RESPONSE TO PUBLIC COMMENTS

Haverhill Wastewater Treatment Facility

NPDES Permit Number MA0101621

From August 28, 2007 to September 26, 2007 the United States Environmental Protection Agency (EPA) and the Massachusetts Department of Environmental Protection (MassDEP) solicited public comments on a draft NPDES permit developed pursuant to a reapplication from the City of Haverhill for reissuance of its NPDES permit to discharge treated wastewater to the Merrimack River from its wastewater treatment facility, and to both the Merrimack and Little Rivers from 20 combined sewer overflows. After a review of the comments received, EPA has made a final decision to issue the permit. The following response to comments responds to the comments on the draft permit and describes the changes made to the permit. A copy of the final permit may be obtained by writing or calling Doug Corb, United States Environmental Protection Agency, 1 Congress Street, Suite 1100 (CMA), Boston, Massachusetts 02114-2023; Telephone (617) 918-1565 or e-mail corb.doug@epa.gov. The final permit is also posted at www.epa.gov/region1/npdes/permits_listing_ma.html.

Comments were submitted by:

- Paul J. Diodati, Director of the Commonwealth of Massachusetts Division of Marine Fisheries (Marine Fisheries) on September 24, 2007
- Paul Jessel, Collection System Supervisor, (City of Haverhill) on September 5, 2007.
- Tracie Sales, Water Resources Manager, Merrimack River Watershed Council, Inc. (MRWC), September 26, 2007

A. Division of Marine Fisheries Comments

Comment No. A.1

Marine Fisheries has reviewed the draft NPDES permit (MA0101621) that allows the Haverhill Wastewater Treatment Facility to discharge treated sewage effluent and effluent from combined sewer overflows into the SB receiving waters of the Merrimack River. The effluent limitations and control measures contained in the current draft permit are adequate for the protection of marine fishery resources from impacts associated with the discharge effluents.

For notification purposes contained in Permit Section I.D.3.vi, we request notifications concerning CSO activation and discharge without chlorination be sent to the Massachusetts Division of Marine Fisheries Shellfish Management Program via FAX (617-727-3337) or via telephone (978-282-0308 extension 160). Additionally, we no longer require that we receive a copy of the first annual report as stipulated in this section.

Response No. A.1

The requested changes have been made to the final permit. Specifically, the CSO activation notification requirements include the corrected FAX and phone numbers, and the permittee shall no longer be required to send Marine Fisheries a copy of the first annual CSO report.

B. City of Haverhill Comments

Comment No. B.1

Please be advised that the City of Haverhill requests that the draft NPDES permit report date of January 1 for I/I, (page 13 of 17), be changed to the same submittal date required for the annual report for CSOs, April, 30. A summary for the previous calendar year can not be submitted in January as there is insufficient time to gather the required information.

Response No. B.1

The requested change has been made to the final permit.

C. Merrimack River Watershed Council Comments

Comment No. C.1

Calculate Dilution Factor Based on Clearly Defined Minimum Flow Characteristics. According to the Fact Sheet for Draft NPDES Permit No. MA0101621, the design flow dilution factor is based on a 7Q10 flow in the Merrimack River at the discharge point of 649 MGD (1006 CFS), as listed in Attachment B of the Fact Sheet. The Fact Sheet further states that this flow statistic was reviewed and considered adequate based on USGS gage data in Lowell, MA with a 7Q10 flow of 930 CFS. However, neither the main body of the Fact Sheet nor Attachment B indicate why 930 CFS was chosen for the Lowell gage statistic, nor how 649 MGD (1006 CFS) was calculated as the flow at the Haverhill WWTP discharge point. Given that stream flow has been recorded as low as 767 CFS in only the past few weeks at the referenced USGS gage in Lowell and that there is a very pronounced diurnal flux in river flows due to flow manipulation by several hydro electric facilities, a full and detailed explanation of how the 7Q10 flow was determined at the discharge site is needed to fully understand how the 7Q10 was derived. In addition, the river flow at the location of the discharge is influenced by tidal variations, so the calculation of the stream flow should be made with reference to the flow at low tide. Finally, the flow calculation should factor in major net water withdrawals from the river between the river gage at Lowell and the Haverhill WWTP discharge point.

Response No. C.1

The fact sheet that accompanied the draft permit makes clear that Massachusetts regulations (314 CMR 4.03(3)(a)) require that for rivers and streams, effluent dilution be calculated based on the receiving water 7Q10. The 7Q10 is defined as the lowest observed mean river flow for 7 consecutive days, recorded over a 10 year recurrence interval.

The use of a 7Q10 dilution is also recommended in EPA's Technical Support Document for Water Quality-Based Toxics Control, (see Page 52). In developing the water quality criteria (as adopted by the State), EPA incorporates a measure of conservatism to account for extreme low flow events such as the low gage flow of 767 cfs, recently recorded in Lowell.

The dilution factor for the discharge has been carried forward through several permit cycles. For each cycle, the updated 7Q10 at the Lowell gage was compared to the 7Q10 at the Lowell gage used in the current and previous permits to confirm that the estimate was reasonable. In response to this comment we have done a complete recalculation of the dilution factor, and have addressed the specific issues raised in the comments.

The Haverhill discharge is almost 20 miles downstream of the river flow gage in Lowell. The drainage area between the gage and effluent discharge point provides additional flow to the Merrimack River not recorded by the gage. The increased 7Q10 flow due to the intervening drainage area was determined by multiplying the gaged flow by the ratio of drainage area at the point of discharge to the drainage area at the gage (see calculations below)

Typically, EPA does not adjust 7Q10 flows based on intervening water withdrawals or additions, unless there is specific information showing that there is a net change in water either out of or into the watershed. However, in response to this comment, we performed such calculations. The specific water withdrawals and additions are summarized in Attachment A. Nine facilities between the Lowell gage and above the Haverhill discharge have a combined average water withdrawal of 32.2 cfs/day. The Cities of Lowell and Lawrence have a combined minimum monthly average wastewater effluent flow of 72.1 cfs. According to theses estimates, the wastewater flows more than offset the water withdrawals, resulting in a net increase in 7Q10 (see calculations below).

To address MRWC's question of how fluctuations in flow caused by the two hydroelectric dams in the lower Merrimack River will impact the dilution, EPA looked to the Merrimack River Watershed Assessment Study - Screening Level Model, prepared for the New England District of the Army Corps of Engineers, March 2004. The report concluded that the "regulation and diversion of flow is negligible" because the Pawtucket (Lowell) and Essex (Lawrence) dams operate as run-of-river hydroelectric facilities. Run-of-river is defined as a low-head plant using the flow of a stream as it occurs and having little or no reservoir capacity for storage.

Regarding the influence of tides on dilution, we believe that the heavier salt water wedge simply raises and lowers the upper layer of freshwater with the tide in Haverhill, but does not reduce the amount of freshwater available for dilution. EPA does not consider the tidal fluctuation to be a significant factor in the dilution calculation.

The following is a step-by-step illustration of how the 7Q10 dilution factor was calculated.

USGS StreamStats for Massachusetts*	Drainage area at plant	= 4880 m^2
USGS Gage # 011000000**	Drainage area at gage	= 4635 m^2
4880 cfs/4635 cfs	Drainage area ratio	= 1.05
USGS Gage # 011000000***	7Q10 at gage	= 898 cfs
(7Q10 gage)(Drainage area ratio)	(1.05)(898 cfs)	= 942.9 cfs
Water withdrawals****		= 32.2 cfs
Wastewater treatment plant flows (GLSD and Lowell)****		= 72.1 cfs
Treatment plant flows – water withdrawals = (72.1 cfs) – (32.2 cfs)		= 39.9 cfs
(7Q10 at outfall) + (additional flows) = (942.9 cfs) + (39.9 cfs)		= 982.8 cfs
(Plant Q 18.1 mgd)(1.55 conversion to cfs)		= 28.1 cfs

DF = $\frac{(7Q10) + (\text{Plant Q})}{\text{Plant Q}}$ = Dilution Factor = $\frac{(982.8 \text{ cfs}) + (28.1 \text{ cfs})}{\text{Plant Q}}$ **= 36.0**

* Basin drainage area at the WWTF outfall was calculated using the program USGS StreamStats for Massachusetts

** Gazetteer of Hydrologic Characteristics of Streams in Massachusetts—Merrimack River Basin, USGS Water Resources Investigation Report 84-4284: W. Wandle Jr. and Fontaine

*** Gage # 011000000, Merrimack River at Lowell, MA (gage is downstream from the Concord River). USGS stream flow data for years 1923 to 2006. Revised 7Q10 provided by W. Wandle Jr.

**** Excerpts from the Merrimack River Basin 1999 Water Quality Assessment Report, Commonwealth of Massachusetts Executive Office of Environmental Affairs

The recalculated Merrimack River 7Q10 flow addresses both water withdrawals from the river and treatment plant additions to the river. There is only a 2% difference between the revised dilution factor found herein of 36.0 and the dilution factor of 36.8 found in the fact sheet prepared for this draft permit (2007) and those fact sheets for the previous 2003 and 1998 permit reissuances. EPA concludes that the dilution factor used in the preparation of the 2007 draft permit remains valid.

Comment No. C.2

Limit Nutrients in Effluent. While the Merrimack River is not currently listed as impaired due to nutrients, and the Plum Island Sound area is not considered exceptionally nitrogen sensitive, Draft NPDES Permit No. MA0101621 does not limit, or even require monitoring of any nutrients. Most municipal treatment plants have some nutrient requirements, but the lack of even a monitoring requirement for the Haverhill WWTP means that we do not know what this plant is adding to the cumulative loads in the river. Even monitoring nutrient levels would at least allow a determination of whether or not the system is meeting the EPA's ecoregional recommendations.

Response No. C.2

Because the Merrimack River Estuary has not been comprehensively assessed for nitrogen impacts on water quality and nitrogen is generally the limiting nutrient controlling excessive algal growth in marine waters, the final permit includes monthly monitoring for total ammonia nitrogen, as N, total Kjeldahl nitrogen, total nitrate, and total nitrite. Monitoring of the various nitrogen species in the Haverhill discharge will aid in determining the nitrogen load to the estuary. The nitrogen monitoring requirements are established in accordance with Section 308 of the Clean Water Act.

Comment No. C.3

Add Criteria for Metals to Fact Sheet. The Fact Sheet for Draft NPDES Permit No. MA0101621 does not include a discussion of metals or limitations thereon. While the dilution factor may mean that there is no reasonable potential for exceedance of criteria for metals, we feel that the information should be clearly presented so that interested parties could see that the issue had been considered. Within this discussion it should be mentioned whether the marine or freshwater criteria has been used for copper. Given the extreme toxicity of copper to the marine life living only a few miles downstream and the fact that this area of the river is tidally influenced, we feel strongly that the marine criteria are the most appropriate.

Response No. C.3

EPA reviewed effluent total metals data submitted as part of the City's whole effluent toxicity (WET) reports from 2003 through January of 2007 as well as the 126 priority pollutants found in the April 2006, NPDES application. EPA is presenting both saltwater and freshwater reasonable potential calculations in this response because the WWTP discharge is located near the point where the river transitions from salt water to freshwater. A summary of the acute and chronic metals saltwater criteria is provided in Attachment B of this document. The EPA surface water criteria are multiplied by the dilution factor of 36 to establish the threshold concentration to be compared against the highest effluent concentration value for each metal. Additionally, a spread sheet program for freshwater metals thresholds ("limits") is provided in Attachment C of this document. Some of the metals criteria are hardness dependent, meaning that the criteria become less stringent as the receiving water hardness increases in concentration. EPA used the lowest recommended hardness value of 25 mg/l (as $CaCO_3$) when calculating the fresh water criteria, to arrive at the most conservative thresholds. EPA again used the dilution factor of 36. The spread sheet calculates the acute and chronic freshwater threshold values as acute and chronic "limits" respectively. An explanation of how each of the criteria and "limits" are calculated is also provided in Attachment C.

A comparison of the highest effluent concentrations for each metal was compared to the acute and chronic freshwater and saltwater criteria as multiplied by the dilution factor. In all cases, the effluent concentrations were below the threshold concentrations and EPA concluded that limits were not required.

Federal regulations require that a fact sheet be prepared to support the draft permit, but do not require an updated fact sheet as part of the final permit decision. Therefore, a new fact sheet has not been prepared. The original fact sheet is part of the administrative record for the permit and the information in this response augments the discussion in the fact sheet and is also part of the administrative record.

Comment No. C.4

Retain Ammonia Limits. Despite the expectation that unionized ammonia may be removed as an impairment of the Merrimack River in 2008, it has not yet been "delisted" and the lack of inclusion of ammonia limits in the discharge permit could be considered backsliding. The limits for total ammonia should be based on the chronic criteria for fresh water, as the receiving waters are tidal fresh water.

Response No. C.4

There are no ammonia limits in the current permit, so antibacksliding is not a consideration. The discussion in the fact sheet regarding ammonia was to determine if there was reasonable potential for the discharge of ammonia to cause or contribute to impairments of water quality standards. EPA evaluated the reasonable potential for the effluent to cause or contribute to an exceedance of either freshwater or saltwater ammonia criteria (See the August 23, 2007 fact sheet, pages 10-11). Based on total ammonia data collected as part of the quarterly whole effluent toxicity tests, EPA concluded there was no "reasonable potential", and thus no total ammonia limits are required. The permit does, however, require monthly total ammonia monitoring (See response to comment number C2).

Comment No. C.5

Test Whole Effluent Toxicity During Extreme Low Flow. The draft permit currently requires testing for Whole Effluent Toxicity during the months of January, April, July, and October. These dates should be shifted to encompass testing during August, the month traditionally showing the lowest flow in the Merrimack River. The revised months would then be February, May, August, and November. If the permittee requests a reduction of the WET testing requirements after showing compliance for one year, testing during the annual extreme low flow period should remain in the requirements.

Response No. C.5

All NPDES dischargers to the Merrimack River required to conduct WET testing have been required to sample during the months of January, April, July, and October, based on MassDEP requirements. The continuity of sampling period among multiple dischargers allows for assessment of cumulative impacts to the river.

Additionally, if all dischargers in Massachusetts were required to test during August, the month in which all river systems typically experience their lowest flow, the limited number of laboratories who perform such tests would be overwhelmed.

Comment No. C.6

Explain BOD_5 and TSS Limit Exceedance. The DMR data included as an attachment to the Fact Sheet shows numerous instances in which the monthly and weekly averages for BOD_5 and TSS have exceeded the permitted limits, as well as some extremely high daily values. We presume that these instances occurred during wet weather events and are the results of combined sewer overflows (CSOs), but no information has been included on the dates on which CSOs [discharges] have occurred. If these values are not the result of wet weather events, then the facility is not meeting its permit obligations and this issue should be addressed.

Response No. C.6

The limits for BOD_5 and TSS in the draft permit are mandated in the secondary treatment requirements found at 40 CFR §133. Compliance with the BOD_5 and TSS permit limits is addressed by EPA or MassDEP enforcement programs. EPA administrative orders were issued to Haverhill in 1999 and 2002, requiring long term CSO control planning and construction of projects to abate CSOs. One of the required projects was to increase the wet weather capacity at the POTW to reduce untreated CSO discharges from the collection system. The constructed facilities include the capability to provide primary treatment and disinfection for flows up to 60 MGD, with a bypass of secondary treatment at flow rates exceeding secondary treatment capacity of 25 million gallons per day (MGD). The order provides interim effluent limitations during wet weather events. Flows receiving secondary treatment must achieve all effluent limitations, but the blended flow must only achieve effluent limitations for fecal coliform bacteria, pH and total chlorine residual.

EPA has required the City to submit supplemental information regarding wet weather flows pursuant to a CWA Section 308 information request letter. The information is currently under review by the Office of Environmental Stewardship. See also the response to Comment C7.

The precipitation data demonstrates that wet weather events appear to correlate with periods of high BOD_5 and TSS loading in the treatment plant effluent. The December 17, 2001 EPA Administrative Order had monitoring requirements for BOD_5 and TSS in place of limits during wet weather, meaning that during wet weather there were no limit “exeedences”.

The next phase of CSO abatement will allow for an even better understanding of the effect of precipitation on BOD_5 and TSS loading rates at the treatment plant.

Comment No. C.7

Outline Actions Taken to Minimize Impacts of CSOs. The number of CSOs listed in NPDES Permit No. MA0101621 Attachment F for 2005 is 39 for one location emptying into the Merrimack River. This seems like an excessive number of overflows to us. In addition, in May of 2005 the local newspaper reported a break in the sewer main during the 50 year flood event that occurred during Mother’s Day of that year. Yet the treatment facilities are supposed to be designed to withstand a 100 year flood event. In relation to these issues, we would like to see included in the Fact Sheet or Permit:

- the minimum amount of precipitation or melt water that will result in a CSO event;
- documentation proving the Nine Minimum Controls are being followed, specifically that the treatment plant is being maintained to withstand the 100 year storm event;
- a guarantee that there will be no net increase in regulated pollutant discharges during wet weather events, even if it means halting new connections to the system until the system can be upgraded to fully process the inflows.

We would also like to request additional monitoring be required during and for the duration of each CSO event. Increased monitoring of this facility, and the other CSO facilities along the river, will provide more detailed information about the pollutant loads into the Merrimack River and ultimately Mass Bays. Without frequent monitoring it would not be possible to ascertain the pollutant load under the highly variable conditions found during CSO events.

We would like to have the increased monitoring start in time to capture the critical 'first flush' of pollutants and be continued through the period when the facility is bypassing flows around secondary treatment. The interval for monitoring should be sufficient to allow for the estimation of pollutant loads. This river is the recipient of many significant point sources and a considerable volume of CSO flows from many communities in the watershed. It is important to understand the larger picture of pollutant loading by understanding individual contributions.

Response No. C.7

As described previously, CSO discharges are not currently in compliance with the permit or water quality standards, and administrative orders have been issued by EPA with compliance schedules for abating these discharges. Similarly, discharges from sewer line breaks are not authorized by the permit, and such discharges are subject to EPA and MassDEP enforcement actions (see Part I.F. of the permit).

The following are responses to the specific information requested in the bulleted comments:

- A review of data provided to EPA by the permittee on August 16, 2007 shows that about 0.5 inches of precipitation will trigger a discharge from some CSOs. Other CSOs had no discharge events regardless of precipitation. This next phase of CSO abatement planning should provide a much better understanding of each individual CSO and what duration and magnitude precipitation event is required to cause an overflow.

- Routine quantification and recording of CSO discharges is required in Part I.D 2.e. of the permit, and reporting of this information is required in the Annual CSO Report (see Part I.D.3 of the permit).

- Part I.D.1.of the permit requires implementation of the Nine Minimum Controls and Part I.D.3 requires that specific information regarding the implementation of the controls be included in the annual CSO report.

EPA has not required as one of the nine minimum controls that the treatment works be maintained to withstand the 100-year storm. However, the permittee is subject to the General Requirements for proper operation and maintenance found in Part II.,B.1. of the Permit, which states *"The permittee shall at all times properly operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by the permittee to achieve compliance with the conditions of this permit and with the requirements of storm water pollution prevention plans…"* .

Also, as previously discussed, any unauthorized discharge is subject to EPA and MassDEP enforcement action. See Part I.F. of the permit for specific requirements regarding unauthorized discharges.

- The permitted loading of BOD_5 and TSS have not increased, even though the secondary treatment capacity has increased from 18.1 mgd to approximately 25 mgd, and the primary capacity has increased to 60 mgd .

  EPA New England does not typically place sewer connection moratoriums in permits. Moratoriums are sometimes placed in enforcement actions if such an action is determined to be necessary to mitigate permit violations. Neither EPA nor MassDEP enforcement programs have placed a moratorium on connections to this system, but it is an enforcement option if it is determined that new connections are exacerbating violations of the permit.

Regarding the comment requesting additional monitoring of the treatment plant discharge and CSO discharges during wet weather, we believe that the requirements in the permit, together with the requirements of the administrative order are sufficient to characterize the discharges (Attachment 1 of the December 17, 2001 administrative order requires treatment plant effluent monitoring during bypass events).

The permit does not require that CSO discharges be sampled for pollutants, but it does require that discharges be quantified and recorded. We believe that ascertaining the discharge frequency and volume from CSOs is much more important than measuring pollutants in the discharge, given that such discharges are a combination of untreated wastewater and stormwater, with pollutant concentrations extremely variable but within known ranges.

<u>Administrative Changes to the Final Permit</u>

The following change has been added to the final permit to correct a typographical error:

Page 4 of 18, Footnote 5: "A twenty-four (24) hour composite sample will consist of at least 24 (24) grab samples taken during one consecutive 24 hour period…"

The draft permit incorrectly stated that the twenty-four (24) composite will consist of at least eight (8) samples.

Attachment A

Excerpts from the Merrimack River Basin 1999 Water Quality Assessment Report

WMA WATER WITHDRAWAL SUMMARY (APPENDIX D, TABLE D3):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source	Authorized 2014 Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Andover Water Treatment [a]	3009000	9P31300901	31300901	009-02S [b]	4.56 reg[b] 3.95 per[b] 8.51 total[b]	4.80[b]
Methuen Water Department	3181000	[c] (see note below)	31318101	01S Merrimack River	4.59	5.02 [C]
Tewksbury Water Department	3295000	9P31329501		295-01S Merrimack River Treatment Plant	3.17	2.5
Lawrence Water Works	3149000		31314902	149-01S (Merrimack River)	9.46	7.11
Hickory Hills Golf Course, Inc.[e]			31318102	River Intake Well #1	0.07 (153 days)	0.15 [d]

[a] withdrawal is pumped to Haggetts Pond (01S) before distribution (approximately half of supply),

WMA WATER WITHDRAWAL SUMMARY (APPENDIX D, TABLE D3):

Facility	PWS ID#	WMA Permit #	WMA Registration #	Source	Authorized 2014 Withdrawal (MGD)	1999 Average Withdrawal (MGD)
Merrimack Paper Company, Inc.			31314903	Essex Co. South Canal Merrimack River	0.55	0.69*
Newark Atlantic Paperboard Corp.			31314901	North Canal Intake	0.56	0.32
Lucent Technologies, Inc.		9P31321001	31321002	Well # 1, 2, 3, 4, 5	0.38 reg 0.29 per 0.67 total	0.17
Spring Hill Farm Dairy, Inc.			31312805	River Intake	0.06	0.01

* withdrawal exceeded registration amount by more than 0.1 MGD (WMA threshold)

The total average withdrawals from the 9 facilities listed above is 20.8 mgd (32.2 cfs)

Lowell Regional Wastewater Utility is permitted (MA0100633) to discharge (permit issued August 1997) 32 mgd of treated municipal and industrial wastewater via outfall) 035 to the Merrimack River. Merrimack River Basin 1999 Water Quality Assessment Report

The NPDES Fact Sheet Dated May 19, 2004 listed the lowest average monthly flow for the LRWWU as 26.4 mgd (40.92 cfs) for the period September 2001 through September 2003.

The Greater Lawrence Sanitary District (GLSD) provides wastewater conveyance, treatment, and disposal for the communities of Lawrence, Methuen, Andover, North Andover, MA and Salem, NH. Of the communities in the District, only the City of Lawrence has a combined sewer system. GLSD is permitted (MA0100447) to discharge (permit issued February 1998) 52 mgd (average monthly) of treatment plant effluent via outfall # 001 to this segment of the Merrimack River. Merrimack River Basin 1999 Water Quality Assessment Report

The NPDES Fact Sheet Dated Fact May 28, 2004, listed the lowest average monthly flow for GLSD as 20.1 mgd (31.2 cfs) for the period September 2001 through September 2003.

Attachment B

Metals data from 15 WET reports submitted from 2003 through January of 2007 and the April 2, 2006 Permit Application

Parameter	Salt Water Criteria		(Criteria)(DF -36) =	(Criteria)(DF -36) =	Effluent Maximum Reported Value
	CMC (acute)* (µg/l)	**CCC (chronic)* (µg/l)**	Acute **(µg/l)**	Chronic **(µg/l)**	**(ug/l)**
Aluminum	750	87	27000	3132	500 (W)
Antimony	N/A	N/A	N/A	N/A	Below Detection (A)
Arsenic	69	36	2484	1296	20 (A)
Beryllium	N/A	N/A	N/A	N/A	Below Detection (A)
Cadmium	40	8.8	1440	317	Below Detection (A)
Chromium (III)	N/A	N/A	N/A	N/A	**********
Chromium (VI)	1,100	50	39600	1800	5 (W)
Copper	4.8	3.1	173	112	20 (A)
Lead	210	8.1	7560	292	9 (W)
Mercury	1.8	0.94	65	34	Below Detection (A)
Nickel	74	8.2	2664	115	23 (A)
Selenium	290	71	10440	2556	Below Detection (A)
Silver	1.9	N/A	68.4	N/A	Below Detection (A)
Thallium	N/A	N/A	N/A	N/A	Below Detection (A)
Zinc	90	81	3240	2516	174 (W)

Below Detection (A) = Reported as Below Detection on the April 2, 2006 permit reapplication
Below Detection (W) = Reported as Below Detection for all metal samples tested as required by the acute whole effluent toxicity (WET) protocol

* EPA suggested water quality criteria as adopted by Massachusetts: http://www.epa.gov/waterscience/criteria/wqcriteria.html#appendxa

Attachment C
Freshwater Metals Limits

A. Water quality criteria for metals have been established using Gold Book values found at FR volume 63, No 237/ published on Thursday, December 10, 1998.

1. Metals criteria based on hardness in the water column have been calculated using the following formulas;

a. Acute Criteria (CMC) - (used to calculate maximum daily limits)

CMC (dissolved) = $\exp\{m_a[\ln(\text{hardness})]+b_a\}CF$

where CMC = criteria maximum concentration,
m_a and b_a = pollutant-specific constants for calculating freshwater dissolved metals criteria that are hardness-dependent (see attached table)
hardness = water column hardness in mg/l
CF = pollutant-specific conversion factor for converting a metal criterion expressed as a total recoverable fraction in the water column to a criterion expressed as the dissolved fraction on the water column.

CMC (total recoverable) = $\exp\{m_a[\ln(\text{hardness})]+ba\}$

where CMC = criteria maximum concentration,
m_a and b_a = pollutant-specific constants for calculating freshwater dissolved metals criteria that are hardness-dependent (see attached table)
hardness = water column hardness in mg/l

b. Chronic Criteria (CCC) - (used to calculate monthly average limits)

CCC (dissolved) = $\exp\{m_c[\ln(\text{hardness})]+b_c\}CF$

where CCC = criteria continuous concentration,
m_c and b_c = pollutant-specific constants for calculating freshwater dissolved metals criteria that are hardness-dependent (see attached table)
hardness = water column hardness in mg/l
CF = pollutant-specific conversion factor for converting a metal criterion expressed as a total recoverable fraction in the water column to a criterion expressed as the dissolved fraction on the water column.

CCC (total recoverable) = $\exp\{m_c[\ln(\text{hardness})]+b_c\}$

where CCC = criteria continuous concentration,
m_c and b_c = pollutant-specific constants for calculating freshwater dissolved metals criteria that are hardness-dependent (see attached table)
hardness = water column hardness in mg/l

Attachment C Continued

2. For metals criteria which are not hardness-dependent, the criteria are taken from FR volume 63, No 237/. Where the criteria are expressed as dissolved metal, the criteria are divided by the appropriate conversion factor (CF) to calculate a criteria expressed as total recoverable metals.

B. Metals Limits

1. Maximum Daily Limits for each metal are calculated by multiplying the CMC expressed as total recoverable metal by the Acute Dilution Factor (see attached table).The limit is expressed as total metal.

Example Calculation

Maximum Daily Limitation for Copper = CMC (total recoverable) * Acute dilution factor
= 7.29 ug/* 84
= 612.36 ug/l = 0.612 mg/l

2. Monthly Average Limits for each metal are calculated by mutiplying the CCC expressed as total recoverable metal by the Chronic Dilution Factor (see attached table). The limit is expressed as total metal.

Example Calculation

Monthly Average Limit for Copper = CCC (total recoverable) * Chronic Dilution Factor
= 5.16 ug/l * 130
= 670 ug/l = .67 mg/l

Attachment C Continued

				Freshwater Metals Criteria and Limits										
Acute Dilution Factor =		36.0		Criteria from National Recommended Water Quality Criteria:2002										
Chronic Dilution Factor =		36.0												
Hardness =	25.	mg/l												
								Dissolved Criteria		Total Recoverable Criteria			Total Recoverable Limit	
								Acute Criteria (CMC)	Chronic Criteria (CCC)	Acute Criteria (CMC)	Chronic Criteria (CCC)		Maximum Daily Limit	Monthly Ave Limit
							Hardness							
	m_a	b_a	m_c	b_c	CF acute	CF chronic	(mg/l)	(ug/l)	(ug/l)	(ug/l)	(ug/l)		(ug/l)	(ug/l)
Cadmium	1.0166	-3.924	0.7409	-4.715	1.002	0.967	25	0.52	0.09	0.52	0.10		18.8	3.5
Chromium III	0.819	3.7256	0.819	0.6848	0.316	0.86	25	183.07	23.81	579.32	27.69		20855.6	996.8
Copper	.9422	-1.7	0.8545	-1.702	0.96	0.96	25	3.64	2.74	3.79	2.85		136.5	102.7
Lead	1.273	-1.46	1.273	-4.705	0.993	0.993	25	13.88	0.54	13.98	0.54		503.3	19.6
Nickel	0.846	2.255	0.846	0.0584	0.998	0.997	25	144.92	16.10	145.21	16.14		5227.5	581.2
Silver	1.72	-6.59	----	----	.85	----	25	0.30	----	0.35	----		12.6	-----
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986	25	36.20	36.50	37.02	37.02		1332.6	1332.6
Non-Hardness Dependent Metals														
Arsenic					1	1		340.00	150.00	340.00	150.00		12240.0	5400.0
Chromium VI					0.982	0.962		16.00	11.00	16.29	11.43		586.6	411.6
Mercury					0.85	0.85		1.40	0.77	1.65	0.91		59.3	32.6
Aluminum					----	----		----	----	750.00	87.00		27000.0	3132.0