

Appendix L

Bucks Creek: Wastewater Modeling Scenario



***** MEP Technical Memorandum *****

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From: Brian Howes, Director Coastal Systems Program SMAST & Technical Director MEP
Trey Ruthven, Applied Coastal Research and Engineering
Ed Eichner, Cape Cod Commission
RE: Bucks Creek: Wastewater Modeling Scenario
Date: August 31, 2007

The present Technical Memorandum summarizes the results of the Bucks Creek CWMP Alternative Scenario related to sewerage plans for the Town of Chatham and increased recharge of treated effluent at the present WWTF location. The work was conducted under the extended contract between the Town of Chatham and the University of Massachusetts-Dartmouth, as finalized on July 31, 2007. As indicated in previous email correspondence (bhowes on July 31, 2007) this Technical Memorandum is being delivered to the Town by August 31, 2007.

The scenario was evaluated using the Linked Watershed-Embayment Nutrient Management Modeling Approach developed by the Massachusetts Estuaries Project Technical Team for the Sulphur Springs-Bucks Creek-Cockle Cove Estuarine System in 2003 and updated for the Town in February 2007.

The key components of the Town's wastewater management scenario are as follows:

- Non-wastewater/septic N loads are to be based upon the Build-Out Nitrogen Load (fertilizer, impermeable surfaces, etc), as specified in the updated Nutrient Technical Report of February 2007 (Chatham letter 6-14-07)
- All septic loading (100%) is removed (i.e. Town-wide sewers)
- All treated wastewater (100%) is treated and discharged at existing WWTF site with all recharge entering downgradient embayments (i.e. no groundwater transport to Nantucket Sound). Average daily effluent recharge is 1.9 mgd @ 3 mg TN L⁻¹ yielding a total effluent N load to each of the 3 main basins of the Sulphur Springs Estuary of
 - 7.90 kg/d to Cockle Cove Creek
 - 1.14 kg/d to Bucks Creek
 - 1.70 kg/d to Sulfur Springs
- Attenuation of N by Cockle Cove Creek is 38% as used in the updated analysis (MEP Tech Memo February 2007)

All information as to changes in nitrogen loading were developed by the Town of Chatham and presented to the MEP Technical Team. It is important to note that only a portion of the nitrogen from the new discharge enters the Sulphur Springs System, the remainder discharging to other of

Chatham's estuaries, which is outside of the scope of this scenario run. It might be useful for the referenced USGS data and a description of how the effluent was apportioned to each sub-embayment to be available with this document.

The above scenario data were used develop total nitrogen loads to the three main basins to determine changes in watercolumn TN levels from those determined by the existing Linked Watershed-Embayment Nutrient Management Model of February 2007 (Tables IX-1, IX-2). The results were then compared to both the present conditions throughout the system and specifically how the TN levels would relate to the threshold at the Sentinel Station inside the inlet to the Sulphur Springs sub-basin and at the mid station in Cockle Cove Creek. The threshold nitrogen level at the Sentinel Station was previously determined to be $0.380 \text{ mg TN L}^{-1}$ and the most conservative level for Cockle Cove Creek level was determined to be 2.0 mg TN L^{-1} .

The results of the Wastewater Scenario indicate that both the threshold level at the Sentinel Station is achieved ($0.365 \text{ mg TN L}^{-1} < 0.380 \text{ mg TN L}^{-1}$) and secondary check TN levels within Cockle Cove are also acceptable, $1.636 \text{ mg TN L}^{-1}$ (Table IX-3). Based upon the wastewater effluent nitrogen load provided by the Town of Chatham, this management alternative would meet the nitrogen threshold and secondary criterion for the Sulphur Springs System.

Table IX-1. Present sub-embayment loads used for total nitrogen modeling of the Sulphur Springs embayment system, with total watershed N loads, atmospheric N loads, and benthic flux.^A

Sub-embayment	Present Watershed Load (kg/day)	Atmospheric Deposition (kg/day)	Benthic Flux (kg/day)
Sulphur Springs System			
Sulphur Springs	9.529	0.378	-3.756
Bucks Creek	3.362	0.132	2.910
Cockle Cove Creek	8.427 ^B	0.060	-0.578

A - Based upon updated data of February 2007 Technical Memo
 B - value does not include attenuation by salt marsh

Table IX-2. Scenario sub-embayment loads used for wastewater scenario for the Sulphur Springs embayment system, with total watershed N loads, atmospheric N loads, and benthic flux.^A

Sub-embayment	Scenario Watershed Load (kg/day)	Atmospheric Deposition (kg/day)	Benthic Flux (kg/day)
Sulphur Springs System			
Sulphur Springs	4.041	0.378	-3.379
Bucks Creek	1.819	0.132	2.585
Cockle Cove Creek	8.959 ^B	0.060	-0.495

A - Based on updated data Technical Memo (February 2007) & Town Scenario
 B - value does not include attenuation by salt marsh

Table IX-3. Comparison of tidally averaged total N concentrations from present loading and sewerage scenario, with percent change from existing conditions, for the Sulphur Springs embayment system sub-embayments. The threshold level at the Sentinel Station in Sulphur Springs is 0.380 mg TN/L.

sub-embayment	Present (mg/L)	Scenario (mg/L)	% change ^A	% change ^B
Sulphur Springs				
Sulphur Springs (Sentinel)	0.452	0.365	-19.2%	-52.1%
Bucks Creek	0.347	0.319	-8.1%	-45.2%
Cockle Cove Cr. – mid	1.373	1.636	+19.2%	+24.2%
Cockle Cove Cr. – low	0.410	0.426	+3.9%	+12.8%

A - change in watercolumn TN concentration
 B - change in TN concentration over background (0.285 mg TN L⁻¹).