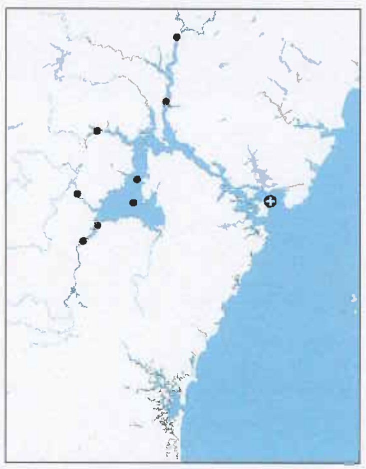
Station Location

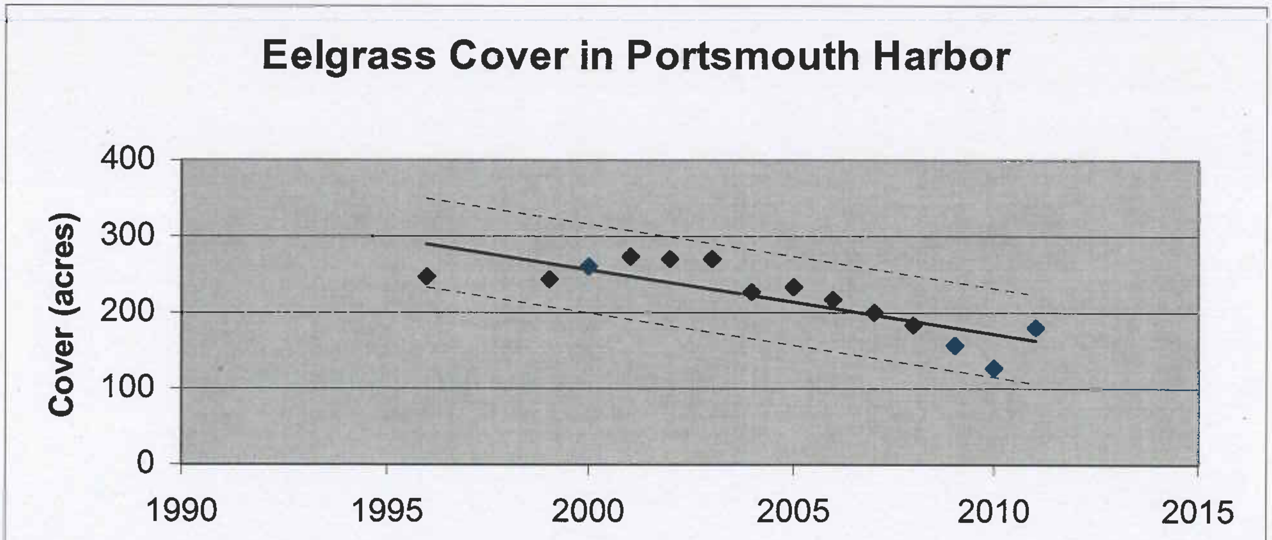






Station Location





Statistically significant trend

Table 3: Eelgrass cover in different zones of the Great Bay Estuary (acres)

Year	Winnicut River	Squamscott River (N)	Lamprey River (S)	Oyster River	Bellamy River	Great Bay	Little Bay	Upper Piscataqua River*	Lower Piscataqua River (N)*	Lower Piscataqua River (S)*	Portsmouth Harbor*	Little Harbor	Sagamore Creek
1948	0.0	42.1	53.4	182.5	66.9	263.9	76.5	62.0	a	a	a	a	a
1962	a	a	a	a	a	a	a	17.7	20.0	21.8	a	a	a
1980-1981	a	a	a	a	36.0	1217.4	408.7	42.2	75.9	10.7	a	a	a
1981	0.0	0.0	0.0	a	3.4	2130.7	252.0	0.5	60.1	5.1	227.7	68.8	4.1
1986	2.2	0.0	0.0	a	a	2015.2	a	a	a	a	a	a	a
1987	2.2	0.0	0.0	a	a	1685.7	a	a	a	a	a	a	a
1988	0.0	0.0	0.0	a	a	1187.5	a	a	a	a	a	a	a
1989	0.0	0.0	0.0	a	a	312.6	a	a	a	a	a	a	a
1990	15.9	0.0	0.0	a	a	2024.2	a	a	a	a	a	a	a
1991	23.4	0.0	0.0	a	a	2255.8	a	a	a	a	a	a	a
1992	7.3	0.0	0.0	a	a	2334.4	a	a	a	a	a	a	a
1993	6.9	0.0	0.0	a	a	2444.9	a	a	a	a	a	a	a
1994	13.8	0.0	0.0	a	a	2434.3	a	a	a	a	a	a	a
1995	7.8	0.0	0.0	a	a	2224.9	a	a	a	a	a	a	a
1996	7.6	0.0	0.0	14.0	0.0	2495.4	32.7	1.6	20.9	10.2	245.6	70.1	1.8
1997	7.5	0.0	0.0	a	a	2297.8	a	a	a	a	a	a	a
1998	10.0	0.0	0.0	a	a	2387.8	a	a	a	a	a	a	a
1999	10.2	0.0	0.0	0.0	0.0	2119.5	26.2	0.5	7.4	4.0	244.0	50.1	3.0
2000	0.0	0.0	0.0	0.0	0.0	1944.5	7.5	1.6	3.8	7.6	260.5	60.9	0.9
2001	4.1	0.0	0.0	0.0	0.0	2388.2	10.9	2.0	9.7	10.7	274.2	45.3	2.2
2002	3.5	0.0	0.0	0.0	0.0	1791.8	4.3	0.5	8.0	9.3	268.9	63.1	2.3
2003	3.5	0.0	2.2	0.0	0.0	1620.9	14.2	2.9	22.9	9.2	270.1	54.7	2.2
2004	4.2	0.0	0.0	0.0	0.8	2037.6	12.8	0.7	13.5	6.5	225.2	65.8	2.5
2005	9.1	0.0	0.0	0.0	0.0	2165.7	25.8	0.4	14.5	9.6	232.5	47.9	6.1
2006	0.8	0.0	0.0	0.0	0.0	1319.8	12.2	0.8	10.8	11.6	217.6	52.1	0.9
2007	0.0	0.0	0.0	0.0	0.0	1245.3	0.1	0.0	0.4	5.6	201.3	42.7	0.6
2008	0.0	0.0	0.0	0.0	0.0	1394.9	0.0	0.0	0.0	3.9	183.8	41.4	2.3
2009	0.1	0.0	0.0	0.0	0.0	1700.6	0.0	0.0	0.0	6.4	155.0	30.2	0.5
2010	0.0	0.0	0.0	0.0	0.0	1722.2	0.3	0.0	0.0	3.5	128.0	42.5	0.2
2008-2010 median	0.0	0.0	0.0	0.0	0.0	1700.6	0.0	0.0	0.0	3.9	155.0	41.4	0.5
Percent Change: Historic to '08-'10	NA	-100.0%	-100.0%	-100.0%	-100.0%	-20.2%	-100.0%	-100.0%	-100.0%	-87.9%	-31.9%	-39.8%	-88.3%
Significant Decrease Since 1990	-70.9%	NA	NA	NA	NA	-15.2%	-48.8%	-41.9%	-29.5%	No trend	-16.2%	-19.2%	No trend
Listing	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired	Impaired

a = not mapped   NA = not analyzed   * The 1948 and 1980-1981 surveys only covered the NH side of the river. The 1962 survey only covered the ME side.

* The acreages for 1996-2008 include beds from both the NH and ME sides of the river but not the tidal creeks along the Maine shore.

Eelgrass has not been mapped in North Mill Pond, South Mill Pond, Berrys Brook, Salmon Falls River, and Cocheco River. These assessment zones were left off this table.

EXHIBIT– 23

HALL & ASSOCIATES

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August 12, 2011

VIA E-MAIL

Stephen S. Perkins
Director, Office of Ecosystem Protection
U.S. Environmental Protection Agency
Region 1
5 Post Office Square
Suite 100
Boston, MA 02109-3912
E-mail: Perkins.Stephen@epamail.epa.gov

RE: Supplemental Comments in Response to Request for Public Comment on Proposed Town of Exeter, NH, NPDES Permit No. NH0100871

Dear Mr. Perkins:

The Great Bay Municipal Coalition (the Coalition) is an organization dedicated to the establishment of appropriate and cost-effective restoration measures to protect Great Bay and its resources. The Coalition represents the six major communities whose wastewater flows into various parts of the Great Bay system – Dover, Durham, Exeter, Newmarket, Portsmouth, and Rochester. These communities are directly impacted by the proposed nutrient reduction water quality objectives and requirements for the Town of Exeter. Attached please find supplemental comments and objections to the proposed modification of the Town of Exeter, NH, NPDES Permit No. NH0100871. These supplemental comments are provided on behalf of the Coalition and on behalf of the Coalition's individual members in addition to the comments and objections submitted to EPA by the Coalition on Aug. 9, 2011. Thank you for your consideration of these comments. We look forward to the Region's response.

Sincerely,

John C. Hall

Enclosures
cc: Coalition Members
Ted Diers, DES

Proposed Exeter Permit
Supplemental Comments of the Great Bay Municipal Coalition

The Great Bay Municipal Coalition (the Coalition) is an organization dedicated to the establishment of appropriate and cost-effective restoration measures to protect Great Bay and its resources. The Coalition members include the towns of Dover, Durham, Exeter, Newmarket, Portsmouth, and Rochester. These communities are directly impacted by the proposed nutrient reduction requirements for the Town of Exeter. These comments supplement the comments submitted by the Coalition on Aug. 9, 2011, regarding the proposed modification of the Exeter, NH, NPDES Permit No. NH0100871 and are based on EPA's July 29, 2011, response to the Coalition's FOIA request dated June 8, 2011. EPA's response – en toto – is incorporated by reference as the administrative record documents addressing the specific topics covered in the Coalition's FOIA request. Further comments may be submitted based on EPA's response to the Coalition's request that EPA clarify or supplement the response provided to the Coalition.

Based on these supplemental comments and the earlier comments submitted by the Coalition, we object to this permit action as technically and legally flawed and request that the proposed permit modification action be withdrawn.

Supplemental Issues Regarding the Ability to Identify Available Arguments and All Supporting Materials

1. The Administrative Record Lacks Adequate Information on the Squamscott River

The Coalition, through its representatives, requested that EPA produce, under the Freedom of Information Act ("FOIA"), those agency records that support various claims that EPA has made in the permit Fact Sheet and in its public presentations regarding the proposed permit modification. EPA recently provided that information on July 29, 2011, and Hall & Associates has reviewed those documents. The FOIA response rather uniformly lacked Agency records addressing nutrient impacts on the Squamscott River, as follows (numbering follows that of original FOIA request):

1. Data from and analyses of the Squamscott River showing:

    a. changes in transparency caused the eelgrass losses in this system;

    b. whether the 0.75 Kd (the transparency basis for the 0.3 mg/1 TN numeric criteria) is attainable in this system;

    c. how other confounding/contributing factors, unrelated to algal growth, impact transparency in this system (i.e., color, turbulent mixing, turbidity);

    d. the relative importance of turbidity and color versus algal level in controlling transparency in the Squamscott River;

e. whether it is proper to apply the 0.3 mg/1 TN median value developed by DES under low flow, limited dilution conditions to derive permit limits;

f. the frequency of occurrence for the conditions used by EPA to generate the TN permit limits;

g. that TN, rather than biologically available nitrogen (generally inorganic nitrogen (TIN), is the appropriate form of nitrogen to control in this system;

h. that there is sufficient detention time in this system to convert organic forms of nitrogen into inorganic nitrogen and significantly impact algal growth in the system;

i. the degree to which chlorophyll a in the Squamscott River affects transparency under average/median conditions; and

j. that nutrients are the limiting factor controlling algal growth in the Squamscott River and Great Bay.

2. Documentation showing where eelgrass originally was present in the Squamscott system and whether the habitat in those areas has changed in the past 40 years.

3. Documentation showing what the TIN, TN and algal levels were in the system when eelgrass was present in the Squamscott River.

4. Documentation showing what caused the loss of eelgrass in the Squamscott River prior to 1980.

5. Documentation showing that the causes of eelgrass decline in the Bay are the same factors that caused eelgrass losses in the Squamscott River decades earlier.

6. Documentation showing that DES has adopted and EPA has approved the proposed numeric criteria used to derive the Exeter permit limits.

7. Documentation of the public review process showing that the 0.3 mg/1 TN criteria applied by EPA has undergone formal notice and comment by DES as part of the CWA Section 303(c) adoption process, as required by applicable federal rules (40 CFR 131.21).

8. Documentation showing that the 0.3 mg/1 TN criteria was based on an analysis of how conditions in the tidal rivers influence algal growth and transparency.

9. Documentation showing that attainment of the 0.3 mg/1 TN criteria will assure attainment of the 22% incident light at 2 meters (0.75 Kd) in the Squamscott River.

10. Documentation that promoting eelgrass growth in the Squamscott River requires the same degree of light penetration as the Bay (22% incident light at 2 meters).

11. Documentation on the degree of transparency improvement and algal growth reduction that will occur in the Squamscott River if the Exeter discharge is limited to 3 mg/1 as recommended in the draft permit.

12. Documentation showing that reduced transparency has occurred in Great Bay from 1990-2008 and that the change in transparency was sufficient to cause the eelgrass reductions occurring in the Great Bay system.

13. All documentation showing that the existing transparency level in the Bay is insufficient to maintain current eelgrass populations, even when the tidal variation in the Bay is considered.

15. Any correspondence/communications between EPA and NHDES indicating whether or not that EPA should impose the transparency-based TN criteria in the tidal rivers such as the Squamscott River.

16. Documentation showing that the TN objectives used by Massachusetts and Delaware referenced in the permit Fact Sheet were intended to be applied in tidal rivers with hydrodynamics similar to the Squamscott River.

Consequently, this FOIA response confirmed that the Administrative record lacks adequate information upon which the Agency could appropriately base a decision that 1) attainment of a 0.3 mg/l TN instream objective in the Squamscott River is necessary to restore lost eelgrass beds in that waterway, and 2) that a 3 mg/l total nitrogen monthly average limitation is necessary to ensure compliance with New Hampshire’s narrative water quality standards and abate existing impairments in the Squamscott River.