UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
NEW ENGLAND - REGION I
ONE CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

FACT SHEET

DRAFT NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM (NPDES) PERMIT TO DISCHARGE TO WATERS OF THE UNITED STATES

NPDES PERMIT NO: **MA0100986**

NAME AND ADDRESS OF APPLICANT:

City of Fitchburg
Wastewater Treatment Facilities Commission
718 Main Street
Fitchburg, MA 01420

The Town of Lunenburg and the Town of Westminster are co-permittee for specific activities required by the permit. See Section VII of this fact sheet and Sections I.B and I.C of the draft permit. The responsible municipal departments are:

Town of Lunenburg
Department of Public Works
520 Chase Road
Lunenburg, MA 01462

Town of Westminster
Department of Public Works
2 Oakmont Avenue
P.O. Box 376
Westminster, MA 01473

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Fitchburg East Wastewater Treatment Facility
24 Lanides Lane
Fitchburg, MA 01420
and Combined Sewer Overflows

RECEIVING WATERS:

North Nashua River (Outfall 063 and 18 CSOs), **Sand Brook** (1 CSO), **Birch Brook** (3 CSOs), **Baker Brook** (2 CSOs), **Punch Brook** (5 CSOs), **and unnamed tributaries** (4 CSOs) **in the Nashua River Watershed - MA81-03**

CLASSIFICATION: **Class B - Warm Water**

I. PROPOSED ACTION

The above named applicant has applied to the U.S. Environmental Protection Agency for the re-issuance of its National Pollutant Discharge Elimination System (NPDES) permit to discharge into the designated receiving waters. The current permit was signed on September 13, 2002 and became effective sixty (60) days later. The permit expired September 30, 2005. A re-application was received on July 29, 2005 and additional information submitted September 22, 2005. This draft permit will expire five (5) years from the effective date.

II. TYPE OF FACILITY AND DISCHARGE LOCATION

The facility is a 12.4 million gallon per day (MGD) advanced wastewater treatment plant, which discharges to the North Nashua River (See Figure 1). The discharge from the treatment plant is treated sanitary, commercial, and industrial wastewater. The permit also covers Fitchburg's 33 combined sewer overflows (CSOs) to the North Nashua River and tributaries. The facility serves a total population of 48,000; Fitchburg's combined and separate collection systems serve 40,000 people, and another 5,000 in Lunenburg and 3,000 in Westminster are served by separate sewer systems.

The facility's discharge outfalls are listed below:

Outfall	Description of Discharge	Receiving Water
063	Treated Effluent	North Nashua River

The 33 CSOs and internal regulators are listed in **Attachment A** to the permit.

III. DESCRIPTION OF DISCHARGE

Quantitative descriptions of the discharge in terms of significant effluent parameters, based on discharge monitoring reports (DMRs) submitted for January 2005 through December 2006, are shown in Tables 1 and 2 of this fact sheet.

IV. LIMITATIONS AND CONDITIONS

The effluent limitations and monitoring requirements may be found in the draft NPDES permit.

V. PERMIT BASIS AND EXPLANATION OF EFFLUENT LIMITATION DERIVATION

A. BACKGROUND

1. Treatment Process Description

The facility is a 12.4 million gallon per day (MGD) advanced activated sludge facility with year-round sodium hypochlorite disinfection, which discharges to the North Nashua River (See Figure 1). In addition to the sanitary flow, there are four categorical and three non-categorical significant industrial dischargers representing less than 3 % of the average daily plant flow.

The Fitchburg East WWTF includes the following treatment units (See Figure 2): two bar racks; three primary settling basins; first-stage aeration with two fine-bubble aeration basins, two first-stage clarifiers, two second-stage fine-bubble aeration basins, and two second-stage clarifiers. Ferrous chloride is added to

the influent flow upstream of the headworks for phosphorus removal, and caustic is added for pH control after the first stage clarification.

Treated effluent is chlorinated with sodium hypochlorite at the effluent well of clarifier No. 2. Approximately 3 MGD of this effluent is drawn off at this point for incinerator air pollution control equipment and other applications throughout the plant. The effluent is dechlorinated with sodium bisulfate before being discharged to the North Nashua River.

Sludge is burned in a multiple hearth incinerator. The ash is trucked offsite to the Fitchburg-Westminster municipal landfill for disposal. When the incinerator is shut down for repair, lime stabilized biosolids are trucked to the landfill.

During certain wet weather conditions, the treatment plant receives high flows exceeding the capacity of its secondary and advanced treatment facilities. These flows are bypassed to disinfection following primary treatment in accordance with its high flow management plan. See following sections for a further description of flow related issues.

2. Collection System Description

According to the permit application, the collection system consists of about 93 percent separate sanitary sewers and 7 percent combined sewers.

A separate sanitary sewer conveys domestic, industrial and commercial sewage, but not storm water. It is typically part of a "two pipe system" consisting of separate sanitary sewers and storm sewers. The two systems have no interconnections; the sanitary sewer leads to a wastewater treatment plant and the storm sewer discharges to a local water body. However, portions of Fitchburg's separate sewer system were constructed with combination manholes, which serve as access points for both the sanitary sewer and storm sewer. While the two flows are technically separate, these manholes, and the sewers adjacent to the manholes are prone to cross contamination, especially during high flow events. The City estimates that there are 250 combination manholes in the collection system. See Part VII of the fact sheet for further information regarding combination manhole requirements.

A combined sewer is a "single pipe" system and conveys both sewage and storm water to a wastewater treatment plant. As described earlier, there are currently 33 combined sewer overflow structures. See Part VI of the fact sheet for further information regarding the CSO requirements in the draft permit.

3. Enforcement Status

The permittee has been issued enforcement orders by both MassDEP and EPA. These orders have required the permittee to address dry weather overflows from its collection system, combined sewer overflows causing violation of water quality standards and effluent violations at the treatment plant resulting from excessive flows.

MassDEP has issued orders requiring the permittee to address unauthorized discharges from its storm water collection system and effluent violations at the treatment plant. A short chronology of the pertinent enforcement orders is presented below.

- Administrative Consent Order ACO-CE-04-1N006 was issued on February 3, 2004 requiring the City to correct a discharge containing elevated levels of bacteria from a storm drain to Shea Brook, a tributary to Notown Reservoir, a principal water supply for the City of Leominster. The source

of the bacteria was determined to be sewage discharged into the storm system from combination manholes.

• Administrative Consent Order ACO-CE-07-1N003 was issued on February 22, 2007, requiring the permittee to upgrade the plant headworks and grit handling facilities by March 31, 2009, to address effluent limit violations and equipment breakdowns resulting from excessive flows and grit loadings to the treatment plant. The project completion date was later amended to October 31, 2009.

EPA has issued a series of orders requiring the permittee to address violations, including dry weather overflows from the collection system, combined sewer overflows resulting in violations of water quality standards, and effluent violations at the treatment plant. A short chronology of the pertinent enforcement actions is presented below:

• An administrative order was issued on July 2, 1996, requiring, among other things that the City complete a long term CSO control plan by August 29, 1998.

• An administrative order was issued on December 1, 2000, requiring elimination of dry weather discharges from the collection system.

• An administrative order was issued on June 13, 2003, requiring, among other things, that the City optimize the removal of phosphorus from the treatment plant discharge and to submit a high flow management plan that recommended "facility management procedures that provide the highest level of BOD, TSS, and bacteria removal feasible while maximizing pollutant removal, disinfection and dechlorination for flows that may bypass a proportion of the treatment plant." The plan recommended that flows in excess of 15 MGD be bypassed to the disinfection facilities following primary treatment. During bypass events, the facility samples effluents from the primary clarifiers, the advanced treatment facilities and the final blended effluent.

• Section 308 information request letters were issued in 2006 and 2007, requesting information regarding dry weather overflows, wet weather overflows, the operation of the treatment plant, the status of CSO abatement, mapping and monitoring of the storm drain system, and the status of projects to identify and eliminate problems associated with combination manholes. The City's responses to these information requests have led to a series of follow-up information submittals and meetings between the City and EPA to establish priorities and schedules by which the City will address its non compliance issues.

It is EPA's intent to issue an enforcement action in the near future that will establish schedules for treatment plant upgrades, CSO abatement and combination manhole activities necessary to correct violations of the Clean Water Act.

B. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Overview of Federal and State Regulations

Under Section 301(b)(1)(B) of the Clean Water Act ("CWA"), publicly owned treatment works ("POTWs") must have achieved effluent limitations based upon Secondary Treatment by July 1, 1977. The secondary treatment requirements are set forth at 40 CFR Part 133.102. In addition, Section 301(b)(1)(C) of the CWA requires that effluent limitations based on water quality considerations be established for point source discharges when such limitations are necessary to meet state or federal water quality standards that are applicable to the designated receiving water.

Pursuant to 40 CFR 122.44 (d), permittees must achieve water quality standards established under Section 303 of the Clean Water Act (CWA), including state narrative criteria for water quality. Additionally, under 40 CFR 122.44 (d)(1)(i), "Limitations must control all pollutants or pollutant parameters which the Director determines are or may be discharged at a level which will cause, have the reasonable potential to cause, or contribute to an excursion above any state water quality standard." When determining whether a discharge causes, or has the reasonable potential to cause or contribute to an in-stream excursion above a narrative or numeric criterion, the permitting authority shall use procedures which account for existing controls on point and non-point sources of pollution, and where appropriate, consider the dilution of the effluent in the receiving water.

2. Water Quality Standards; Designated Use; Outfall 063

The North Nashua River in the vicinity of the discharge is classified as a Class B-warm water fishery in the Massachusetts Surface Water Quality Standards (314 CMR 4.00). Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, and for primary and secondary contact recreation. They shall be suitable for irrigation and other agricultural uses and for compatible industrial cooling and process uses. The waters should have consistently good aesthetic value.

A warm water fishery is defined in the Massachusetts Surface Water Quality Standards (314 CMR 4.02) as waters in which the maximum mean monthly temperature generally exceeds 68° F during the summer months and are not capable of supporting a year-round population of cold water stenothermal aquatic life.

Section 303(d) of the Federal Clean Water Act (CWA) requires states to identify those waterbodies that are not expected to meet surface water quality standards after the implementation of technology-based controls and, as such require the development of total maximum daily loads (TMDL). The segment of the river (MA81-03), North Nashua River, from the Fitchburg East WWTF to the Leominster WWTF, is listed on the Massachusetts 2008 Integrated List of Waters (303d) as impaired and requiring the development of a TMDL. The listed impairments for this segment are unknown toxicity; pathogens; taste, odor and color; and turbidity. These same impairments, except turbidity, are listed for the river segment immediately upstream of this segment.

The MassDEP 1998 Water Quality Assessment Report for the Nashua River, which is the basis for the 303(d) list, assesses this segment as not supporting primary contact, secondary contact, and aesthetic uses due to urban runoff/storm sewers and CSOs, and also assesses this segment as not supporting aquatic life uses with the suspected cause being municipal and industrial point sources, urban runoff/storm sewers, and CSOs.

3. Limits Derivation

Available Dilution

Water quality based limits are established with the use of a calculated available dilution. 314 CMR 4.03(3)(a) requires that effluent dilution be calculated based on the receiving water 7Q10. The 7Q10 is the lowest observed mean river flow for 7 consecutive days, with a 10-year recurrence interval. Additionally, the facility design flow is used to calculate available effluent dilution.

The facility design flow is 12.4 million gallons per day or 19.2 cubic feet per second (cfs). The 7Q10 flow at the WWTF used to calculate the effluent limits in the 2002 permit was 22.22 cfs (14.4 MGD), resulting in a dilution factor of 2.16.

In the 2002 Fact Sheet, EPA and MassDEP calculated the dilution factor using the 7Q10 flow of 34.9 cfs, measured at the USGS gage 01094500, North Nashua River, located in Leominster 1.3 miles upstream of Wekepeke Brook (Figure 1). This gage is downstream of the Fitchburg West, Fitchburg East, and Leominster WWTF discharges. Therefore, the dry weather flows from these wastewater treatment plants should have been subtracted from the 7Q10 to obtain the baseflow of the river. However, an error was made in the calculations and the flow from the Leominster plant was not subtracted, resulting in a watershed flow factor that was too high and a calculated 7Q10 that was also too high. In the calculations for this fact sheet we have corrected this error and have made further adjustments based on a more current period of record for the Leominster gage, a recalculation of the drainage area upstream of the Fitchburg East discharge, and updated dry weather flows from the treatment facilities.

The 7Q10 at the Leominster gage is now 27.1 cfs, based on the record for 1986 to 2007. This period of record was used, rather than the entire record, which began in 1935, because of the need to use relatively current dry weather treatment plant flows in the calculations. The estimated drainage area of the gage remains at 110 square miles, but the estimated drainage area upstream of the Fitchburg East discharge was recalculated to be 86.6 square miles with MassGIS, which is an increase over the 81.6 square miles previously used.

The derivation of the 7Q10 at the Fitchburg East discharge and the corresponding dilution factor are shown below.

Baseflow (i.e., the non-WWTP flow) at the Leominster gage can be calculated by subtracting the upstream dry weather WWTF discharges from the gage flow:

7Q10 at USGS gage 01094500 in Leominster (1986 – 2007) = 27.1 cfs

Dry weather contributing flows from WWTFs upstream of the USGS gage in June to September, 2004 - 2006:

Fitchburg West:	2.58 MGD	4.0 cfs
Fitchburg East:	5.4 MGD	8.4 cfs
Leominster:	3.7 MGD	5.7 cfs
Total	11.7 MGD	18.1 cfs

Therefore, baseflow at USGS Leominster = [7Q10] – [contributing flows] =
= 27.1 cfs - 18.1 = 9.0 cfs

Baseflow per square mile of gage drainage area:
9 cfs/110 sq mi = 0.08 cfs/sq mi

Baseflow at Fitchburg East:
[86.6 sq mi] x [0.08 cfs/sq mi] = 6.9 cfs

7Q10 at Fitchburg East (Baseflow at Fitchburg East plus Fitchburg West flow):
7Q10 = 6.9 cfs + 4 cfs = 10.9 cfs

Dilution factor:

$$DF = \frac{7Q10 + \text{design flow}}{\text{Design flow}} = \frac{10.9 \text{ cfs} + 19.2 \text{ cfs}}{19.2 \text{ cfs}} = \mathbf{1.6}$$

Flow - The flow limit is based on the annual average design flow of the treatment plant, which is 12.4 MGD. Flow is to be measured continuously. The permittee shall also report the average monthly flow and the maximum daily flow for each month as well as the date, time of initiation, duration, and estimated volume of each bypass during the month.

OUTFALL 063- CONVENTIONAL POLLUTANTS

Biochemical Oxygen Demand (BOD_5) - The draft permit carries forward the BOD_5 limits in the current permit. The summer water quality based limits are from a wasteload allocation developed by the MassDEP and published in The Nashua River Water Quality Management Plan 1981 (MassDEP 1981). The limits in the draft permit are seasonal. During the period of November 1 to April 30, the average monthly limit is 20 mg/l, the average weekly is 30 mg/l, and the maximum daily is 35 mg/l. For the period of May 1 to October 31, the average monthly limit is 8 mg/l, the average weekly limit is 12 mg/l, and the maximum daily is 15 mg/l. The mass limitations for BOD are based on a 12.4 MGD design flow. The monitoring frequency continues to be once per day.

In 2005 and 2006, the average monthly winter BOD_5 ranged from 6.0 to 20.9 mg/l, and the maximum daily ranged from 23.7 to 103 mg/l. The summer average monthly ranged from 4.1 to 20 mg/l and the maximum daily ranged from 9.6 to 118 mg/l.

Total Suspended Solids (TSS) - The draft permit carries forward the TSS limits in the current permit. The summer water quality based limits are from a wasteload allocation developed by the MassDEP and published in The Nashua River Water Quality Management Plan 1981 (MassDEP 1981). The limits in the draft permit are seasonal. During the period November 1 to April 30, the average monthly and average weekly limits are based on the secondary treatment requirements set forth at 40 CFR133.102(b)(1), (2) and 40 CFR 122.45 (f). The secondary treatment limitations are a monthly average of 30 mg/l and a weekly average of 45 mg/l. The permit also continues the maximum daily limit of 50 mg/l. For the period of May 1 to October 31, the average monthly limit is 10 mg/l, the average weekly limit is 15 mg/l, and the maximum daily limit is 20 mg/l. The mass limitations for TSS are based on a 12.4 MGD design flow. The monitoring frequency continues to be once per day.

In 2005 and 2006, the winter average TSS ranged from 9.5 to 43.6 mg/l, and the maximum daily ranged from 31 to 292 mg/l. The summer average ranged from 8.7 to 33.1 mg/l, and the maximum daily ranged from 28 to 292 mg/l.

BOD_5 and TSS Mass Loading Calculations:

Calculations of allowable loads for average monthly, average weekly and maximum daily BOD_5 and TSS are based on the following equation:

L = C x DF x 8.34 where:

L = Allowable load in lbs/day.
C = Allowable effluent concentration for reporting period in mg/l.
(Reporting periods are average monthly, average weekly and daily maximum.)
DF = Design flow of facility in MGD.
8.34 = Factor to convert effluent concentration in mg/l and design flow in MGD to lbs/day.

(Concentration limit) [50] X 8.34 (Constant) X 12.4 (design flow) = 5170 lbs/day

(Concentration limit) [45] X 8.34 (Constant) X 12.4 (design flow) = 4650 lbs/day

(Concentration limit) [35] X 8.34 (Constant) X 12.4 (design flow) = 3620 lbs/day

(Concentration limit) [30] X 8.34 (Constant) X 12.4 (design flow) = 3100 lbs/day

(Concentration limit) [20] X 8.34 (Constant) X 12.4 (design flow) = 2070 lbs/day

(Concentration limit) [15] X 8.34 (Constant) X 12.4 (design flow) = 1550 lbs/day

(Concentration limit) [12] X 8.34 (Constant) X 12.4 (design flow) = 1240 lbs/day

(Concentration limit) [10] X 8.34 (Constant) X 12.4 (design flow) = 1030 lbs/day

(Concentration limit) [8] X 8.34 (Constant) X 12.4 (design flow) = 830 lbs/day

Eighty-Five Percent (85%) BOD_5 and TSS Removal Requirement - The provisions of 40 CFR "133.102(a)(3) and (b)(3) requires that the 30 day average percent removal for BOD_5 and TSS be not less than 85%. These limits are maintained in the draft permit.

pH - The draft permit includes pH limitations, which are required by state water quality standards for Class B waters at 314 CMR 4.05 (3)(b) 3. The pH of the effluent shall not be less than 6.5 or greater than 8.3 standard units at any time.

Fecal Coliform and Escherichia coli Bacteria – The draft permit includes bacteria limitations, which are in accordance with the Massachusetts Surface Water Quality Standards, 314 CMR 4.05 (3)(b)(4).

Several scientific studies have demonstrated that Escherichia coli bacteria are a better indicator than fecal coliform bacteria of potential human health effects of bacteria in recreational uses such as swimming. On December 29, 2006, Massachusetts promulgated new bacteria criteria in the Massachusetts Surface Water Quality Standards, replacing fecal coliform with E. coli as an indicator bacterium for recreational uses, consistent with the guidance and regulations promulgated by EPA and with the Massachusetts Department of Public Health regulations for bathing beaches.

Therefore, the permit includes both fecal coliform and E.coli limits, with a one year compliance schedule for attaining the new limits. The fecal coliform limits of 200 colony forming units (cfu)/100 ml for the average monthly geometric mean limit and 400 cfu/100 ml for the maximum daily limit are the same as the previous limit. After one year, the fecal coliform limits and monitoring requirement ends and is replaced by E.coli.

During this period of transition from the fecal coliform to E.coli standard, the draft permit contains E.coli report only requirements at a reduced monitoring frequency for the first year. After the permit has been in effect for one year, the E.coli limits and monitoring frequency of 1/day will go into effect. The effluent limits for E.coli are 126 colony forming units (cfu)/100 ml geometric mean and 409 cfu/100 ml maximum daily value (this is the 90% distribution of the geometric mean of 129 cfu/100 ml).

The samples must be collected at the same time as one of the Total Residual Chlorine (TRC) samples is collected.

The effluent limitations for bacteria are based on state certification requirements for WWTFs under Section 401(d) of the CWA, 40 CFR 124.53 and 124.55.

Dissolved Oxygen - The draft permit includes a limitation of not less than 5.0 mg/l for dissolved oxygen (DO) from May 1 to October 31, which is the same as the previous permit. This limit is consistent with the Massachusetts Water Quality Standards (314 CMR 4.05(3)1) for warm water fisheries and the wasteload allocation developed by the MassDEP and published in The Nashua River Water Quality Management Plan 1981 (MassDEP 1981).

OUTFALL 063 - NON-CONVENTIONAL POLLUTANTS

Total Residual Chlorine - Chlorine is a toxic chemical. DMRs show chlorine residual levels ranging from 0.01 to 1.5 mg/l with 9 violations in a 24 month period. The draft permit includes TRC limitations, which are based on state water quality standards [314 CMR 4.05(5)(e)]. Chlorine compounds produced by the chlorination of wastewater can be extremely toxic to aquatic life.

The acute and chronic water quality criteria for chlorine defined in the 2002 EPA National Recommended Water Quality Criteria (EPA 822-R-02-047) for freshwater are 19 ug/l and 11 ug/l, respectively. Given the dilution factor of 1.6, total residual chlorine limits have been calculated as 30 ug/l maximum daily and 18 ug/l average monthly. Compliance sampling is continued at three times per day. Bacteria samples are required to be collected concurrently with the TRC grab samples.

Total Residual Chlorine Limitations:
(acute criteria * dilution factor) = Acute (Maximum Daily)
(19 ug/l x 1.6) = 30 ug/l

(chronic criteria * dilution factor) = Chronic (Monthly Average)
(11 ug/l x 1.6) = 18 ug/l

The permit also requires reporting TRC based on measurements taken by a continuous TRC meter. Using the data collected by the continuous TRC meter will provide for a more comprehensive evaluation of the potential impacts associated with chlorine toxicity. An attachment to the monthly DMRs containing the following information shall be submitted each month:

a. The average monthly, maximum daily and maximum instantaneous concentration.

b. The results of the grab samples and a comparison to the continuous analyzer reading, including the time of the grab samples.

c. The total duration of time during the month that the average monthly limit was exceeded;

d. The total duration of time during the month that the maximum daily limit was exceeded;

Total Phosphorus - The Massachusetts Surface Water Quality Standards (314 CMR 4.00) do not contain numerical criteria for total phosphorus. The narrative criteria for nutrients is found at 314 CMR 4.05(5)(c), which states that nutrients "shall not exceed the site specific limits necessary to control accelerated or cultural eutrophication." The Standards also require that "any existing point source discharges containing nutrients in concentrations that encourage eutrophication or the growth of weeds or algae shall be provided with the highest and best practicable treatment to remove such nutrients" (314 CMR 4.04). MassDEP has established that a monthly average total phosphorus limit of 0.2 mg/l represents highest and best practical treatment for POTWs.

EPA has produced several guidance documents that contain recommended total phosphorus criteria for receiving waters. The 1986 Quality Criteria of Water ("the Gold Book") recommends in-stream

phosphorus concentrations of 0.05 mg/l in any stream entering a lake or reservoir, 0.1 mg/l for any stream not discharging directly to lakes or impoundments, and 0.025 mg/l within a lake or reservoir.

More recently, EPA has released "Ecoregional Nutrient Criteria", established as part of an effort to reduce problems associated with excess nutrients in water bodies in specific areas of the country. The published criteria represent conditions in waters in each specific ecoregion that are minimally impacted by human activities, and thus representative of waters without cultural eutrophication. Fitchburg is within Ecoregion XIV, Eastern Coastal Plains. The recommended total phosphorus criteria for this Ecoregion XIV is 24 ug/l (0.024 mg/l) and can be founded in the Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Ecoregion XIV, published in December 2000.

Data collected for the 1998 Nashua River Water Quality Assessment Report shows that the average instream concentration of total phosphorus in the North Nashua River downstream of the Fitchburg East and Leominster wastewater discharges (Station NN12) averaged 138 ug/l with a range of 70 – 180 ug/l. Data collected for the DWM Year 2003 Water Quality Monitoring Data – Rivers from the same station resulted in an average total phosphorus concentration of 93 ug/l and a range from 54 – 140 ug/l. At a station downstream of the Fitchburg East wastewater discharge, but upstream of the Leominster wastewater discharge (Station NN10A) the 2003 data resulted in an average total phosphorus concentration of 79 ug/l and a range from 36 – 140 ug/l. These values exceed the ecoregion criteria of 24 ug/l. These values also represent a significant increase over the average upstream value of 40 ug/l in 1998 and 25 ug/l in 2003 with ranges of 20 – 60 ug/l and 11 – 65 ug/l respectively. Streamflows during the sampling events varied widely. An analysis of the limited data sets shows correlation between the mean monthly streamflow and the instream total phosphorus concentrations. During the low flow period of July through September, the instream total phosphorus concentrations were significantly higher.

MassDEP has included the segment of the Nashua River immediately downstream of the confluence with North Nashua River on the 303(d) list for nutrients. Furthermore, the State has also documented the eutrophication of the Pepperell Impoundment, located downstream of the Fitchburg East WWTF. The Impoundment is the downstream point of accumulation for any biomass produced upstream as the result of phosphorus inputs.

Discharge Monitoring Reports (DMRs) submitted by the permittee over the last 24 months report average monthly total phosphorus values between 0.35 mg/l and 1.86 mg/l. The calculated instream contribution at the current monthly average limit of 1 mg/l (1 mg/l divided by the dilution factor of 1.6) would be 0.6 mg/l, which is higher than both the ecoregion criteria and the "Gold Book" criteria.

The major discharges upstream of the confluence of the North Nashua River and the Nashua River (locally known as the "South Branch") are the POTWs in Fitchburg West, Fitchburg East, and Leominster, which discharge to the North Nashua, and the MWRA Clinton POTW which discharges to the South Branch. The Fitchburg West plant is not a significant source of phosphorus given that its flow consists of nutrient deficient paper making waste, and the flow is consistent at 2.8 MGD or 4.4 cfs. Together, the Fitchburg East, Leominster and Clinton treatment plants represent a high percentage of the receiving water low flow in this segment under 7Q10 conditions. The average summer flow from these facilities is currently about 17 cfs and the receiving water 7Q10 is about 40 cfs (see calculations below).

7Q10 Flow = North Nashua 7Q10 + South Branch 7Q10

North Nashua 7Q10 = gage downstream of Leominster + (flow factor)(watershed area between Leominster gage and confluence of North Nashua and South Branch)

= 27.1 cfs + (0.08 cfs/sq mi [1]) (24 sq mi)
= 27.1 cfs + 1.9 cfs
= 29 cfs

South Branch 7Q10 = 7Q10 at Clinton[2] + Clinton dry weather flow + (flow factor) (watershed area between Clinton and confluence with North Nashua)

= 2.8 cfs + 3.1 cfs + (0.08 cfs) (6 sq mi)
= 2.8 cfs + 3.1 cfs + 0.5 cfs
= 6.4 cfs

7Q10 at confluence of North Nashua and South Branch = 29 cfs + 6.4 cfs = 35.4 cfs

Dry weather flow from POTWs [3]:

Fitchburg East	5.4 MGD	= 8.4 cfs
Leominster	3.7 MGD	= 5.7 cfs
MWRA Clinton	2 MGD	= 3.1 cfs
Total		17.2 cfs

These calculations show that under current dry weather conditions the discharges from these POTWs account for about 50 percent (17.2 cfs/35.4 cfs) of the total flow in the river in segment MA81-05 during dry weather. The corresponding dilution factor would be:

Dilution factor = (7Q10 + POTW flow)/POTW flow
= 35.4 cfs/17.2 cfs
= 2.1

Using this dilution factor calculated above, the instream concentration of total phosphorus in Segment MA81-05 due to those discharges can be estimated for a given POTW effluent concentration by dividing the effluent concentration by the dilution factor. For an effluent concentration of 1.0 mg/l, the estimated instream concentration would be 0.5 mg/l (1.0 mg/l / 2.1), while the estimated instream concentration at a POTW effluent concentration of 0.2 mg/l would be 0.095 mg/l (0.2 mg/l / 2.1).

At an effluent concentrations of 1 mg/l, the treatment plants discharges would result in a phosphorus concentration roughly 4 times the Gold Book-recommended criteria of 0.1 mg/l under dry weather flow conditions. At effluent concentrations of 0.2 mg/l, the POTW discharges would cause an instream concentration of about 0.095 mg/l which is about equal to the Gold Book-recommended criteria.

Under design flow conditions, which are the basis for establishing permit conditions, the instream concentrations would be higher for any given POTW effluent concentration, given that the loads from the POTWs would increase and there would be no increase in non-POTW dilution flow.

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[1] Flow factor calculated in Available Dilution section of the fact sheet.. This factor is consistent with flow factors from other gages in the watershed. The flow factor calculated from the downstream gage in East Pepperell is 46 cfs/435 sq mi = 0.11 cfs/sq mi and the flow factor for the Squannacook River gage is 5.5 cfs/63.7 sq mi = 0.09 cfs/sq mi.

[2] 7Q10 of 1.8 MGD (2.8 cfs) from MWRA Clinton WWTF fact sheet.

[3] Dry weather flows are the lowest monthly average flows reported during the months of June to September 2004 – 2006.

7Q10 with POTWs at design flow = Current 7Q10 + increase in flow due to POTWs discharging at design flow[4].

Design flows of POTWs:

Fitchburg East	= 12.4 MGD	= 19.2 cfs
Leominster	= 9.3 MGD	= 14.4 cfs
MWRA Clinton	= 3 MGD	= 4.6 cfs
Total		38.2 cfs

Increase in Flow from POTWs = Design Flow – Dry Weather Flow

Fitchburg East	= 12.4 MGD – 5.4 MGD	= 7 MGD	= 10.8 cfs
Leominster	= 9.3 MGD– 3.7 MGD	= 5.6 MGD	= 8.7 cfs
MWRA Clinton	= 3 MGD – 2 MGD	= 1 MGD	= 1.5 cfs
Total =			21 cfs

7Q10 = 35.4 cfs + 21 cfs = 56.4 cfs

Under this scenario, the POTW flows would represent about 68 percent of the dry weather flow in Segment MA81-05 (38.2 cfs/56.4 cfs). The corresponding dilution factor would be:

Dilution Factor = (7Q10 + POTW flow) / POTW flow
= 56.4 cfs / 38.2 cfs
= 1.5

At a POTW effluent concentration of 0.2 mg/l, the estimated instream concentration would be 0.133 mg/l (0.2 mg/l/1.5), which is slightly greater than the Gold Book-recommended criteria.

While there may be some attenuation of phosphorus discharged from the treatment plants, the preceding analyses do not factor in other nonpoint sources of phosphorus, including phosphorus resuspended from sediments. Overall, the analyses demonstrate that the upstream discharges cause or contribute to the impairment of the Nashua River, and therefore must provide highest and best practical treatment, and that such limits are necessary to achieve the Gold Book-recommended criteria instream.

EPA has determined that an effluent limit of 0.2 mg/l is necessary to achieve water quality standards and has established the limit seasonally (April 1 to October 31) in order to ensure that phosphorus discharges do not result in excessive plant and algae growth during the active growing season. EPA has also included a winter limit of 1 mg/l to ensure that particulate phosphorus is not discharged in significant quantities during this period. Particulate phosphorus discharged during the winter months could settle in the downstream impoundments and be available to support plant growth during the growing season. A weekly orthophosphorus reporting requirement has been included in the draft permit to determine the proportion of dissolved phosphorus in the winter months.

MassDEP has recently completed preliminary water quality modeling of the Nashua and North Nashua Rivers. The preliminary model results indicate that the proposed seasonal total phosphorus limit of 0.2 mg/l is appropriate.

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[4] This analysis assumes that the increased POTW discharges will not impact base flow in the river. This is unlikely as base flow in the river is likely to decrease with increased POTW flows given that at least some of the necessary drinking water withdrawals will come from the watershed.

Ammonia - The draft permit includes seasonal effluent limitations for ammonia nitrogen. During the month of May, the average monthly and average weekly limit for ammonia nitrogen is 5 mg/l and the maximum daily discharge limit is 8 mg/l. For the summer months, defined as June 1 through October 31, the draft permit includes an average monthly limit and average weekly limit of 1 mg/l and a maximum daily limit of 2.0 mg/l. These limits are carried forward from the existing permit and are based on the 1981 wasteload allocation. The monitoring frequency in May is twice per week, and June 1 through October 31 is three times per week. The average monthly ammonia in the summer months ranged from 0.56 to 2.57 mg/l with three violations, and 0.56 to 5.95 mg/l maximum daily with five violations.

During the winter months, ammonia limits may not be necessary to ensure compliance with dissolved oxygen criteria given the higher receiving water flows, reduced rates of biological degradation of ammonia and higher instream concentrations of dissolved oxygen. However, winter limits may be necessary to ensure that ammonia toxicity does not cause or contribute to violations of water quality standards.

In order to determine if there is a reasonable potential for the Fitchburg East discharge to cause a violation of the water quality standards, the potential winter limits were calculated based on the 1999 Update of Ambient Water Quality Criteria for Ammonia (EPA-822-R-99-014), and Federal Register Vol. 64, No. 245, pgs. 71973 - 71980, December 22, 1999.

The recommended chronic ammonia criteria is established as a 30-day concentration, therefore the monthly average limit has been calculated using a dilution factor based on 30-day mean low flow with a recurrent interval of 10 years (30Q10) and the discharge design flow.

The Nashua River 30Q10 at USGS gage 01094500 in Leominster is 67.8 cfs for November 1986 through December 2007. The following analysis utilizes the conservative assumption that contributing discharge flows for the 30Q10 estimate are equal to design flows, in contrast to the 7Q10 estimate where the flows were based on the actual discharge volumes during a period when low flow conditions existed in the river.

Contributing flows from upstream WWTPs:

Fitchburg West	10.5 MGD	16.2 cfs
Fitchburg East	12.4 MGD	19.2 cfs
Leominster	9.3 MGD	14.4 cfs
Total contributing flows	32.2 MGD	49.8 cfs

Therefore, base flow at USGS Leominster = [30Q10] – [contributing flows] =
= 67.8 cfs – 49.8 cfs = 18.0 cfs

Base flow per square mile of gage drainage area:

(18.0 cfs) / (110 sq mi) = 0.16 cfs/sq mi

30Q10 estimate at Fitchburg East:

(base flow factor) (drainage area) + (Fitchburg West flow) = (0.16) (86 sq mi) + (16.2 cfs) = 30 cfs

Instream dilution based on 30Q10:

$$DF = \frac{30Q10 + \text{design flow}}{\text{design flow}} = \frac{30.0 \text{ cfs} + 19.2 \text{ cfs}}{19.2 \text{ cfs}} = 2.6$$

Calculation of Ammonia Criteria:

The winter ammonia instream criteria are dependent on pH and temperature. Ambient pH data collected as part of the WWTF quarterly toxicity testing and temperature data collected by the MassDEP at Station NN12 (downstream from the Route 190 bridge in Lancaster) were used to calculate the ammonia criteria. On occasion, the pH in the winter months was below the minimum water quality standard of 6.5. Since the ammonia criteria increases with lower pH, the criterion at 6.5 was used for the effluent limit calculation.

Month	pH, S.U.	Temperature, ° C	Instream Criteria, mg/l	Limit, mg/l	Effluent Ammonia, mg/l
March 2004	6.5	2.43	6.67	17.3	8.1
December 2004	6.51		6.67	17.3	6.8
March 2005	6.71		6.44	16.7	11.0
December 2005	6.72		6.44	16.7	<0.1
January 2006	6.15	2.61	6.67	17.3	2.3
March 2006	6.46	6.20	6.67	17.3	1.0
December 2006	6.69		6.44	16.7	2.6

Therefore, a criteria value of 6.44 mg/l based on a pH of 6.7 and temperature of 0 ^{0}C was selected to be protective of the river during cold weather conditions.

Average monthly winter ammonia limit = (ammonia criteria) (30Q10 DF)
= (6.44 mg/l) (2.6) = 16.7 mg/l

The weekly average ammonia criteria should be no more than twice the monthly average limit:

Weekly average winter ammonia limit = (average monthly limit) (2) = (16.7 mg/l) (2) = 33.4 mg/l

The effluent average monthly ammonia concentration range in the winter was <0.1 to 11 mg/l. Winter ammonia limits are not required at this time because a reasonable potential for the ammonia levels in the effluent to exceed water quality criteria does not exist. The winter reporting requirement is carried over from the current permit with a 1/month sampling frequency.

OUTFALL 063 – TOXIC POLLUTANTS

Relatively low concentrations of trace metals in receiving waters can be toxic to resident aquatic life species. Effluent metals data submitted with toxicity tests results were reviewed to determine if any of the metals in the discharge have the potential to exceed aquatic life criteria in the North Nashua River. The data indicate that the discharge has the potential during low flow conditions to cause or contribute to exceedances of the ambient copper criteria as adopted in the Massachusetts Surface Water Quality Standards. These criteria are set at levels to protect aquatic life from both acute and chronic toxicity.

Copper - The current permit includes monthly average and daily maximum copper limits of 13.95 ug/l and 20.16 ug/l, respectively. These limits were calculated using the 1998 National Recommended Water Quality Criteria for copper calculated at a hardness of 65 mg/l and a dilution factor of 2.16.

Analytical data submitted with toxicity test results and past Discharge Monitoring Reports (DMRs: see Table 2) indicates that the facility has not consistently achieved the limitations in the previous permit. The concentrations of copper from January 2005 to December 2006 ranged from the below detection limit of 10 ug/l to 59 ug/l (Table 2).

The previously mentioned revision to the Massachusetts Surface Water Quality Standards includes site-specific criteria for copper in the Nashua River in Table 28 (314 CMR 4.05(5)(e). These criteria have been developed in instances where national criteria are invalid due to site-specific physical, chemical, or biological considerations, and do not exceed the safe exposure levels determined by toxicity testing. MassDEP has adopted an acute site specific criterion of 25.7 ug/l and a chronic criterion of 18.1 ug/l for dissolved copper in the North Branch of the Nashua River. The conversion factor to convert total recoverable metal to dissolved metal is 0.960.

Mass DEP prepared *PROTOCOL FOR AND DETERMINATION OF SITE SPECIFIC COPPER CRITERIA FOR AMBIENT WATERS IN MASSACHUSETTS* (the Site Specific Copper Protocol) in conjunction with the new criteria. In this document DEP states that "While site-specific copper criteria are being established, prudence dictates that loads of copper and other metals be minimized. This, in part, is because possible impacts on sediment quality and toxicity remain an open question. Therefore, as part of the site-specific criteria, all reasonable efforts to minimize the loads of metals, and copper in this case, are part of the criteria revision protocol. So, the Department on a case-by-case basis will develop permit copper limits. Each determination will be based not only on the adjusted concentration resulting from the appropriate multiplier but will reflect the demonstrated level of copper reduction routinely achievable at the facility in order to minimize copper loads and thereby reduce its accumulation in the sediment."

Antibacksliding requirements found at Clean Water Act (CWA) 402(o) and 40 CFR 122.44(l) generally prohibit relaxation of effluent limits. Water quality-based limits can only be relaxed if one of the exceptions found at CWA 402(o)(2) is met or if the requirements of CWA 303(d)(4) are met. In this case, none of the exceptions listed in 402(o)(2) apply[5]

CWA 303(d)(4) requires that a determination be made whether the receiving water is attaining the applicable water quality standard. If the water is in attainment of the standard, a relaxation of the limit would be allowed subject to the state antidegradation policy. If the receiving water is not in attainment of the applicable standard, the existing limit must be based on a wasteload allocation or a total maximum daily load (TMDL) and the relaxed limit is only allowed if attainment of water quality standards is ensured.

The effluent limits for copper were re-calculated based on the new criteria. When calculating the effluent limits using the site-specific criteria, the concentration of copper in the receiving water upstream of the discharge is considered. This value, 4.4 ug/l, is based on the average ambient concentration from water

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5 It may appear that that the exception found at 402(o)(2)(B)(i) would apply. This exception is for a situation where "information is available which was not available at the time of permit issuance (other than revised regulations, guidance, or test methods) and which would have justified the application of a less stringent effluent limitations at the time of permit issuance". However, new water quality criteria are "revised regulations" and are therefore specifically excluded as "new information".

samples collected for toxicity tests just upstream of the discharge point during the low-flow months of June and September 2004 – 2006.

Basic mass balance water quality equation:

$$Q_r C_r = Q_d C_d + Q_s C_s$$

Where:

Q_s	=	7Q10 river flow upstream of plant = 10.9 cfs = 7.0 MGD
Q_d	=	Discharge flow from plant = 12.4 MGD
Q_r	=	Combined river flow (7Q10 + plant flow)
C_s	=	Upstream copper concentration = 4.4 ug/l
C_d	=	Plant discharge copper effluent limit
C_r	=	Allowable receiving water copper concentration based on water quality criteria

To calculate an effluent limitation:

Acute criteria for dissolved copper = 25.7 ug/l

$$C_d = \frac{Q_r C_r - Q_s C_s}{Q_d} = \frac{(12.4 \text{ MGD} + 7.0 \text{ MGD})(25.7 \text{ ug/l}) - (7 \text{ MGD})(4.4 \text{ ug/l})}{(12.4 \text{ MGD})} = 37.7 \text{ ug/l}$$

Maximum daily effluent limitation for total recoverable copper = 37.7/0.96 = 39.3 ug/l

Chronic criteria for dissolved copper = 18.1 ug/l

$$C_d = \frac{Q_r C_r - Q_s C_s}{Q_d} = \frac{(12.4 \text{ MGD} + 7.0 \text{ MGD})(18.1 \text{ ug/l}) - (7 \text{ MGD})(4.4 \text{ ug/l})}{(12.4 \text{ MGD})} = 25.8 \text{ ug/l}$$

Monthly average effluent limitation for total recoverable copper = 25.8/0.96 = 26.8 ug/l

In each case, the calculated limit was greater than the limit in the current permit. However, pursuant to the State's antidegradation policy and the Site Specific Protocol, the new limit is not based entirely on these calculations if the demonstrated level of copper reduction routinely achievable at the facility is greater than would be required to achieve the re-calculated limits. Therefore, the effluent copper data from the facility for the years of 2005-2006 was reviewed to characterize the performance of the facility. The effluent copper concentrations for the past 24 months are shown on Table 2. In order to capture the statistical variation in the data, the 99th percentile for maximum daily data and the 95th percentile for the average monthly concentration were calculated (see Table 3 for calculations). Based on these calculations, the monthly average limit would be 50.7 ug/l and the maximum daily limit would be 45.23 ug/l.

Accordingly, the limitations in the draft permit are established at the more stringent of the limits calculated to achieve the new water quality criteria and those based on demonstrated performance of the facility. In this case, the limits based on the new water quality criteria (monthly average- 27 ug/l, daily maximum- 39 ug/l) are more stringent and are included in the draft permit.

Hardness-based metals limits:

Certain metals, including cadmium, lead, nickel and zinc, are more toxic at lower hardness, and this is

factored into calculations of the water quality criteria. EPA's Office of Water – Office of Science and Technology stated in a letter dated July 7, 2000 that: *The hardness of the water containing the discharged toxic metal should be used for determining the applicable criterion. Thus the downstream hardness should be used.*

The hardness of the North Nashua River downstream of the treatment plant during critical low flow periods was calculated based on average ambient and effluent hardness data collected for the whole effluent toxicity tests conducted in the summer months (June to October) from 2002 to 2006.

$$C_r = \frac{Q_d C_d + Q_s C_s}{Q_r} = \frac{(12.4\ MGD)(64\ mg/l) + (7\ MGD)(43\ mg/l)}{(12.4\ MGD + 7\ MGD)} = 56\ mg/l$$

Where:

Q_s = 7Q10 river flow upstream of plant = 10.9 cfs = 7.0 MGD
Q_d = Discharge flow from plant = 12.4 MGD
Q_r = Combined river flow (7Q10 + plant flow)
C_s = Upstream hardness concentration = 43 mg/l
C_d = Plant discharge hardness concentration = 64 mg/l
C_r = Receiving water hardness concentration

Therefore, a hardness of 56 mg/l was used to calculate the water quality criteria for certain metals. The water quality criteria formulas are found in Appendix B of EPA's National Recommended Water Quality Criteria – 2006:

Acute criteria (dissolved) = $\exp\{ m_a [\ln(\text{hardness})] + b_a \}$ (CF)
m_a = pollutant specific coefficient
b_a = pollutant specific coefficient
h = hardness
ln = natural logarithm
CF = pollutant specific conversion factor used to convert total recoverable to dissolved metal
Chronic criteria (dissolved) = $\exp\{ m_c [\ln(\text{hardness})] + b_c \}$ (CF)
m_c = pollutant specific coefficient
b_c = pollutant specific coefficient
h = hardness
ln = natural logarithm
CF = pollutant specific conversion factor used to convert total recoverable to dissolved metal

Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness Dependent

					Freshwater Conversion Factors (CF)	
Chemical	**m_A**	**b_A**	**m_C**	**b_C**	**CMC**	**CCC**
Cadmium	1.0166	-3.924	0.7409	-4.719	1.136672-[(ln hardness) (0.041838)]	1.101672-[(ln hardness) (0.041838)]
Lead	1.273	-1.460	1.273	-4.705	1.46203-[(ln hardness) (0.145712)]	1.46203-[(ln hardness) (0.145712)]
Nickel	0.8460	2.255	0.8460	0.0584	0.998	0.997
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

The dissolved acute and chronic criteria and total recoverable maximum daily and average daily limits are listed on the summary table below.

Metals Criteria and Limits

In order to determine the reasonable potential to cause or contribute to exceedances of the metals criteria in the North Nashua River, metals data submitted with the toxicity test reports and DMRs were evaluated against potential water quality based effluent limits based on the respective water quality criteria for each metal. The table below summarized the criteria, potential water quality based limits, and discharge quality for five trace metal (aluminum, lead, zinc, cadmium, nickel) that are commonly present in the effluent of POTWs.

Summary of Reasonable Potential Analysis for Selected Trace Metals

Metal	Acute Criterion, Dissolved (ug/l)	Chronic Criterion, Dissolved (ug/l)	Maximum Daily Limit, Total (ug/l)	Average Monthly Limit, Total (ug/l)	Effluent	
					Range (ug/l)	Number of Exceedances
Aluminum	750	87	1200	139	<10 - 690	2
Cadmium	1.1	0.2	2	0.3	<1 – 6.7	3
Copper	25.7	18.1	39	27	<10 – 59	1 [1]
Lead	34	2	62	3	<5 - 24	4
Nickel	286	32	458	52	3 - 14	0
Zinc	72	72	117	117	45 - 110	2

[1] Based on revised Massachusetts WQC

Based on the criteria and concentrations of metal in the effluent, there is a reasonable potential to cause or contribute to a violation of the water quality standards for several metals. The report requirement for aluminum has been changed to a limit, the lead limit has been revised, and limits have been added for cadmium and zinc.

OUTFALL 063 - WHOLE EFFLUENT TOXICITY (WET)

Under Section 301(b)(1)(C) of the CWA, discharges are subject to effluent limitations based on water quality standards. The Massachusetts Surface Water Quality Standards include the following narrative statement and requires that EPA criteria established pursuant to Section 304(a)(1) of the CWA be used as guidance for interpretation of the following narrative criteria: All surface waters shall be free from pollutants in concentrations or combinations that are toxic to humans, aquatic life or wildlife.

National studies conducted by the EPA have demonstrated that domestic sources contribute toxic constituents to POTWs. These constituents include metals, chlorinated solvents, aromatic hydrocarbons and others. Based on the potential for toxicity from domestic sources, the state narrative water quality criterion, the limited dilution at the discharge location, and in accordance with EPA national and regional policy and 40 CFR § 122.44(d), the draft permit includes a whole effluent chronic and acute toxicity limitations (C-NOEC = 62 % and LC50 =100%). (See also "Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants", 49 Fed. Reg. 9016 March 9, 1984, and EPA's "Technical Support Document for Water Quality-Based Toxics Control", September, 1991.)

The draft permit carries forward the requirements for quarterly Chronic and Acute toxicity tests using the species Ceriodaphnia dubia and Pimephales promelas. The tests must be performed in accordance with the test procedures and protocols specified in **Permit Attachment B**. EPA authorized using alternate dilution water in P. promelas tests only on May 22, 2001. The site water controls continue to be toxic or unreliable with the minnows, and survivability has ranged from 33 to 98 percent, so this authorization is continued. The permittee must continue to run the required sets of controls including chemistry (e.g. site water controls and lab water controls) when utilizing alternative dilution water for the minnows. The tests will be conducted four times a year, during March, June, September and December.

The acute toxicity has been >100%, but the C-NOEC has not met the permit limits four times in the last two years.

The LC_{50} limit of ≥100% is established by EPA/MassDEP policy for facilities with less than 10:1 dilution (See MassDEP's "Implementation Policy for the Control of Toxic Pollutants in Surface Waters, February 23, 1990). The C-NOEC is established at the receiving water concentration (1/Dilution Factor = 1/1.6) which is 62%.

VI. COMBINED SEWER REQUIREMENTS

1. Background

Combined sewer overflows (CSOs) are overflows from a combined sewer system that are discharged into receiving waters before reaching the headworks of a publicly owned treatment works (POTW). CSOs occur during precipitation events when the flow in the combined sewer system exceeds interceptor or regulator capacity. CSOs are distinguished from bypasses, which are "intentional diversions of waste streams from any portion of a treatment facility" (40 CFR 122.41(m)).

Flows in combined sewers can be classified as dry weather flow or wet weather flow. Wet weather flow is a combination of domestic, commercial, and industrial wastewater, groundwater infiltration, and storm water flow including snowmelt. Dry weather flow is the flow in a combined sewer that results from domestic, commercial, and industrial wastewater and groundwater infiltration with no contribution from storm water runoff or storm water induced infiltration.

CSOs are subject to the non POTW technology-based effluent limitation requirements found at Section 301 (b)(1)(A) of the Clean Water Act, rather than the POTW technology-based requirements found in Section 301(b)(1)(B). (See Montgomery Environmental Coalition vs. Costle, 646F.2d 568 (D.C. Cir 1980)). CSOs are also subject to effluent limitations based on water quality standards pursuant to Section 301(b)(1)(C) of the CWA.

On April 19, 1994 EPA published the National CSO Control Policy (59 FR 18688). The purpose of the Policy was to establish a consistent national approach for controlling discharges from CSOs to the Nation's waters. The Policy reiterates the goals of EPA's 1989 CSO Strategy, which are:

- To ensure that if the CSO discharges occur, they are only as a result of wet weather;
- To bring all wet weather CSO discharge points into compliance with the technology based requirements of the CWA and applicable federal and state water quality standards; and
- To minimize water quality, aquatic biota, and human health impacts from wet weather flows.

To achieve these goals, the CSO Policy recommended that technology-based limitations be developed using best professional judgment (BPJ). The recommended limitations consisted of the following nine minimum controls:

1. Proper operation and regular maintenance programs for the sewer system and the CSOs;
2. Maximize use of the collection system for storage;
3. Review and modification of pretreatment requirements to assure CSO impacts are minimized;
4. Maximization of the flow to the POTW for treatment;
5. Prohibition of CSOs during dry weather;
6. Control of solid and floatable material in CSOs;
7. Pollution prevention;
8. Public notification to ensure that the public receives adequate notification of CSO occurrences and CSO impacts; and
9. Monitoring to effectively characterize CSO impacts and the efficacy of CSO control

The CSO Policy also recommended that each combined sewer system develop and implement a long-term CSO control plan (LTCP) that will ultimately result in compliance with the requirements of the Clean Water Act.

In 2001, Congress added Section 402(q) to the CWA to specifically address CSOs by stating that "Each permit, order, or decree issued pursuant to this Act after the date of enactment of this subsection for a discharge from a municipal combined storm and sanitary sewer shall conform to the Combined Sewer Overflow Control Policy signed by the Administrator on April 11, 1994."

The CSO conditions in the draft permit are consistent with the National CSO Control Policy.

2. Effluent Limits

The draft permit requires that CSOs discharges achieve technology-based limits. EPA has made a BPJ determination, consistent with the CSO Policy, that technology-based limits are the nine minimum controls. The draft permit requires the City to continue implementing the nine minimum controls as documented in its previous submissions, but also requires the City to evaluate and update its documentation within six months of the permit effective date to determine if there are modifications that can be made to its NMC program that will enhance its effectiveness. To ensure that each of the NMCs has an appropriate minimum implementation level, the permit specifies minimum implementation levels for each NMC. These levels must be included, at a minimum, in the permittee's nine minimum control program.

The draft permit also establishes narrative water quality–based limitations for CSOs, requiring that CSO discharges shall not cause or contribute to exceedances of water quality standards. As described in the following sections, the permittee has submitted a CSO interim control plan, and the schedule for implementing that plan will be included in an appropriate enforcement order.

3. Reporting

The draft permit requires the permittee to submit an annual report, by March 1, summarizing its implementation of the nine minimum controls during the previous calendar year. This report shall include:

- A summary of dry weather overflows that occurred during the year, including the location date, estimated duration and estimated flow, and a description of measures taken to stop and eliminate the dry weather overflows.

- A summary of CSO activations that occurred at each CSO during the year, including the date, estimated duration and estimated flow.

• A certification that the previous year's inspections have been conducted and records maintained.

4. Current CSO Status

As described earlier, the City of Fitchburg submitted a CSO facilities plan in June 2006 that recommended a city-wide combined sewer separation project to ultimately eliminate all CSO discharges. The first of five separation projects has been substantially completed and four of the 37 outfalls have been eliminated. Two of these outfalls were in the top ten highest volume overflows, and 40 percent of the total CSO volume has been eliminated. The City is also investigating eliminating two or three additional CSOs with minor separation work or manhole modifications. Based on visual observations, the annual inspection reports indicate that 97 overflows occurred in 2005 and 48 overflows occurred in 2006.

EPA anticipates issuing an enforcement action in the near future that requires implementation of additional CSO separation projects.

VII. SEPARATE SEWER REQUIREMENTS

1. Inflow/Infiltration

There are approximately 240 miles of separate sewer in the collection system., including sewers in the Towns of Lunenburg and Westminster. Many of these lines are very old, and as a result, there is significant infiltration and inflow (I/I) into the separate system. Infiltration is groundwater that enters the collection system though physical defects such as cracked pipes, or deteriorated joints. Inflow is extraneous flow entering the collection system through point sources such as roof leaders, yard and area drains, sump pumps, manhole covers, and cross connections from storm water systems.

Significant I/I in a collection system may displace sanitary flow, reducing the capacity and the efficiency of the treatment works and may cause bypasses of the full treatment process. It greatly increases the potential for sanitary sewer overflows (SSO) in separate systems, and combined sewer overflows in combined systems.

As described earlier, the combined sewer system is being separated, which will significantly reduce flows to the treatment plant during wet weather. However, the facility reports high flows during periods when there is no precipitation, indicating significant extraneous flows not attributable to storm water runoff.

The permit standard conditions for 'Proper Operation and Maintenance' are found at 40 CFR §122.41(e). These conditions require proper operation and maintenance of permitted wastewater systems and related facilities to achieve permit conditions. NPDES permittees also have a 'duty to mitigate' as stated in 40 CFR §122.41 (d). This requires permittees to take all reasonable steps to minimize or prevent any discharge in violation of the permit that has a reasonable likelihood of adversely affecting human health or the environment. These regulations apply to the entire POTW, which is defined at 40 CFR 403.3, and includes "...any devices and systems used in the storage, treatment recycling, and reclamation of municipal sewage or industrial waste of a liquid nature. It also includes sewers, pipes and other conveyances only if they convey wastewater to a POTW treatment plant."

EPA and MassDEP maintain that an I/I removal program is an integral component of ensuring permit compliance under both of these provisions, MassDEP has required that I/I conditions be included in NPDES permits for POTWs as a conditions for receiving State Certification under Section 401 of the Clean Water Act and 40 CFR §124.55(b).

Accordingly, collection system operation and maintenance requirements have been included in the draft permit. The Towns of Lunenburg and Westminster have been made co-permittees to the specific parts of the permit related to operation and maintenance of the collection systems they own and operate. The specific sections of the draft permit are Part I.B, Unauthorized Discharges from the Sewer System and Part I.C, Operation and Maintenance, which include conditions regarding the operation and maintenance of the collection systems owned and operated by the Towns.

2. Combination Manholes

As discussed earlier, combination manholes in the separate system are known to be susceptible to cross contamination between separate sanitary sewers and storm drains, resulting in either overflows of sewage through storm drains or discharge of storm water to the sanitary sewer. Unauthorized discharges from the sanitary sewers are violations of this permit and any discharge of untreated sewage to receiving waters either directly or through storm drains are violations of this permit and/or the City's municipal separate storm sewer system (MS4) permit. Accordingly, the draft permit includes specific inspection, maintenance, and monitoring requirements for the City's combination manholes.

Specifically, within twelve (12) months of the effective date of the permit, the permittee must identify and assess all combination manholes in the Collection System, and shall submit a report providing the location and a description of each manhole (the "Combination Manhole Report") to EPA and MassDEP.

The permit requires that the City submit a plan, within 3 months of the effective date of the permit, for monitoring combination manholes in the system. Tell-tale blocks and chalk lines will be set in 250 manholes and monitored after two significant rainfalls (i.e. $\geq$ 1.0 inches/24 hours) during the first two years of the permit. After each storm, the manholes will be checked to see if the tell-tale washed over and if the manhole surcharged.

For all combination manholes indicating evidence of the transference of sewage to a storm drain or transference of storm water to the sanitary sewer, the manhole will be completely separated or otherwise modified in order to control the transfer of sewage and/or storm water within one year of the monitoring date.

During years three through five of term of the permit, the permittee will continue monitoring all combination manholes, except those that have been completely separated, once per year for storm events that equal or exceed two inches in a 24-hour period with requirements for remediation similar to the first two years of the permit.

VIII. UNAUTHORIZED DISCHARGES and BYPASSES

The draft permit prohibits unauthorized discharges and requires that such discharges be reported to EPA and MassDEP within 24 hours

The draft permit does not authorize bypasses of any portion of the treatment facility. EPA recognizes that such bypasses are currently necessary as an interim measure pending completion of CSO abatement facilities and elimination of excessive infiltration and inflow, and expects to allow such bypasses to the extent necessary as an interim measure in the planned enforcement schedule.

IX. SLUDGE INFORMATION AND REQUIREMENTS

Section 405(d) of the Act requires that EPA develop technical regulations regarding the use and disposal of sewage sludge. These regulations are found at 40 CFR Part 503 and apply to any facility engaged in the

treatment of domestic sewage. The Act further requires that these conditions be implemented through permits. The sludge conditions in the draft permit are intended to implement these regulations.

The Fitchburg East Wastewater Treatment Facility operates a multiple hearth sewage sludge incinerator designed to burn up to 9 tons of wet sludge per hour, or 55 dry tons per day. The incinerator has the following air pollution control devices: a scrubber system with a cooling water spray, impingement section, and caustic spray/venturi section, which removes particulate matter and metals; a wet electrostatic precipitator which removes fine particulates and metals; and a regenerative thermal oxidizer that converts volatile organic compounds to carbon dioxide. The City generates 4300 dry metric tons of sludge each year and receives sludge from approximately 35 facilities throughout Massachusetts, New Hampshire and Vermont. The total amount of sludge incinerated is 11,400 dry metric tons per year.

Subpart E of the Part 503 regulations outlines the standards for the incineration of sewage sludge. The permit contains general requirements, management practices, pollutant limitations, an operational standard, monitoring frequency, record keeping and reporting requirements implementing the provisions of the regulations. The basis of each provision is detailed below.

Pollutant Limitations:

The sludge standards regulate seven metals. The pollutant limits in the permit are based on the requirements in §503.43.

Mercury and beryllium are regulated by the National Emission Standard for Hazardous Air Pollutants (NESHAPs) found in 40 CFR Part 61. The permit requires that the firing of sewage sludge in the facility's incinerators does not cause the violation of the NESHAPs for mercury and beryllium. The limit for beryllium is 10 grams/per 24 hours, and the limit for mercury is 3200 grams/per 24 hours.

The allowable sludge concentrations for arsenic, cadmium, chromium, and nickel are calculated from Equation (5) in §503.43(d):

$$C = \frac{RSC \times 86.400}{DF \times (1 - CE) \times SF} \qquad \text{Eq. (5)}$$

Where:

C = Daily concentration of pollutant in sewage sludge in mg/kg of total solids (dry weight basis)
CE = Control efficiency for the incinerator - based on performance tests
DF = Dispersion factor in micrograms per cubic meter per gram per second
RSC = Risk specific concentration in micrograms per cubic meter
SF = Sewage sludge feed rate in metric tons per day (dry weight basis)

The parameters, with the exception of RSC, are site specific to the Fitchburg East incinerator. The RSC is derived for each pollutant based on a risk assessment.

The RSC is the allowable increase in the average daily ground level ambient air concentration for a pollutant above background levels that result from the firing of sewage sludge in an incinerator. It is equivalent to the amount of a pollutant that a person living near the incinerator can inhale with a probability of 1 in 10,000 that the person will contract cancer as a result of inhaling the pollutant. The RSC was calculated from the equation below, which is found in the *Technical Support Document for Sewage Sludge Incineration* (EPA 822/R-93-003, November 1992):

$$RSC = \frac{RL \times BW}{} \times 10^3$$

$$Q^* \times I_a$$

Where:

RL = Risk Level, 10^{-4}
BW = Body weight, 70 kg (154 lbs), this is the average weight of an adult male
Q^* = Allowable dose of a pollutant from EPA's Integrated Risk Information System database
I_a = Inhalation rate, 20 m/day, normal inhalation rate for an adult male.

The RSC calculated from this equation is intended to protect the "Highly Exposed Individual" (HEI). The HEI is a person who remains for an extended period of time, 70 years, at the point of maximum ground level pollutant concentration. The RSC values for the regulated metals are found in Tables 1 and 2 of § 503.43.

The pollutant limit for lead is calculated using equation (4) of §503.43:

$$C = \frac{0.1 \times NAAQS \times 86{,}400}{DF \times (1 - CE) \times SF} \qquad \text{Eq. (4)}$$

Instead of using an RSC, a percentage of the National Ambient Air Quality Standard (NAAQS) for lead was used. The NAAQS for lead is found in 40 CFR Part 50.12. It is 1.5 ug/l. Although lead is classified as a probable human carcinogen, the Clean Air Science Advisor Committee of the Science Advisory Board recommended that the NAAQS for lead be based on the non-carcinogenic effects. Developmental neurotoxicity is considered to be the most sensitive end point for lead exposure. The calculated concentration from equation (4) also protects the HEI described above.

The following are parameters used to calculate metals limits contained in the permit:

Sludge Feed Rate: 2.295 dry tons/hour = 55 dry tons/day = 49.88 metric tons/day
Dispersion factor: 2.7 ug/m^3/g/sec

Pollutant	Control Efficiency, %	RSC, ug/m^3
Arsenic	91.27	0.023
Cadmium	69.30	0.057
Chromium	99.90	0.16
Lead	97.97	
Nickel	99.94	2.0

Equation (5) limits:

$$As = \frac{0.023\ g/m^3 \times 86{,}400}{2.7\ ug/m^3/g/sec \times (1 - 0.9127) \times 49.88\ dmt/day} = 169 \text{ mg/kg}$$

$$Cd = \frac{0.057\ g/m^3 \times 86{,}400}{2.7\ ug/m^3/g/sec \times (1 - 0.6930) \times 49.88\ dmt/day} = 119 \text{ mg/kg}$$

$$Cr = \frac{0.016\ g/m^3 \times 86{,}400}{2.7\ ug/m^3/g/sec \times (1 - 0.9990) \times 49.88\ dmt/day} = 10240 \text{ mg/kg}$$

$$Ni = \frac{2.0\ g/m^3 \times 86{,}400}{} = 2.14 \times 10^6 \text{ mg/kg}$$

$2.7\ ug/m^3/g/sec \times (1 - 0.9994) \times 49.88\ dmt/day$

Equation (4) limit:

$$Pb = \frac{0.1 \times 1.5\ ug/m^3 \times 86{,}400}{2.7\ ug/m^3/g/sec \times (1 - 0.9797) \times 49.88\ dmt/day} = 4747 \text{ mg/kg}$$

Operational Standard:

The Part 503 regulations have an operational standard for total hydrocarbons (THC). Hydrocarbons are simple organic compounds containing carbon and hydrogen. The standard is designed to regulate organic emissions from sewage sludge incinerators. Total hydrocarbons represent a subset of organic compounds and are used in the regulation since it is impractical to attempt to monitor sludge or stack emissions for all organic compounds that may be present.

The THC value must be corrected to seven percent oxygen and zero percent moisture. The correction to seven percent oxygen is used because seven percent is the standard amount of oxygen used to reference measurements of pollutant limits expressed as concentration; it is also equivalent to 50 percent excess air (excess air is air added to a system above the amount of air needed for complete combustion to occur); and without the correction, inaccurate readings may occur because the presence of the additional oxygen may dilute the THC reading. Similarly, the correction for moisture is needed since the presence of moisture can also dilute the actual THC reading. THC is conventionally expressed in terms of a dry volumetric basis, hence the need to set the standard based on zero moisture.

On February 25, 1994, §503.40 was amended. The amendment allows facilities to monitor carbon monoxide (CO) instead of THC. A facility can monitor for CO if the facility can meet a monthly average concentration CO limit of 100 parts per million on a volumetric basis. This limit, like the THC limit, is corrected to seven percent oxygen and zero percent moisture. The Fitchburg East WWTF monitors CO.

Management Practices:

The permit contains management practices based on §503.45. They pertain to the operation of the incinerator. The management practices include maintaining the instruments that monitor CO, oxygen and temperature; proper operation of all air pollution control devices; and notification to EPA when the continuous monitoring equipment is not operational for a period of 72 hours or more.

The permit requires notification to EPA and the state if any monitoring equipment is broken or shut down for longer than 72 hours. It also prohibits adversely affecting a threatened or endangered species or their critical habitat. There are no known threatened or endangered species within the vicinity of the incinerator. Therefore, EPA has determined that the activity will not affect a threatened or endangered species.

The monitoring frequency for heavy metals is based on Table 1 in §503.46, which requires monitoring based on the volume of sludge incinerated. Fitchburg East fires 11,400 dry metric tons per year, therefore the monitoring requirement for arsenic, cadmium, chromium, lead, and nickel is reduced to once per 60 days (6 times per year). The monitoring for mercury and beryllium is at the frequency required by 40 CFR Part 61. The record keeping requirements are based on §503.47.

X. PRETREATMENT

The facility accepts industrial wastewater from four categorical SIUs and three non-categorical SIUs.

The permittee is required to administer a pretreatment program based on the authority granted under 40 CFR Section 122.44 (j), 40 CFR Section 403 and Section 307 of the Act. Fitchburg East WWTF's pretreatment program received EPA approval on September 23, 1983 and, as a result, appropriate pretreatment program requirements were incorporated into the current permit that were consistent with that approval and federal pretreatment regulations in effect when the permit was issued.

In the reissued permit, activities that the permittee must address if applicable include, but are not limited to, the following: (1) implement and enforce specific effluent limits (technically-based local limits); (2) revise the local sewer-user ordinance or regulation to be consistent with federal regulations; (3) develop an enforcement response plan; (4) implement a slug control evaluation program; (5) track significant noncompliance for industrial users; and (6) establish a definition of and track significant industrial users. These requirements are necessary to ensure continued compliance with the POTW's NPDES permit and its sludge use or disposal practices.

The permittee must continue to submit, annually by March 1st, a pretreatment report detailing the activities of the program for the twelve month period ending December 31.

XI. ANTI-BACKSLIDING

Anti-backsliding, as described in Section 402 (o) of the Clean Water Act and 40 CFR §122.44(l)(1), requires reissued permits to contain limitations as stringent as or more stringent than those of the previous permit unless the circumstances allow application of one of the defined exceptions.

XII. ANTIDEGRADATION

The Massachusetts Antidegradation Policy is found at Title 314 CMR 4.04. All existing uses of the North Nashua River must be protected. This draft permit is being reissued with allowable discharge limits as or more stringent than the current permit with the same parameter coverage. There is no change in outfall location. The public is invited to participate in the antidegradation finding through the permit public notice procedure.

XIII. ESSENTIAL FISH HABITAT

Under the 1996 Amendments (PL 104-267) to the Magnuson-Stevens Fishery Conservation and Management Act (16 USC § 1801 et seq. (1998)), EPA is required to consult with the National Marine Fisheries Service (NMFS) if EPA's action or proposed actions that it funds, permits, or undertakes, "may adversely impact any essential fish habitat," 16 USC § 1855(b). The Amendments broadly define "essential fish habitat" (EFH) as: "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity," 16 USC § 1802(10). "Adverse impact" means any impact that reduces the quality and/or quantity of EFH, 50 CFR § 600.910(a). Adverse effects may include direct (e.g., contamination or physical disruption), indirect (e.g., loss of prey, reduction in species' fecundity), site specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions. Id.

Essential fish habitat is only designated for fish species for which federal Fisheries Management Plans exist. 16 U.S.C. § 1855(b)(1)(A). EFH designations for New England were approved by the U.S. Department of Commerce on March 3, 1999.

Only **Atlantic Salmon** is believed to be present during one or more life stage within the EFH Area, which encompasses the **existing discharge site**. No "habitat area of particular concern" as defined under §600.815(a)(9) of the Magnuson-Stevens Act, has been designated for this site. Although EFH has been

designated for this general location, EPA has concluded that this activity is not likely to affect EFH or its associated species for the following reasons:

- This is a reissuance of an existing permit with the same or stricter effluent limits;
- Limits specifically protective of aquatic organisms have been established for phosphorus, chlorine and metals based on Massachusetts water quality criteria;
- Acute and chronic toxicity testing on *Ceriodaphnia dubia* and *Pimephales promelas* is required four (4) times per year.
- The permit prohibits any violation of state water quality standards.

Accordingly, EPA has determined that a formal consultation with NMFS is not required.

XIV. MONITORING AND REPORTING

The permittee is obliged to monitor and report sampling results to EPA and the MassDEP within the time specified in the permit. The effluent monitoring requirements have been established to yield data representative of the discharge by the authority under Section 308(a) of the CWA in accordance with 40 CFR 122.(i), 122.44(j), and 122.48.

The remaining general conditions of the permit are based primarily on the NPDES regulations 40 CFR 122 through 125 and consist primarily of management requirements common to all permits.

XV. STATE PERMIT CONDITIONS

The NPDES Permit is issued jointly by the U. S. Environmental Protection Agency and the Massachusetts Department of Environmental Protection under federal and state law, respectively. As such, all the terms and conditions of the permit are, therefore, incorporated into and constitute a discharge permit issued by the MassDEP Commissioner.

XVI. GENERAL CONDITIONS

The general conditions of the permit are based on 40 CFR Parts 122, Subparts A and D and 40 CFR 124, Subparts A, D, E, and F and are consistent with management requirements common to other permits.

XVII. STATE CERTIFICATION REQUIREMENTS

The staff of the Massachusetts Department of Environmental Protection ("MassDEP") has reviewed the draft permit. EPA has requested permit certification by the State pursuant to CWA § 401(a)(1) and 40 CFR § 124.53 and expects that the draft permit will be certified.

XVIII. PUBLIC COMMENT PERIOD AND PROCEDURES FOR FINAL DECISION

All persons, including applicants, who believe any condition of the draft permit is inappropriate must raise all issues and submit all available arguments and all supporting material for their arguments in full by the close of the public comment period, to the U.S. EPA, Office of Ecosystem Protection, Municipal Permits Branch -CMP, One Congress Street, Suite-1100, Boston, Massachusetts 02114. Any person, prior to such date, may submit a request in writing for a public hearing to consider the draft permit to EPA and the State Agency. Such requests shall state the nature of the issues proposed to be raised in the hearing. Public hearings may be held after at least thirty days public notice whenever the Regional Administrator finds that response to this notice indicates a significant public interest. In reaching a final decision on the draft

permit, the Regional Administrator will respond to all significant comments and make these responses available to the public at EPA's Boston office.

Following the close of the comment period and after a public hearing, if such a hearing is held, the Regional Administrator will issue a final permit decision and forward a copy of the final decision to the applicant and each person who has submitted written comments or requested notice.

XIX. EPA AND MASSDEP CONTACTS

Additional information concerning the draft permit may be obtained between the hours of 9:00 a.m. and 5:00 p.m., Monday through Friday, excluding holidays from:

David Pincumbe
Office of Ecosystem Protection
U.S. Environmental Protection Agency
One Congress Street, Suite-1100 (CMP)
Boston, MA 02114-2023
Telephone: (617) 918-1695
Pincumbe.David@epa.gov

Kathleen Keohane
Massachusetts Department of Environmental Protection
627 Main Street, 2nd Floor
Worcester, MA 01608
Telephone: (508)-767-2856 FAX: (508) 791-4131
Email: Kathleen.Keohane@state.ma.us

_____
Date

Stephen Perkins, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency

Attachments:
Figure 1: Fitchburg East WWTP and USGS Gage
Figure 2: Plant Flow Diagram
Tables 1 & 2: Effluent Data January 2005 to December 2006
Table 3: Statistical Analysis of Existing Copper discharge

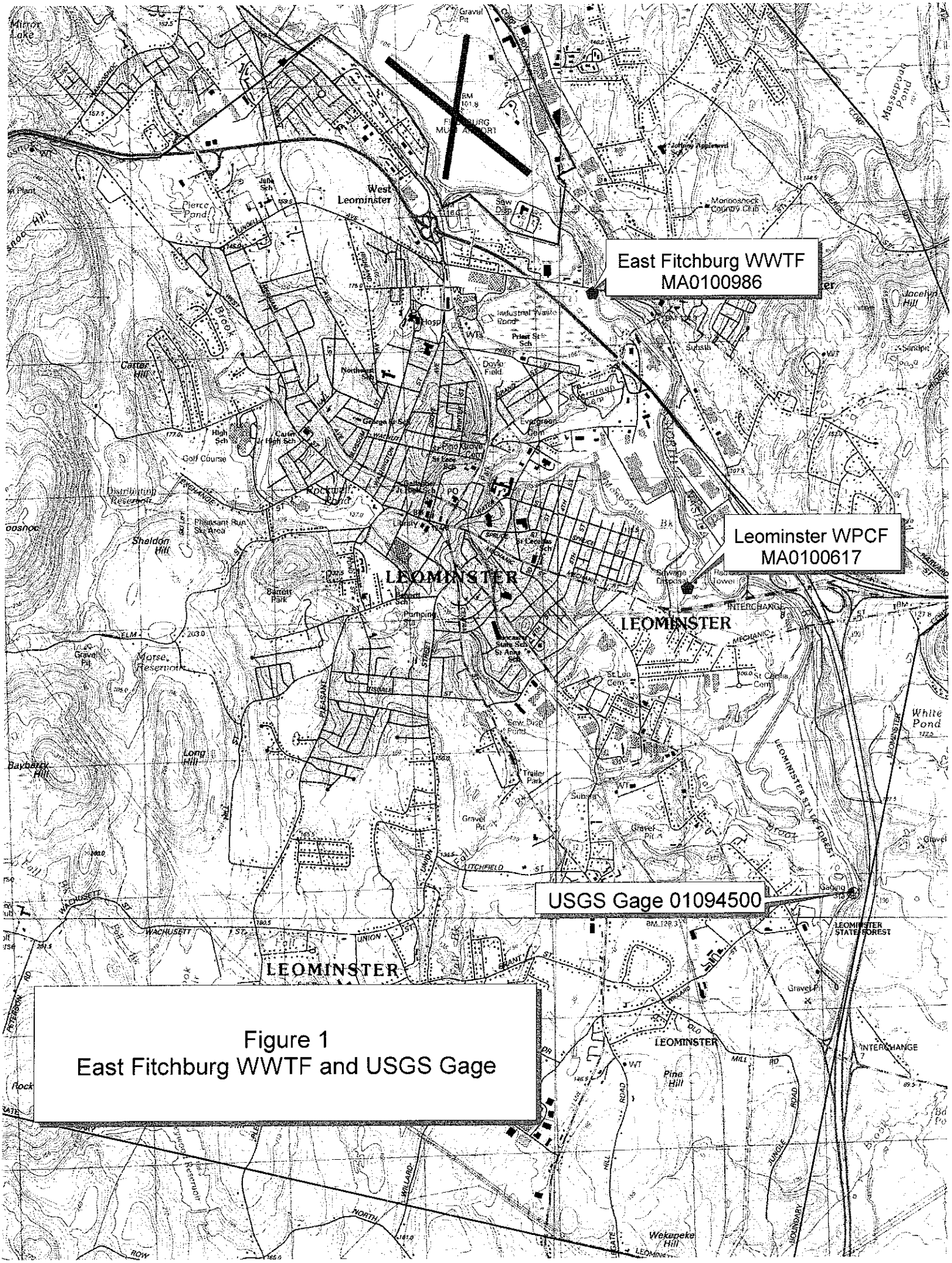

Figure 1
East Fitchburg WWTF and USGS Gage

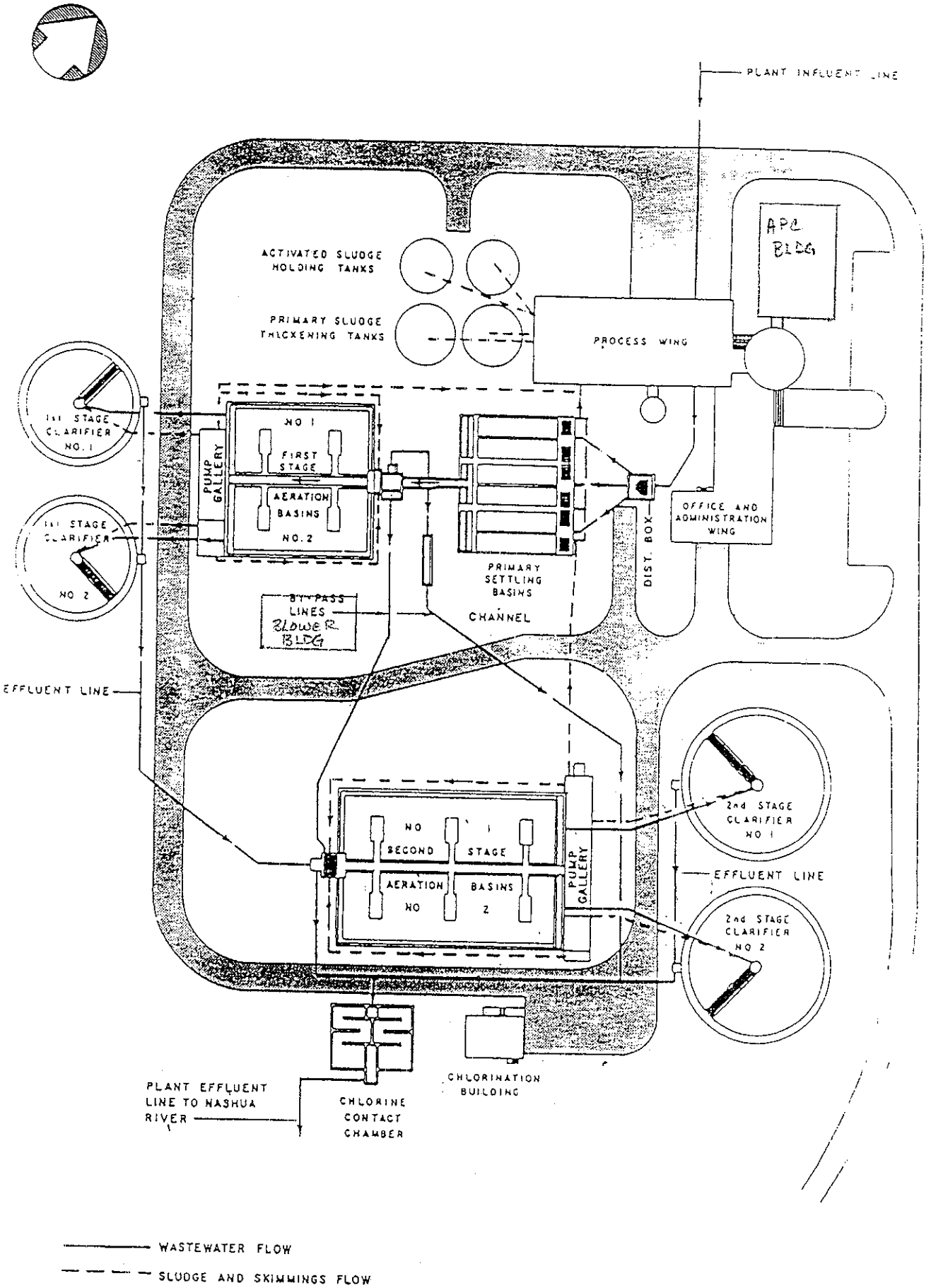

FIG. 2 PLANT FLOW DIAGRAM

Table 1
Effluent Data - January 2005 to December 2006
Fitchburg East WWTF - MA 0100986

Date	Rolling Annual Ave. Flow, MGD	Daily Max. Flow, MGD	BOD, ave. mo., mg/l	BOD, max. daily, mg/l	TSS, ave. mo., mg/l	TSS, max daily, mg/l	TRC, max. daily, mg/l	Fecal Coliform, ave. mo., cfu/100 ml	Fecal Coliform, max daily, cfu/100 ml	pH, S.U. min	pH, S.U. max
1/05	8.28	18.53	20.8	72.0	34.1	158	0.03	23	40,000	6.8	7.5
2/05	8.49	14.67	19.8	96	25.8	87	0.01	12	12,000	6.6	7.3
3/05	8.66	33.3	16.4	39	21.3	108	0.22	54	97,000	7.0	7.4
4/05	8.55	31.4	16.8	42	23.4	63	0.22	19	1,600	6.9	7.5
5/05	8.7	20.7	20.0	50	33.1	107	0.60	7.9	11,700	6.7	7.5
6/05	8.76	11.67	19.2	86	29.8	152	0.02	7.7	500	6.6	7.3
7/05	8.8	14.1	14.7	118	19.9	66	0.02	11	48	6.5	8.0
8/05	9.0	14.3	5.1	38	10.5	52	0.02	32	78,000	6.4	8.1
9/05	8.8	7.9	5.5	28	8.7	28	0.02	29	7,400	6.5	8.0
10/05	9.4	30.5	13.8	45	16.4	40	0.02	1,076	33,000	6.5	7.2
11/05	9.6	18.0	11.5	37	15.4	42	0.03	123	89,000	6.5	7.3
12/05	9.6	24.4	18.6	103	32.3	180	0.04	187	4,800	6.7	7.2
1/06	9.9	22.1	19.4	98	29.3	166	0.4	35	4,000	6.6	7.3
2/06	10.1	24.3	9.6	23.7	14.5	37	0.1	4	25	6.9	7.8
3/06	9.8	8.5	6.5	26	12.1	45	0.02	46	830	6.5	7.2
4\06	9.2	12.5	6	30	9.5	31	0.06	22	2400	6.7	7.2
5/06	9.4	30.4	19.2	65	25.5	92	0.06	14	470	6.7	8.1
6/06	9.8	29.3	17.5	39	25.7	66	0.08	475	20,600	6.6	8.0
7/06	9.85	12.57	6.8	24.7	12.1	51	0.02	10	193	6.5	7.1
8/06	9.8	11	6.3	21	13.6	46	0.06	110	1090	6.6	7.3
9/06	9.84	12.2	4.1	9.6	9.2	30	0.03	48	144	6.7	8.0
10/06	9.3	17.9	8.2	56	13.5	73	0.03	176	10,700	6.6	7.6
11/06	9.6	26.8	19.1	87	35.2	285	0.46	56	670	6.7	7.6
12/06	9.4	10.4	20.9	91	43.6	292	1.5	20	50	6.8	7.6

Table 2
Effluent Data - January 2005 to December 2006
Fitchburg East WWTF - MA 0100986

Date	Phosphorus, ave. mo., mg/l	Copper, ave. mo., ug/l	Aluminum, ave. mo., mg/l	Lead, ave. mo, mg/l	Dissolved Oxygen, mg/l	Ammonia, ave. mo., mg/l	Ammonia, max. daily, mg/l	Ceriadaphnia WET		Pimephales WET	
								Acute	Chronic	Acute	Chronic
1/05	1.86	16.2	<100	--- [1]	---	---	---	---	---	---	---
2/05	0.91	10.8	<100	---	---	---	---	---	---	---	---
3/05	1.07	<10	<100	<5.0	---	---	---	>100	25	>100	50
4/05	1.68	<10	<100	---	---	---	---	---	---	---	---
5/05	0.9	<10	<100	---	6.6	5.1	7.8	---	---	---	---
6/05	0.91	13	<100	5.0	6.0	2.57	5.95	>100	100	>100	100
7/05	0.84	59	140	---	5.4	0.74	2.02	---	---	---	---
8/05	0.67	15	<100	---	6.0	0.79	1.46	---	---	---	---
9/05	0.75	21	<100	16	5.8	0.74	1.96	>100	100	>100	100
10/05	0.53	19	<100	---	6.1	2.3	5.0	---	---	---	---
11/05	0.35	<10	<100	---	---	---	---	---	---	---	---
12/05	0.68	14	<100	24		---	---	>100	100	>100	6.25
1/06	0.81	11	120	---	---	---	---	---	---	---	---
2/06	0.49	8.32	<100	---	---	---	---	---	---	---	---
3/06	0.99	27.0	170	<5.0	---	---	---	>100	46	>100	100
4/06	1.37	25.0	<100	---	---	---	---	---	---	---	---
5/06	0.97	<10	<100	---	6.0	1.6	3.8	---	---	---	---
6/06	0.50	<10	<100	5.0	5.5	2.2	4.1	63.2	46	>100	25
7/06	0.49	<10	<100	---	6.0	0.57	0.6	---	---	---	---
8/06	0.48	23.0	<100	---	5.7	0.56	0.56	---	---	---	---
9/06	0.62	16.9	<100	5.0	5.9	0.56	0.56	>100	100	>100	100
10/06	0.51	11.0	<100	---	6.0	0.9	2.2	---	---	---	---
11/06	0.73	11.0	<100		---	---	---	---	---	---	---
12/06	0.68	<10	<100		---	---	---	---	---	---	---

Notes:
[1] — - no sampling required

Table 3

Cu - East Fitchburg (Lognormal distribution, ND)

Daily Maximum Limit Derivation (some measurements < detection limit)

Detection Limit** =		10.0
u_y = Avg of Nat. Log of daily Discharge (mg/L) =		2.78650
$\Sigma (y_i - u)^2$ =		3.34798
k = number of daily samples =		24
r = number of non-detects =		8
σ_y^2 = estimated variance = $(\Sigma[(y_i - u_y)^2]) / (k-r-1)$ =		0.22320
σ_y = standard deviation = square root σ_y^2 =		0.47244
δ = number of nondetect values/number of samples =		0.33333
z=z-score[(0.99-δ)/(1-δ)] =	z-score of	0.98500
	=	2.170091

(from z-score calculator at http://www.fourmilab.ch/rpkp/experiments/analysis/zCalc.html)

Daily Max Limit = exp (u_y + z-score*σ_y)

Daily Max Limit = 45.23 ug/l

(Log normal distribution, 99th percentile)

Average Monthly Limit Derivation (some measurements < detection limit)

Number of samples per month***, n =	1.00
E(x) = Daily Avg = $\delta D + (1-\delta) \exp(u_y + 0.5 \sigma_y^2)$ =	15.42641
V(x) = Daily Variance = $(1-\delta)\exp(2u_y + \sigma_y^2)[\exp(\sigma_y^2)-(1-\delta)] + \delta(1-\delta)D[D-2\exp(u_y + 0.5\sigma_y^2)]$ =	69.57899
A = $V(x)/[n(E(x)-\delta^n D)^2]$ =	16.12378552
B = $-[\delta^n D^2(1-\delta^n)]/(E(x)-\delta^n D)^2$ =	-0.151954555
C = $(2\delta^n D)/(E(x)-\delta^n D)$	0.55127952
σ_n^2 = Monthly Average variance = $\ln\{(1-\delta^n)[1+A+B+C]\}$	2.45806
σ_n = Monthly Average standard deviation = σ_n^2^(0.5) =	1.56782
u_n = n-day monthly average = $\ln[(E(x)-\delta^n D)/(1-\delta^n)] - 0.5\sigma_n^2$ =	1.66907
z=z-score[(0.99-δ)/(1-δ)]	0.92500
z-score =	1.439531

Monthly Average Limit = exp (u_n + z-score*σ_n)

Monthly Avg Limit = 50.70 ug/l

(Log normal distribution, 95th percentile of average monthly values)

**Assumed detection limit = 10.0, which was the detection limit for the majority of the tests which returned ND.

*** Assumed number of samples per month = 1 since this was the minimum sample number per month.