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ENVIR. APPEALS BOARD

BEFORE THE ENVIRONMENTAL APPEALS BOARD
UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C.

In re:	)
	)
City of Attleboro, MA Department of	)
Water and Wastewater, Government Center,	)
77 Park Street, Attleboro, MA 02703	)
NPDES Permit No. 0100595	)
	)

APPENDIX TO PETITION FOR REVIEW

Douglas H. Wilkins
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July 8, 2008

APPENDIX

Tab A	Attleboro comments submitted 9/14/06 through its engineering firm, Camp, Dresser and McKee ("CDM")
Tab B	Attleboro comments submitted 9/14/06 through its Water Superintendent
Tab C	Attleboro comments submitted 9/14/06 through its attorneys, Anderson & Kreiger LLP ("A&K") (Exhibits A and B to this letter appear as Exhibits B and A to this appendix, respectively)
Tab D	Attleboro comments submitted 8/30/07 through CDM
Tab E	Attleboro comments submitted 8/30/07 through A&K
Tab F	Proposed Permit and Fact Sheet (Fact Sheet #1) jointly issued by Region 1 of EPA ("Region 1") and MADEP on August 16, 2006
Tab G	Rhode Island Department of Environmental Management ("RIDEM") comments
Tab K	Revised draft permit issued by Region 1 and MADEP on August 1, 2007 ("Fact Sheet #2")
Tab I	MADEP's water quality certification pursuant to Section 401(a) of the Act

A

CDM
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Cambridge, Massachusetts 02139
tel: 617 452-6000
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September 13, 2006

Mr. Paul A. Kennedy
Superintendent
Department of Wastewater
Government Center
77 Park Street
Attleboro, MA 02703

Dear Mr. Kennedy:

As you have requested, CDM has reviewed certain elements of the draft NPDES permit issued by the Environmental Protection Agency to the City of Attleboro.

We have prepared comments with respect to this permit, copies of which are attached hereto. Should you have any questions on these matters, please do not hesitate to contact me at 617-452-6246

Sincerely,

CAMP DRESSER & McKEE Inc.

John J Gall, Jr.
Vice President

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Comments on the Attleboro Permit

EPA presents no substantive justification of its own for the conclusion that "the nitrogen limit proposed in this permit is necessary to meet Rhode Island Water Quality Standards". It merely indicates that it has reviewed the RIDEM reports, RIDEM's responses to Massachusetts DEP's comments on the draft permits and other unspecified documents, and declares that it has concluded the limits are necessary. While acknowledging both the complexity and uncertainty associated with the dynamics of upper Narragansett Bay and the application of the MERL experiments to this system, EPA presents no discussion of the factors that it evaluated in reaching conclusions exactly the same as RIDEM. In particular, various individuals provided significant technical commentary on RIDEM's analysis, some of which RIDEM attempted to answer, and others of which RIDEM did not answer at all. EPA appears not to have addressed these questions at all, even though they form the basis for the continuing appeals of some Rhode Island Permits. The following presents an analysis of the existing permit.

Analysis of the Rhode Island Department of Environmental Management's
Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers

In December of 2004 RIDEM issued a study entitled *Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers* ("The 2004 Evaluation"). The study attempts to provide the substantiation of the permit limits for Total Nitrogen proposed by RIDEM for the treatment plants discharging into the Providence and Seekonk River systems. It uses research conducted by the Marine Ecosystems Research Laboratory (MERL) at the University of Rhode Island in the early 1980's on nutrient enrichment of Narragansett Bay, and data collected in 1995 and 1996 to support its conclusions. The study was developed by RIDEM when its initial efforts to construct a more formal total maximum daily load (TMDL) analysis using a numerical model to simulate the Providence/Seekonk River systems were unsuccessful.

Based on our review as described further below, the central problems with this analysis are that:

> It does not present a cohesive analysis of the dissolved oxygen dynamics of the Providence and Seekonk Rivers. The analysis ignores fundamental and critically important factors, including local sources of oxygen demanding substances and the impacts of physical processes such as elevated temperature and stratification on the oxygen dynamics of the Providence and Seekonk Rivers.
>
> In extrapolating the results of the MERL experiments it generally ignores the significant differences between the conditions in Narragansett Bay that the MERL simulates, and the Providence and Seekonk River system.
>
> In applying the the MERL experimental results, RIDEM makes significant conceptual errors which lead to flaws in its arguments.

Our concerns are more fully discussed below.

The analysis fails to properly analyze the oxygen deficits in the Providence River system.

The oxygen dynamics of an urban river/estuary system that receives discharges of oxygen demanding pollutants from multiple sources are very complicated. Any analysis of the conditions should take into account all potential sources of oxygen demanding substances, including the close-by discharges of two large wastewater treatment plants discharging significant quantities of oxygen demanding substances and the impacts of sediment oxygen demand reflecting the highly urbanized nature of adjacent watersheds. It should also include the impacts of physical conditions such as stratification, temperature, tidal stage, wind induced mixing and re-aeration, as well as the potential impacts of algae on the oxygen conditions. The complexity of these interactions is presumably the reason that RIDEM originally undertook to establish a model of the Seekonk and Providence River systems to develop a TMDL.

Having failed in its initial attempt to develop a numerical model of the system, RIDEM has then turned to an overly simplistic adaptation of local research. RIDEM'S analysis is based entirely on an extrapolation of the concept that excess nitrogen leads to algal growth, which can lead to diminished DO. The work is based solely on the nitrogen flux into the Providence river system, and draws from the system loading response in the Marine Ecosystems Research Laboratory (MERL) studies conducted at URI in the 1980's. The analysis completely ignores any other pollutant sources that impact the local oxygen conditions, and fails to consider major differences between the physical characteristics of the Providence and Seekonk River systems, and that of Narragansett Bay which the MERL experiments were built to simulate.

While the literature is quite clear that nutrient over-enrichment can lead to low dissolved oxygen, this is not the only reason for oxygen depletion, and it is imperative that one fully understands the reasons for low dissolved oxygen before one launches a nitrogen reduction program based on the DO in the Providence River. Careful attention must be given to these other DO sinks that may be as important as or more important than the nitrogen flux in order to avoid the inappropriate expenditure of limited public funds.

Inaccuracies with respect to Watershed Sources of Nitrogen.

RIDEM's analysis incorrectly assigns all the nitrogen discharged from the Ten Mile River to two wastewater treatment plants (WWTP) and makes conceptual and computational errors in estimating the delivery of these loads to the Seekonk River. These errors and inaccuracies magnify the potential impacts of the City's discharge on the Seekonk and Providence River System.

RIDEM attributes essentially all the N discharged at the mouth of the Ten Mile River to the Attleboro and North Attleboro discharges. See page 20 of The 2004 Evaluation, where RIDEM asserts that compared to these discharges "other watershed sources [of nitrogen] are assumed to be negligible". Although the discussion is with respect to the Blackstone River, RIDEM apparently applies the same logic to the Ten Mile River and the Attleboro discharge. This assertion apparently serves to justify the analysis presented on page 18 of The 2004 Evaluation that expresses the level of discharge of Nitrogen from the Ten Mile into the Seekonk River as a function of the level of discharge of from the treatment plants.

This analysis is correct only to the extent that there are no other sources of nitrogen in the tributary River systems. However, virtually all studies done on the tributaries suggest that the two treatment plants contribute on the order of 60 % to 70 % of the nitrogen discharged into tributaries of the Providence and Seekonk Rivers.

The Governor's Panel on Nutrient and Bacteria Pollution recognized the importance of other sources when it says …"Other analyses show general agreement regarding total loading but decompose the "river/stream" component to provide more insight into sources by recognizing that it is, in large part, due to wastewater treatment facilities (WWTFs) and atmospheric deposition. Alexander et al. (2001) estimated that 62% of the total came from point sources, 19% from non-agricultural nonpoint sources, 6% from fertilizer and 3% from livestock in addition to the 10% from atmospheric deposition. Castro et al. (2001) estimated 73% of their total loading figure came from human sewage (through WWTFs and Individual Sewage Disposal Systems (ISDSs)), 13% from atmospheric deposition, 10.5% from agricultural runoff, and 3% from urban nonpoint sources. The analysis reported by Roman et al. (2000) estimated that wastewater treatment facilities contributed 73% of the nitrogen load, atmospheric deposition 23%, and agriculture 4%. RIDEM (2000)5 estimated that WWTFs contributed 66% of the total nitrogen to Upper Narragansett Bay; rivers and runoff (not including WWTFs) 30%, and direct atmospheric deposition 4%. Moore et al. (in press), using a similar but higher resolution technique than Alexander et al. (2001), estimated that total nitrogen load from the Providence /Seekonk River was 68% municipal wastewater, 15% atmospheric deposition, 14% runoff from developed lands, and 3% runoff from agricultural lands. All these analyses agree that wastewater treatment plants are the major source of nitrogen to the Bay. (See http://www.ci.uri.edu/GovComm/Documents/Phase1Rpt/Docs/Nutrient-Bacteria.pdf, page 2)

Also, studies conducted by the USGS indicate that for the Providence River system, approximately 68 % of the total nitrogen load is from municipal wastewater treatment plants, with the remainder attributed to nonpoint sources. (see http://water.usgs.gov/pubs/sir/2004/5012/SIR2004-5012_report.pdf, page 23).

The erroneous assumptions adopted by RIDEM significantly impact their analysis, and overstates the impacts of the tributary treatment plants on the receiving waters. It can be shown by simple algebra that if the WWTP discharge is 70 % of the total nitrogen load, and that the amount discharged from the Ten Mile to the Seekonk River is 60 % of the amount discharged by the WWTP's, then the River Delivery Factor is more on the order of 42 %, rather than the 60 % used by RIDEM. This issue is important because it indicates that a discharge of 8 mg/l into the Ten Mile River is more like a discharge of 3.4 mg/l directly into the Providence and Seekonk rivers simply because of natural attenuation of the nitrogen load.

Contradictory Data are Presented in the Analysis

In support of its arguments RIDEM presents a variety of plots and data from the MERL experiments as well as from a cruise in the summers of 1995 and 1996. The MERL data are synthesized in figures 1 through 11 of The 2004 Evaluation, and information for the 1995 and 1996 cruises are presented in figures 13 through 18 of The 2004 Evaluation. The MERL data show that high levels of chlorophyll result in increasing average dissolved oxygen, but lower instantaneous oxygen concentrations, owing to diurnal swings in oxygen production and consumption by phytoplankton. The plots presented by DEM appear to indicate that low values for dissolved oxygen (associated with the 8x, 16 and 32x loading conditions) occur simultaneously with the high chlorophyll values (See figures 3 and 9 of The 2004 Evaluation).

In contrast, the data from 1995 and 1996 show that the occurrence of low DO and high chlorophyll in the Providence and Seekonk river systems are not occurring simultaneously. On pages 13 through 16 of The 2004 Evaluation, RIDEM presents plots of oxygen and chlorophyll-a concentrations at depth along a transect from the upper reaches of the Seekonk River, down to the Upper portions of Narragansett Bay. The plots show that the year with the worst DO problem (1996) has far less chlorophyll-a than 1995. The extent of hypoxia, both vertically in the water column and longitudinally along the length of the Rivers, is far greater in 1996 than in 1995, whereas the 1995 chlorophyll data show far greater algal abundance. As discussed by RIDEM, there is a 10 fold difference in chlorophyll a from 1995 to 1996. This contradiction is further highlighted by the charts on page 17 of The 2004 Evaluation that show the higher the chlorophyll-a, the higher the DO. These points are highly inconsistent with the underlying hypothesis of RIDEM and points out the importance of thoroughly understanding all the DO demands before establishing a DO restoration plan.

We should note that our preliminary investigations of the climatic conditions of the summers of 1995 and 1996 indicate that they were so radically different that they may not be simply averaged in the way that RIDEM has done without great caution. The summer of 1995 was among the driest recorded for 132 years of record at a location in the Blackstone watershed (34th driest), while the summer of 1996 was amongst the wettest (9th wettest). The difference could markedly impact the fate of pollutants in such a way as to make simple averaging of data across the two years inappropriate.

This extreme differences in climatic conditions is contrary to the claim made by RIDEM that its samples were taken during "typical summer season flows" (page 10 of The 2004 Evaluation), which would lead one to believe that the summers sampled reflected average or normal conditions. But it is consistent with the arguments made by RIDEM to explain the difference between 1996 and 1995 chlorophyll levels (page 11), where the difference in flushing times owing to higher river flows – which was a result of greater rainfall – is used to explain the year on year differences in chlorophyll a concentrations.

Unsubstantiated extrapolation of the MERL experiments to the Providence/Seekonk River System.

The use of the MERL data to analyze the Seekonk and Providence River system is questionable in that there are several critical and important differences between the conditions in the Bay and in the Providence and Seekonk River systems. .

As RIDEM points out, on page 12 of The 2004 Evaluation, the MERL experiments were conducted under simulated flushing conditions that are almost 7.8 times lower than the conditions in the Providence River (27 day flushing time in the Bay versus 3.5 day flushing time in the River). The higher flushing rates of the Providence River would lead to lower nutrient loadings (expressed as mass per unit volume) and therefore much less algal activity. Indeed, RIDEM uses exactly this logic to explain why the observed chlorophyll a values in 1996 are an order of magnitude lower than observed in 1995. While RIDEM suggests that for some pollutants the hydraulic residence time might overstate the transport of the pollutant out of the river segment, no explanation, data or other information is presented as to how this would operate in the Providence and Seekonk River systems.

As a first approximation, the relationship between the standing concentration and flushing rates out varies inversely with respect to each other. Thus, an increase in flushing rate by a factor of 7.8 would result in a decrease in concentration of by a factor of 7.8. Stated another way, a loading rate of 32 x in the Providence River will have the impact of a loading rate of 4X in the bay at large system.

The effect is even more dramatic for the Seekonk River. The 1991 studies cited by RIDEM indicate that the average flushing time of the Seekonk River is 1.2 days (See Asselin, S. and Spaulding M.L., Flushing Times for the Providence River Based on Tracer Experiments, Estuaries, Vol 16, No. 4, p 830-839, December 1993, page 838). Thus, for the Seekonk river system, the flushing rate is 22 times greater than value used in the MERL experiments.

RIDEM also errs when it uses the MERL values, which are based on dissolved inorganic nitrogen (DIN) loadings to compute total nitrogen (TN) limits in the permits. Effluents from wastewater treatment facilities often contain residual, refractory organic nitrogen that is not biologically available, as RIDEM has acknowledged in its response to comments on the Rhode Island Permits (See page 18 of 41). If one accepts the area loading approach, and it is based on data developed around DIN, then the permit values ought be presented either as DIN, or adjusted to available Total N, in much the same manner that metals limits are adjusted from the biologically available form to total metals for permitting purposes.

Errors in the Calculations of Nitrogen Loadings to the Providence and Seekonk Rivers.

RIDEM calculates the nitrogen loading on 4 different river segments by dividing the upstream N load by the area of the segment. As their analysis moves downstream, they add area and loads. This analysis ignores the fact that for half the day, because of tidal effects, the Seekonk River is "downstream" from the discharges of the NBC at Fields Point, East Providence, Craston, Warwick and West Warwick and nutrients discharged by these point sources clearly influence the Seekonk River. Thus the loads expressed on an area basis on the Providence and Seekonk River system are significantly greater than calculated by RIDEM.

This is important because even without this consideration, RIDEM has difficulty reconciling the observed and implied concentrations of nitrogen in the upper reaches of the Seekonk River. See page 12 of 32 of RIDEM's Evaluation of Nitrogen Targets and WWTF Load Reductions for the Providence and Seekonk Rivers, where RIDEM compares the measured nitrogen concentration to the concentrations implied by the area loading rates of the MERL experiments. RIDEM observes that the actual measured concentrations are far lower than the MERL values for comparable area loading rates, with the observed values being one-fourth the value predicted by the MERL data. Had RIDEM properly included some fraction of the Fields Point, East Providence, Cranston, Warwick and West Warwick loadings to the Seekonk River in this calculation, the MERL predicted values should be even more than four times higher than the observed concentrations. This clearly points out the fallacy of extrapolating the results of the MERL experimental area loading rates to the Seekonk and Providence Rivers.

RIDEM Fails to Incorporate All available Information into its Analysis

RIDEM uses data from the 1995/1996 time frame to analyze the condition of the Providence and Seekonk River systems. They appeared to have ignored other readily available sources of information concerning the dynamics of dissolved oxygen in the Providence and Seekonk rivers that could serve to validate their analyses. In particular, RIDEM participated in an EMPACT program that deployed continuous recording sensors (salinity, temperature, dissolved oxygen, amongst other parameters) at various locations in the Providence and Seekonk River systems for upwards of two years. That information is available on the worldwide web at http://www.narrabay.com/empact/ . Combined with concurrent discharge monitoring reports from the various wastewater treatment plants and flow data gathered from USGS gages, this would result in an extensive data set that could serve to validate RIDEM's conclusions. The lack of analysis of this information in the December 2004 report is surprising.

EPA improperly speculates on the effects of the current permit.

In discussing its findings, EPA speculates that the 40 % nitrogen attenuation ascribed by RIDEM to the Attleboro discharge attributable will lower in the future because the phosphorus limits in the draft permit will reduce phosphorus driven eutrophication. This is true only in the special case that phosphorus from the treatment plants was the only limiting factor that controlled algal growth in the period reviewed by RIDEM. However, other factors – temperature, light penetration, cloud cover, and residence time all impact algal growth. EPA has provided no evidence to show that these factors were not limiting algal growth, and accordingly their speculation is inappropriate. In order to reach the conclusion that EPA has adopted, it would be appropriate for the Agency to develop a detailed TMDL that considers all factors influencing algal growth.

The Calculation of Effluent Metals Limits Is Based On The Wrong Hardness.

The permit calculates effluent metals limits based on 100 mg/l of hardness, which reflects the hardness of the upstream receiving water. However, the Wastewater Treatment Plant discharges effluent with a significantly higher hardness, approximately 250 mg/l, and thus the downstream receiving water, under 1.4:1 dilution conditions can be expected to have a hardness of approximately 207 mg/l. Under this condition, the permit limits ought to be as follows:

Constituent	*Monthly Limit*	*Daily limit*
Cadmium	0.6	6.3
Copper	24.3	38.9
Zinc	310.7	310.7
Lead	11.2	288.6
Nickel	135.1	1215.6
Silver		18.5

This approach has been used several times in recent Massachusetts permits, including Southbridge, Upton, and Northbridge.

Limits for Zinc should be struck from the permit.

This permit eliminates a permit limit for chromium, based on the fact that the data shows no reasonable potential to exceed water quality criteria in the receiving water. The same conclusion can be reached for zinc, and the zinc limit should be eliminated from the permit. As with chromium, testing will be conducted periodically as part of the WET testing, thus providing EPA with continuing assurance that the plant is discharging low levels of zinc.

The Limit for Aluminum should be eliminated

Aluminum is a component of several highly effective coagulants commonly used in wastewater treatment to provide control of metals and phosphorus and to improve overall process performance. The Attleboro plant has successfully used Polyaluminium chloride (PAC) over the past two years, resulting in overall enhancement of plant effluent, especially with respect to phosphorus levels in the discharge as compared to previous use of alum. Changing out this coagulant would likely cause operational difficulty for the plant.

The water quality criteria for aluminum indicates that the chronic criteria for aluminum may be overly restrictive. It says:

> There are three major reasons why the use of Water-Effect Ratios might be appropriate. (1) The value of 87 g/l is based on a toxicity test with the striped bass in water with pH= 6.5-6.6 and hardness <10 mg/L. Data in "Aluminum Water-Effect Ratio for the 3M Plant Effluent Discharge, Middleway, West Virginia" (May 1994) indicate that aluminum is substantially less toxic at higher pH and hardness, but the effects of pH and hardness are not well quantified at this time. (2) In tests with the brook trout at low pH and hardness, effects increased with increasing concentrations of total aluminum even though the concentration of dissolved aluminum was constant, indicating that total recoverable is a more appropriate measurement than dissolved, at least when particulate aluminum is primarily aluminum hydroxide particles. In surface waters, however, the total recoverable procedure might measure aluminum associated with clay particles, which might be less toxic than aluminum associated with aluminum hydroxide. (3) EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 87 g aluminum/L, when either total recoverable or dissolved is measured.
>
> See http://www.epa.gov/waterscience/criteria/wqcriteria.html#L2, footnote L.

Recognizing:

> The importance of aluminum in the wastewater industry,
>
> The fact that the toxic effects that drove the development of the chronic criterion were for ambient environmental conditions far different (hardness of 10 versus hardness of 207) from that of Attleboro,
>
> Attleboro's demonstrated ability to consistently meet its chronic WET limit, which shows the nontoxic nature of Attleboro's effluent

The limit on aluminum should be struck from the permit.