

July 19,1990

Anita Kelman  
Bureau of Municipal Facilities  
One Winter Street  
Boston, MA 02108

re: addressing nitrogen loading issues in the development of STF plans

Dear Ms. Kelman:

As you know, the Buzzards Bay Project has recommended in the Buzzards Bay Comprehensive Conservation and Management Plan that both DEP and municipalities adopt embayment-specific nitrogen loading rate limits to prevent critical impacts from nitrogen on water quality, living resources, and habitat in coastal waters.

To explore the possibility of the DEP adopting this strategy, the Buzzards Bay Project met on June 28, 1990, with the Division of Water Pollution Control and the Bureau of Municipal Facilities Planning, as well as the Town of Marion and its engineering firm (CDM), to discuss the need for assessing existing and potential future nitrogen impacts from Marion's wastewater treatment facility and other sources discharging to Aucoot Cove. The Project met with the town and DEP in an advisory capacity to review proposed work by CDM to address nitrogen loading issues.

At the meeting, the Project discussed its concerns about nitrogen loading impacts to Aucoot Cove. To determine if a nitrogen management strategy needs to be applied to the Marion sewage treatment facility, we stated that the following assessments must be made:

- The drainage basin to Aucoot Cove must be delineated (note: except for some minor details, this has been done).
- Existing nitrogen inputs from septic systems, agriculture, the sewage treatment facility and other sources in the Aucoot Cove drainage basin must be calculated. The contribution of nitrogen from so-called non-point sources is determined by parcel-by-parcel landuse analysis. The contribution from the sewage treatment facility can be calculated from monitoring volume and total nitrogen in stream discharges.
- A similar assessment needs to be conducted to estimate the nitrogen contribution from all sources when the drainage basin is fully built-out.

- Flushing time of Aucoot Cove must be calculated.
- To document the potential need for nitrogen management in Aucoot Cove, and to help develop a final recommendation for a nitrogen loading rate limit specific to Aucoot Cove, we are recommending that water quality be monitored this summer in Aucoot Cove, and that the condition of living resources be assessed.

In terms of accomplishing these tasks and to test a nitrogen management strategy in Aucoot Cove, the Buzzards Bay Project agrees to the following:

- The BBP will work with DEP and Marion to resolve boundary delineation issues of the Aucoot Cove drainage basin.
- The Buzzards Bay Project will hire a contractor to calculate flushing time in Aucoot Cove.
- The Buzzards Bay Project will fund the Town of Marion to hire a contractor to conduct a marine water quality survey. The Buzzards Bay Project will evaluate the data produced by this effort and make recommendations to DEP and the Town of Marion and its consultant. We will work with CDM to fold this information into the facilities plan.

The Buzzards Bay Project is requesting that the Town of Marion conduct the nitrogen loading and build-out assessment as well as the stream water monitoring program to quantify effluent water discharge and nitrogen load to Aucoot Cove from freshwater sources.

After evaluating the scope of services prepared by CDM to assess nitrogen inputs to Aucoot Cove, and after considering CDM's statements during the meeting on June 28, 1990, the Buzzards Bay Project makes these recommendations on how the proposed scope of service should be modified:

- Four summertime marine water quality surveys of Aucoot Cove, rather than a single survey as was proposed, are necessary to characterize nitrogen loading impacts to the Cove. This survey should include chlorophyll a measurements and light extinction measurements in addition to the other parameters that were proposed to be measured.
- Oxygen levels should be measured routinely in all streams entering Aucoot Cove whenever water samples are taken. At any streams that may be tidally influenced, conductivity should also be measured so that seawater mixing can be accounted for in evaluating contaminant concentrations.
- The nitrogen loading assessment and build-out analysis must be based on a parcel-by parcel evaluation of existing and potential land-use, and conducted over the entire Aucoot Cove drainage basin.
- Because a nitrogen loading assessment is based on annual nitrogen loadings it is necessary to have a reasonable estimate of annual nitrogen loading from the facility. An estimate of annual nitrogen loading from effluent samples taken only during the summer months may be inadequate because higher stream flow and reduced biological activity during winter months may result in higher

loading rates from the facility. Because of this, we believe some monitoring of the effluent discharge should be conducted in the fall, winter, and spring as well.

After the meeting on June 28th, you requested that the project submit written justification for these recommendations, particularly the need and use of data collected in a survey of marine water quality. On the attached page, I have included a summary of the Project's positions. I have also attached a draft of a fact sheet on nitrogen loading that we are preparing.

Thank you for considering these matters.

Sincerely,

Joseph E. Costa, Ph.D.  
Project Manager

cc: Jeff Benoit, Director, CZM  
Jan Smith, CZM  
Brian Donahoe, Director, DWPC  
Larry Gil, DWPC  
Bernadette Kolb, CDM  
Ray Pickles, Town Administrator, Marion

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## **Buzzards Bay Project Position Summary**

### **Addressing nitrogen impacts in sewage treatment facilities plans**

#### Background

The addition of nitrogen to coastal waters can cause significant water quality and habitat degradation. Adverse effects may include copious growth and accumulation of both micro- and macro-algae, loss of eelgrass and shellfish habitat, and low dissolved oxygen resulting in finfish and shellfish kills.

The effects of this nitrogen loading are most pronounced in embayments with restricted flushing, but any habitat can be impacted if nitrogen inputs are sizeable. The primary sources of nitrogen include sewage treatment facilities, septic systems, and fertilizer use. Sewage treatment facilities also pose an additional related threat because the biological and chemical oxygen demand of effluent can contribute to the oxygen deficit caused by increased algal production.

Because sewage treatment facilities, where present, generally represent the largest local source of nitrogen, it may be necessary to manage these and other sources of nitrogen to sensitive embayments to prevent nitrogen inputs from exceeding critical limits.

At present, there are no water quality standards or regulations that encompass all nitrogen loading issues. In the draft Buzzards Bay Comprehensive Conservation and Management Plan (CCMP), we recommend that anthropogenic inputs of nitrogen to nitrogen sensitive embayments not exceed 250 mg per cubic meter per water turnover time. This number was determined based on studies conducted in Buzzards Bay and elsewhere. This limit will be carefully reviewed by experts in the scientific community this fall, and the limit may be revised in the final CCMP.

To help evaluate this proposed standard, the Buzzards Bay Project intends to examine wherever possible, the relationship between existing loading and existing water quality and habitat degradation. In this respect, Aucoot Cove is ideal because virtually all anthropogenic loading is located near Aucoot Cove or has a short transit time to Aucoot Cove.

#### Justification for Recommendations

Below are justifications for the build-out and monitoring strategy outlined. With respect to water quality and habitat monitoring, this data fulfills three needs: 1) it documents whether Aucoot Cove is now degraded under existing loading conditions, 2) it will help the project and state formulate water quality standards (loading limits) specific to Aucoot Cove, and 3) it can be used as baseline information to help detect new trends in water quality, and the effectiveness of management action taken.

- N-loading assessment and build-out analysis

A parcel by parcel analysis of Aucoot Cove drainage basin is necessary to evaluate all existing and future inputs of nitrogen to Aucoot Cove. The build-out analysis will identify what nitrogen management options must be taken to protect the Cove. For example, if existing loading from the

facility, agricultural land, and development do not exceed critical loading limits for Aucoot Cove, but a larger facility and a full build-out would exceed critical limits, then the Town of Marion could take action to manage growth, future loading from the facility, or both to keep below these limits. For example, if loading rates resulting from expansion of the facility, together with a full build-out, elevates nitrogen loading rates above critical limits, the Town of Marion could take steps to either reduce the density of future development or limit the number new units in the drainage basin, reduce the number of units tied into the treatment facility, or provide increased nitrogen removal capacity at the treatment facility. Many steps can be taken to manage future nitrogen inputs, and options depend upon the results of the loading assessment from land use and the treatment facility, as well as future build-out conditions. Decisions on a performance standard for nitrogen loading from the treatment plant would also depend on whether or not Marion could offer guarantees to manage nitrogen inputs from landuse if it was determined land-use inputs were a significant factor in the assessment.

- Nitrogen monitoring of streams discharging to Aucoot Cove

Actual volume and total nitrogen concentration (TKN+Nitrate+nitrite) of effluent discharged from the facility is necessary to document the relationship between population served by the facility and actual annual effluent discharge. Monitoring for nitrogen along Effluent Stream will also show whether nitrogen is attenuated to any appreciable extent along transit or if there other significant inputs from other streams. While total nitrogen (TKN+nitrate+nitrite) is useful for quantifying mass loadings, it is appropriate to monitor ammonia as well in the streams both to validate TKN measurements and to determine how much bioavailable nitrogen (primarily dissolved inorganic fractions, that is, nitrate+nitrite and ammonia) is discharged to Aucoot Cove.

- Stream gauges

Stream gauges can be used not only to calculate mass loading of nitrogen from surface waters, but groundwater as well. That is, groundwater contributions to Aucoot Cove can be approximated by subtracting surface water flow from rainwater recharge (after accounting for transpiration). The limited number of groundwater stations now proposed may be adequate for this assessment if both groundwater volumes are small and groundwater nitrogen concentrations are low.

- Seawater analyses for nutrients and chlorophyll

Seawater assessment of dissolved organic, inorganic, total nitrogen, orthophosphorus, and chlorophyll as important parameters for documenting the quantity of and existing impact of nitrogen inputs to Aucoot Cove. This data will be used in part to define existing impacts on receiving waters, as well as to interpret dissolved oxygen data and to predict organic enrichment of sediments and sediment oxygen demands.

- Oxygen monitoring

Oxygen monitoring in streams and Aucoot Cove will indicate if there is significant water quality degradation in any of these receiving waters. If there is evidence of low dissolved oxygen in Aucoot Cove, it would be appropriate to consider existing sediment oxygen demand in evaluating the potential future impact of increased nitrogen discharge from the facility.

- Light extinction coefficients

Decreased water transparency is a result of coastal enrichment, hence monitoring the light

extinction coefficients at a station is a useful indicator existing impacts and for documenting long-term changes in water quality. Light extinction coefficients are also useful in determining the extent of benthic algal production.

- Eelgrass and algal indexes

Oxygen deficits and fish kills are indicators of extreme adverse impacts of nitrogen loading. By the time water quality declines to this degree, important habitat such as eelgrass beds and shellfish beds may already be lost, and benthic algae may have already accumulated to unacceptable levels. Because the loss of eelgrass beds is a sensitive indicator to nutrient loading, as well as the growth, accumulation, and species composition of algae, measurements of both are important for characterizing existing conditions in Aucoot Cove and as indicators of future changes in water quality. The measurements of these parameters was not specifically discussed, but it is important that these biological indicators be part of the facilities plan evaluative process. The Buzzards Bay Project, will procure historical aerial photographs of Aucoot Cove to document whether eelgrass beds have declined appreciably there in recent decades. We will consult with DEP and researchers involved with the Project to determine if there is both a need and a feasible strategy to evaluate the accumulation and composition of benthic algae.