UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION I
1 CONGRESS STREET - SUITE 1100
BOSTON, MASSACHUSETTS 02114

FACT SHEET

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

NPDES PERMIT NO.: **MA0101711**

NAME AND ADDRESS OF APPLICANT:

Billerica Wastewater Treatment Plant
365 Boston Road
Billerica, Massachusetts 01821

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Billerica Wastewater Treatment Plant
70 Letchworth Avenue
Billerica, Massachusetts 01862

RECEIVING WATER: **Concord River** (Concord Basin)
USGS Hydrologic code: 01070005

PUBLIC NOTICE DATE**:**

CLASSIFICATION: **Class B - Warm Water**

I. PROPOSED ACTION

The above named applicant has applied to the U.S. Environmental Protection Agency ("EPA") for the reissuance of its National Pollutant Discharge Elimination System (NPDES) permit to discharge into the designated receiving water. The current permit was signed on November 2, 2001 and became effective sixty days later. The permit expired on January 1, 2004, and was administratively extended given the applicant filed an application for permit reissuance (received on December 1, 2003). This draft permit, after it becomes effective, will expire five (5) years from the effective date of issuance.

II. TYPE OF FACILITY AND DISCHARGE LOCATION

The Town of Billerica's Wastewater Treatment Plant (WWTP) is a 5.4 million gallon per day (MGD) secondary wastewater treatment facility with chlorine disinfection. It discharges to the Concord River via outfall 001, which is located at a depth of 6 feet below water surface. The collection system is separate and serves a population of approximately 22,000. Domestic and industrial wastewater are treated at this facility. Sludge produced at this facility is composted and used for land application.

The facility's discharge outfall is listed below:

Outfall	Description of Discharge	Outfall Location
001	Treated Effluent	Concord River

III. DESCRIPTION OF DISCHARGE

Table One of this fact sheet provides a quantitative description of the wastewater treatment plant discharge in terms of significant effluent parameters. Data presented in Table One is based on discharge monitoring reports (DMRs) from January 2002 through December 2003.

IV. LIMITATIONS AND CONDITIONS

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

V. PERMIT BASIS AND EXPLANATION OF EFFLUENT LIMITATION DERIVATION

A. PROCESS DESCRIPTION

The WWTP is located in Billerica, Massachusetts, serving a population of about 22,000. Based on the permit application (Fay, Spofford, Thorndike 2003), there are currently 18 industrial users contributing wastewater to this facility. See Figure 1 for the facility location.

Preliminary treatment consists of removing large solids from the influent flow. Equipment used for this purpose includes bar screens and gravity grit chambers with drag bucket/elevators and a dewatering screw. After large solids are removed, the flow rate of the facility influent is measured at the Parshall flumes (Fay, Spofford, Thorndike 2003).

Primary treatment consists of 3 primary settling tanks (PSTs), where heavier solids can settle from the wastewater. Floating material (scum) is also removed from the PSTs by skimming. The clarified and skimmed wastewater exits the PSTs and enters aeration tanks. Primary effluent and activated sludge are mixed together (called a mixed liquor) and aerated within the aeration tanks. The mixed liquor exits the aeration tanks and flows to the final settling tanks (FSTs), where the activated sludge and floating scum are separated from the treated wastewater. Clarified wastewater (secondary effluent) from the FSTs flows to the chlorine contact chamber. Within the chlorine contact chamber, the secondary effluent is injected with sodium hypochlorite for disinfection. Dosing with sodium

hypochlorite is based on flow rate and residual chlorine readings. A residual chlorine analyzer continuously samples the treated wastewater at a location approximately five minutes downstream of the sodium hypochlorite addition. Secondary effluent then flows from the chlorine contact chamber into the post aeration facility, where it is distributed through post aeration tanks (Fay, Spofford, Thorndike 2003).

Removal of residual chlorine from the disinfected wastewater is accomplished by the addition of sodium bisulfate. Sodium bisulfate is added to the effluent channels of the post aeration tanks via chemical metering pumps, prior to the three-step post aeration cascade. Sodium bisulfate additions are similarly based on flow rate and residual chlorine readings. Effluent from the channel flows down the post-aeration cascade where it then enters the outfall sewer, and ultimately discharges into the Concord River (Fay, Spofford, Thorndike 2003).

B. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Overview of Federal and State Regulations

Under Section 301(b)(1) 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 C.F.R. 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 C.F.R. § 122.44 (d), permittees must achieve water quality standards established under Section 303 of the CWA, including state narrative criteria for water quality. Additionally, under 40 C.F.R. § 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 Uses; Outfall 001

The Concord River, at the point of this facility's 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 20° Celsius during the summer months and are not capable of supporting a year-round population of cold water stenothermal aquatic life.

Eutrophic conditions persist in the Concord River and have resulted in its listing on the *Massachusetts Year 2002 Integrated List of Waters* (MADEP 2002), formerly referred to as the 303(d) list. 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 Concord River appears in Category 5 of the integrated list for waters requiring a TMDL. Water quality impairments in the Concord River are attributed to nutrients, metals and pathogens. Due to nutrient loading, the majority of the water quality concerns associated with the Concord River are directly related to eutrophication (USACOE, MADEP, ENSR 2003). As discussed below (pages 7 - 10), the majority of phosphorus entering this river basin (which includes the Sudbury and Assabet Rivers) during the critical summer period is from Publicly Owned Treatment Works (POTW) discharges.

3. <u>7Q10 Flow</u>

The 7Q10 is the lowest observed mean river flow for 7 consecutive days recorded over a 10-year recurrence interval. For rivers and streams, Title 314 CMR 4.03(3)(a) requires that 7Q10 be used to represent the critical hydrologic condition at which water quality criteria must be met.

The current permit estimated a 7Q10 flow of 17.1 MGD. Given that withdrawals from, and discharges to the Concord River have not changed since this permit was written, the 7Q10 value from the previous Fact Sheet is maintained. **Attachment A** includes calculations supporting the7Q10 flow value for the Concord River in the vicinity of this discharge. This 7Q10 flow analysis was based on recent 30 year records of the Maynard and Lowell USGS flow gages, and estimated drainage areas in the basin.

Available Dilution

Water quality based limitations are established with the use of a calculated available dilution. The facility design flow is 5.4 million gallons per day (MGD) or 8.353 cubic feet per second (cfs). The 7Q10 flow at the point of discharge is17.1 MGD (26.45 cfs), as noted in the previous permit. Based on this information, the dilution factor is 4.1;

$$\frac{\text{River flow (7Q10)} + \text{Plant Design Flow}}{\text{Plant Design Flow}} = \text{Dilution Factor}$$

$$\frac{17.1\ \text{MGD} + 5.4\ \text{MGD}}{5.4\ \text{MGD}} = 4.1$$

Plant Flow - The flow limit is based on the annual average design flow of the treatment plant, which is 5.4 MGD. Flow is measured continuously. The permittee shall report the annual average monthly flow using the annual rolling average method (see Permit Footnote 1) and the maximum daily flow for the month.

OUTFALL 001 - CONVENTIONAL POLLUTANTS

Under Section 301(b)(1)(B) of the CWA, 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. Effluent limitations for monthly and weekly average Biochemical Oxygen Demand (BOD_5) and Total Suspended Solids (TSS) are based on requirements under Section 301(b)(1)(B) of the CWA and 40 CFR 133.102. The limits for *Fecal coliform* bacteria as well as the range in pH are based upon State Certification requirements for Publicly Owned Treatment Works (POTW) under Section 401(d) of the CWA, 40 CFR 124.53 and 124.55, and water quality considerations.

Outfall 001 discharged an average of 3.18 MGD to the Concord River during the period of January 2002 through December 2003. There have been no exceedances of the 5.4 MGD flow limit during this two year period. This flow limit is expressed as an annual average instead of a monthly average limit because the design flow was stated as an annual average (see Permit Footnote 1).

As stated in the previous Fact Sheet, the Town requested that the flow limit in its permit be increased to reflect the planned tie-in of wastewater from the Billerica House of Correction (BHOC). The BHOC, a State entity, currently owns and operates a wastewater treatment plant with an NPDES permitted discharge of 0.15 MGD to the Concord River. Following the tie-in of the BHOC, the Town has tentative plans to take over the BHOC treatment plant,

rehabilitate and expand the facility, and resume treating flow from the BHOC and a planned industrial park at the BHOC treatment plant. In the event this plan is executed, it is likely that more stringent limits (in particular phosphorus) will be necessary because existing water quality data, collected under current loadings, indicate that the Concord River is already impaired and has very limited assimilative capacity for nutrients. In addition, any net increase in flow above the permitted levels may not be approved (see below).

Any requested increase of flow to the Concord River must be closely reviewed to ensure that water quality standards and antidegradation requirements are met. Since the plans for the future purchase and rehabilitation of the BHOC are not finalized and it is, therefore, not known if the tie-in of the BHOC to the Billerica WWTP will be permanent, we are reissuing the draft permit with the current flow limit of 5.4 MGD, but with the limit expressed as an annual average. Even with the addition of the BHOC flow, the facility will be able to achieve this limitation. We will consider a permit modification request to increase the flow limit when the Town's plans regarding the BHOC treatment plant are more developed and finalized.

The BOD_5 and TSS draft limits are based on secondary treatment requirements. There have been no violations for BOD_5 or TSS during the period of January 2002 through December 2003, with the monthly averages11.2 mg/l and 15 mg/l, respectively. The BOD_5 and TSS removal percentages have both averaged 93% with no violations during this same time period (See Table One for details).

<u>BOD_5 and TSS Mass Loading Calculations:</u>

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

L = C x DF x 8.34 where:

L = Maximum allowable load in lbs/day.
C = Maximum allowable effluent concentration for reporting period in mg/l.
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.

<u>BOD_5 Average Monthly and Average Weekly Limits</u>

[30](Concentration limit) X 5.4 (design flow) X 8.345 (Conversion Factor) = 1351 lbs/day

[45] (Concentration limit) X 5.4 (design flow) X 8.345 (Conversion Factor)= 2027 lbs/day

TSS Average MontHly and Average Weekly Limits

[30] (Concentration limit) X 5.4 (design flow) X 8.345 (Conversion Factor)= 1351 lbs/day

[45] (Concentration limit) X 5.4 (design flow) X 8.345 (Conversion Factor) = 2027 lbs/day

The settleable solids monitoring requirement was removed from the previous permit because it is no longer a State certification requirement.

Eighty-Five Percent BOD_5 and TSS Removal Requirement - the provisions of 40 CFR §133.102(3) requires that the 30 day average percent removal for BOD 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, and are at least as stringent as pH limitations set forth at 40 C.F.R. §133.102(c). Class B waters shall be in a range of 6.5 through 8.3 standard units and not more than 0.5 standard units outside of the normally occurring range [314 CMR 4.0 (4)(a)3]. There shall be no change from background conditions that would impair any use assigned to this class. The monitoring frequency is once (1) per day.

Fecal Coliform Bacteria - The draft permit includes fecal coliform bacteria limitations which are in accordance with the Massachusetts Surface Water Quality Standards 314 CMR 4.05 (4)(b). The proposed limits in the draft permit are a geometric mean of no more than 200 colony forming units (cfu)/100 ml for the average monthly limit and shall not exceed a daily maximum of 400 colony forming units (cfu)/100 ml for the maximum daily limit. These limits are consistent with Class B surface water quality requirements of the MA DEP. Monitoring will occur on a year-round basis given the downstream drinking water intakes on the Merrimack River and is maintained as three (3) samples per week.

OUTFALL 001 NON-CONVENTIONAL POLLUTANTS

Nutrients

EPA has produced several guidance documents which 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 the lake or reservoir.

In December 2000, EPA released "Ecoregional Nutrient Criteria," (USEPA 2000) established as part of an effort to reduce problems associated with excess nutrients in water bodies located within specific areas of the country. The published criteria represent

conditions in waters within each specific ecoregion which are minimally impacted by human activities, and thus are representative of waters without cultural eutrophication. Billerica is within Ecoregion XIV, Eastern Coastal Plains (level III ecoregion 59). The recommended total phosphorus criteria for Ecoregion XIV is 24 ug/l (0.024 mg/l) and can be found in the *Ambient Water Quality Criteria Recommmendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Ecoregion XIV*, (see reference list for complete publication details).

More recently, Mitchell, Liebman, Ramseyer, and Card (in draft 2004), in conjunction with the New England States, developed potential nutrient criteria for rivers and streams in New England. Using several river examples representative of typical conditions for New England streams and rivers, they investigated several approaches for the development of river and stream nutrient criteria that would be dually protective of designated uses in both upstream reaches and downstream impoundments. Based on this investigation an instream total phosphorus concentration of 0.020 - 0.022 mg/l was identified as protective of designated uses for New England rivers and streams. The development of this New England-wide total phosphorus concentration was based on more recent data than the National Ecoregional nutrient criteria, and have been subject to quality assurance measures. Additionally, the development of the New England-wide concentration included reference conditions for waters presumed to be protective of designated uses.

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 Water Quality Standards also require that "any existing point source discharges containing nutrients in concentrations which encourage eutrophication or the growth of weeds or algae shall be provided with the highest and best practicable treatment (HBPT) to remove such nutrients (314 CMR 4.04). MADEP has established that a monthly average total phosphorus limit of 0.2 mg/l represents highest and best practical treatment for POTWs.

Eutrophication and the Concord River: Past and Present

It is well documented that reaches along the Concord River suffer from eutrophication, a condition primarily caused by excessive nutrients entering and accumulating in the river (Goldman Environmental Consultants 1994, MADEP 1990, USACOE, MADEP, ENSR 2003). Phosphorus and other nutrients (i.e., nitrogen) promote the growth of nuisance algae and rooted aquatic plants. Typically, elevated levels of nutrients will cause excessive algal and/or plant growth resulting in reduced water clarity and poor aesthetic quality. Also, through respiration, and the decomposition of dead plant matter, excessive algae and plant growth can reduce in-stream dissolved oxygen concentrations to levels that could negatively impact aquatic life and/or produce strong unpleasant odors.

Historically, there is strong evidence that eutrophic conditions have been present in the Concord River. Based on ten studies from 1965 through 1990, typical total phosphorus concentrations measured in the Concord River ranged between 0.21 mg/l and 0.5 mg/l (USACOE, MADEP, ENSR 2003). These results indicate that nutrient concentrations in the Concord River have been sufficient to promote eutrophication; especially, considering that phosphorus concentrations were consistently greater than the suggested criteria in the Gold Book (0.05 mg/l) and National Ecoregion XIV guidance (0.024 mg/l), and the concentrations presented in the New England-wide document (0.020 - 0.022 mg/l).

Recent field surveys conducted between June 2001 to September 2002 measured total phosphorus concentrations along the mainstem of the Concord River ranging between <0.01mg/l and 0.25 mg/l with an average concentration of 0.08 mg/l (USACOE, MADEP, ENSR 2003). These values are based on limited data collected during dry and wet weather surveys. However, using these data to compare the total phosphorus concentrations upstream and downstream of the WWTF, it is apparent that upstream total phosphorus concentrations are lower than downstream concentrations. Specifically, upstream of the WWTF total phosphorus concentrations averaged 0.05 mg/l, while downstream phosphorus concentrations in the Concord River averaged 0.15 mg/l. The downstream total phosphorus concentration is approximately three (3) times that of the upstream concentrations and exceeds the recommended criteria in the Gold Book and the National Ecoregion XIV guidance, and the New England-wide total phosphorus concentrations (0.05 mg/l, 0.024 mg/l, and 0.020 - 0.022 mg/l, respectively). This data set illustrates the influence of the WWTF discharge upon the instream concentrations of total phosphorus.

Dry weather data collected from seven survey stations along the mainstem of the Concord River (July 24th and 26th, 2001), yielded total phosphorus concentrations ranging between 0.05 mg/l - 0.10 mg/l (USACOE, MADEP, ENSR 2003). Of the seven survey stations sampled, six were above the suggested criteria in the Gold Book (0.05 mg/l) and National Ecoregion XIV guidance (0.024 mg/l), and above the concentrations presented in the New England-wide document (0.020 - 0.022 mg/l). Additionally, instream flows measured in the Concord River during the July 2001 survey (July 24 and 26) were well above 7Q10 conditions (26 cfs) measuring 150 cfs and 101cfs, respectively (USGS 2002). Thus, total phosphorus concentrations would have been even higher if flows were nearer the 7Q10.
Also, both the July and September 2001 surveys had higher total phosphorus concentrations downstream of the WWTF than upstream survey stations. In particular, total phosphorus concentrations measured at survey stations CR01 and CR02, located approximately 2.8 and 3.4 miles (respectively) downstream of the WWTF, measured 0.09 and 0.10 versus downstream stations which ranged between 0.01 mg/l - 0.04 mg/l during September 2001, and 0.05 - 0.085 during the July 2001 survey (0.085 mg/l occurred only once, the remaining values were 0.05 mg/l, 0.06 mg/l, 0.07 mg/l). This data set further reflects the influence of the WWTF on the instream phosphorus concentrations.

The highest total phosphorus concentration, 0.25 mg/l, was measured during the August 30, 2002 survey (USACOE, MADEP, ENSR 2003). This measure was recorded at survey station CR01, which is located approximately 3.4 miles downstream of the Billerica WWTF. This occurred during a low flow period (38 cfs; USGS 2003), but not during a 7Q10 (26 cfs) event, in which case the total phosphorus concentration would have been higher. Overall, this total phosphorus concentration also exceeds the suggested criteria in the Gold Book (0.05 mg/l) and National Ecoregion XIV guidance (0.024 mg/l), and the concentrations presented in the New England-wide document (0.020 - 0.022 mg/l).

While phosphorus is often used as a causal indicator of eutrophication because its presence results in plant growth, chlorophyl *a* and dissolved oxygen are response indicators. Measures of chlorophyl *a* in surface waters may be correlated with the amount of suspended algae ("phytoplankton"). The recommended total phosphorus criteria for aggregate Ecoregion XIV streams is 3.75 ug/l. This value can be found in the *Ambient Water Quality Criteria Recommmendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Ecoregion XIV*, (see reference list for complete publication details).

During water quality surveys conducted July 26 and September 7, 2001, total chlorophyll *a* concentrations increased with distance downstream, and were higher downstream of the WWTF than upstream (USACOE, MADEP, ENSR 2003). These chlorophyll *a* measures included only phytoplankton (algal mat or other macrophyte chlorophyll was not assessed). During the July and September surveys, at station CR01(located approximately 3.4 miles downstream of the WWTF), instaneous measures of chlorophyll *a* were 16 ug/l, and 25 ug/l, respectively. Ryding and Rast (1989), as cited in the Draft Chesapeake Bay Chlorophyll *a* Criteria Document (July 3, 2001), report that peak chlorophyll *a* values ranging between 16.9 ug/l and 107 ug/l are indicative of eutrophic conditions. Thus, the values measured at survey station CR01 are indicative of high levels of algae and eutrophic conditions that are likely contributing to aesthetic impairments downstream of the WWTF.

During the July and September 2001 surveys, the percent saturation of dissolved oxygen was measured in the Concord River at several stations along the mainstem. Supersaturation can occur under conditions of excessive algae/plant growth which produce oxygen during photosynthesis (Thomann and Mueller 1987). Hence, the supersaturated conditions can be indicative of eutrophic conditions. Of fifteen samples collected from the Concord River, thirteen were supersaturated, which included those downstream of the WWTF. The average percent saturation of DO for this data set ranged between 82.5 % and 159.2%, with maximum values as high as 182.0 % (USACOE, MADEP, ENSR 2003). More specifically, the maximum percent saturation of dissolved oxygen measured at two survey stations (CR1 and CR 2), located downstream of the WWTF (approximately 2.8 and 3.4 miles, respectively), ranged between 121.8 % and 162.0 %. These supersaturated conditions serve as another indicator of eutrophic conditions in the Concord River.

As stated earlier, given the eutrophic conditions in the Concord River, it has been listed on the *Massachusetts Year 2002 Integrated List of Waters* (MADEP 2003). The Concord River appears in Category 5 of the integrated list for waters requiring a TMDL. Water quality impairments in the Concord River are attributed to nutrients, metals and pathogens. Due to nutrient loading, the majority of the water quality concerns associated with the Concord River are directly related to eutrophication (USACOE, MADEP, ENSR 2003). As discussed below, the majority of phosphorus entering this river basin (which includes the Sudbury and Assabet Rivers) during the critical summer period is from Publicly Owned Treatment Works (POTW) discharges.

The Massachusetts Department of Environmental Protection (MADEP), in conjunction with the United States Army Corps of Engineers (USACOE) is currently developing a TMDL allocation for nutrients in the Concord River. To assist in the development of the TMDL, USACOE and MADEP conducted a field investigation of the Concord River system (June 2001 through September 2002. In 2003, the *SuAsCo Watershed Concord River, TMDL Study Assessment, Final Report* (USACOE, MADEP, ENSR 2003) was written to document the water quality status of the Concord River based on the field investigation and a modeling analysis. This document estimates the total phosphorus budget based on field measurements. As indicated in this report, point source phosphorus loadings exceeded non-point source loadings, comprising 54% to 97% of the total load. During a dry weather survey (September 2001), when river flows were very low (47 cfs), point sources dominated the total phosphorus load (97%). Of the point source loading, the Billerica POTW was observed to contribute the majority of the total phosphorus at 80% (see page 6-11, USACOE, MADEP, ENSR 2003).

Discharge Monitoring Reports (DMRs) submitted by the permittee (January 2002 through December 2003) reported monthly average total phosphorus values ranging between 0.21 mg/l and 3.74 mg/l with a maximum daily average of 2.5 mg/l. At the calculated dilution factor of 4.1, a discharge concentration of 0.21 mg/l would, after mixing, result in an in-stream concentration of 0.05 mg/l, which meets the Gold Book recommended criteria, but is in excess of the total phosphorus concentrations recommended in the National Ecoregion XIV guidance and New England-wide document. The National Ecoregion XIV guidance and New England-wide document recommended total phosphorus concentrations would be achieved at effluent concentrations of 0.098 mg/l, and 0.082 mg/l - 0.090 mg/l, respectively.

The draft permit contains the HBPT total phosphorus concentration of 0.2 mg/l. Based on narrative and the national and regional criteria, a limit of at least 0.2 mg/l is necessary to meet water quality standards. A lower limit may be required upon completion of a future TMDL, or an updated water quality analysis, including a better understanding of the reductions in upstream concentrations that may be achievable. Therefore, this permit may be re-opened and modified to account for a more stringent limit or new state criteria.

The total phosphorus limit (0.2 mg/l) is a seasonal limit in effect from April through October. It is defined as a 60 day rolling average limit. The 60 day average value for each day in a given month, beginning on the 60th day after April 1, must be calculated and the highest 60 day average value for that month must be reported on the monthly discharge monitoring report (DMR). In addition, the maximum daily value must be reported for each month.

In addition to the seasonal total phosphorus limit of 0.2 mg/l, the permit contains a total phosphorus limit of 1.0 mg/l during November through March. The winter period limitation on phosphorus is necessary to ensure that the higher levels of phosphorus discharged in the winter period do not result in the accumulation of phosphorus in the sediments. The limitation assumes that the dissolved fraction of the total phosphorus will pass through the system given the short detention time of the impoundments and the lack of plant growth during the winter period. A monitoring requirement for orthophosphorus has been included for the winter period in order to determine the particulate fraction.

Ammonia

The current permit contains seasonal limits during the period of June through September. The current limits are monthly and weekly averages of 6.0 mg/l and a daily maximum of 9.0 mg/l. These limits are based on ammonia toxicity. During the last two years, the permit limits have been exceeded on two different occasions with readings up to 13.8 mg/l. These limits will be retained to maintain the water quality of the Concord River. Future TMDL efforts and water quality studies on the Concord River could result in more stringent and possibly year round ammonia limits based on either ammonia toxicity criteria or on dissolved oxygen concerns. Additionally, EPA has recently noticed its intention to re-evaluate the current aquatic life ambient water quality criteria for ammonia to determine whether it should be revised based on new toxicity data for aquatic organisms. If future ammonia criteria demonstrate that more stringent ammonia limits are needed to meet water quality standards, this permit may be re-opened and modified.

Total Residual Chlorine (TRC)

Chlorine and chlorine compounds produced by the chlorination of wastewater can be extremely toxic to aquatic life. Effluent limits are based water quality criteria for total residual chlorine (TRC) which are specified in the water quality criteria document, often referred to as the EPA Gold Book. The criteria states that the average TRC in the receiving water should not exceed 11 ug/l for protection from chronic toxicity and the maximum TRC should not exceed 19 ug/l to protect fresh water aquatic life from acute toxicity.

As required in the draft permit, individual TRC daily results (three per day) will be reported and include the 1) individual sample result, 2) time at which the sample was taken, and 3) sampling date. The information for each sample will be reported in an attachment to the monthly DMRs.

TRC Limit Calculation:

The 7Q10 dilution and plant design flow are necessary to calculate the appropriate TRC limits. The 7Q10 dilution multiplied by the acute and chronic fresh water criteria provide the appropriate TRC limits. As shown below, the calculated limits are 0.045 mg/l and 0.078 mg/l.

Given:

acute freshwater criteria	19 ug/l (0.019 mg/l) chlorine
chronic freshwater criteria	11 ug/l (0.011 mg/l) chlorine
dilution factor	4.1

Then:

(acute criteria)(dilution factor) = Daily Maximum Limit
(19 ug/l)(4.1) = 78 ug/l (0.078 mg/l)

(chronic criteria) (dilution factor) = Monthly Average Limit
(11 ug/l)(4.1) = 45 ug/l (0.045 mg/l)

This draft permit includes a requirement that chlorination and dechlorination systems provide an alarm for indicating system interruptions or malfunctions. Any interruption or malfunction of the chlorine dosing system may result in levels of chlorine that are inadequate for achieving effective disinfection, or interruptions and/or malfunctions of the dechlorination system may result in excessive levels of chlorine in the final effluent. The draft permit requires that all interruptions or malfunctions be reported with the monthly DMRs. The draft permit requires that the report include the date and time of the interruption or malfunction, the nature of the problem, and the estimated amount of time that the reduced levels of chlorine or dechlorination chemicals occurred.

Metals: Calculations for Copper, Zinc and Aluminum

The permit must limit any pollutant or pollutant parameter (conventional, non-conventional, toxic and whole effluent toxicity) that is, or may be discharged at a level that causes, or has "reasonable potential" to cause or contribute to an excursion above any water quality criterion. An excursion occurs if the projected or actual in stream concentration exceeds the applicable criterion.

In determining reasonable potential, EPA considers: (1) existing controls on point and non-point sources of pollution; (2) pollutant concentration and variability in the effluent and receiving water as determined from permit's reissue application, Monthly Discharge Monitoring Reports (DMRs), and State and Federal Water Quality Reports; (3) sensitivity of the species to toxicity testing; (4) statistical approach outlined in *Technical Support*

Document for Water Quality-based Toxics Controls, (USEPA 1991) in Section 3; and, where appropriate, (5) dilution of the effluent in the receiving water.

Certain metals in water can be toxic to aquatic life. There is a need to limit toxic metal concentrations in the effluent where aquatic life may be impacted. An evaluation of the reasonable potential of toxicity on the concentration of metals in the effluent shows there is not a reasonable potential of toxicity for copper or zinc. However, there is a reasonable potential of toxicity for aluminum (see evaluations below).

EPA is required to limit any pollutant or pollutant parameter that is or may be discharged at a level that caused, has reasonable potential to cause or contributes to an excursion above any water quality criterion.

Calculation of Water Quality Criteria and Limits for Copper:

Copper data was taken from sampling analyses that were submitted as part of the quarterly WET tests conducted between September 2001 and March 2004. A total of eleven rounds of samples were collected during this time period. Federal Register, December 10, 1998, National recommended Water Quality Criteria is used with a hardness of 49.1 ug/l. This hardness value is the most conservative reported value reported in the December 2002 and June 2003 quarterly WET tests.

Water Quality Criteria for hardness-dependent metals:

Acute criteria (dissolved) = exp{ m_a [ln(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

Calculation of acute limit for copper:

m_a = 0.9422 b_a = -1.700 CF = 0.960 h = 49.1

Acute criteria (dissolved) = exp {0.9422 [ln (49.1)] + -1.700} * (0.960) = 6.875 ug/l
Dilution factor = 4.1
Effluent limitation for dissolved copper = 6.875 ug/l * 4.1 = 28.1 ug/l
Effluent limitation for total recoverable copper = 28.1 ug/l/0.960 = 29.27 ug/l***

Chronic criteria (dissolved) = exp{ m_c [ln(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

Calculation of chronic limit for copper:

m_c = 0.8545 b_c = -1.702 CF = 0.960 h =49.1

Chronic criteria (dissolved) = exp {0.8545 [ln (49.1)] + -1.702} * (0.960) = 4.876 ug/l
Dilution factor = 4.1
Effluent limitation for dissolved copper = 4.876ug/l * 4.1 = 19.99 ug/l
Effluent limitation for total recoverable copper = 19.99 ug/l / 0.960 = 20.82 ug/l***

Reasonable Potential: Copper
Effluent copper concentrations collected for quarterly WET tests (September 2001 to March 2004) ranged between 4.7 ug/l to 13.00 ug/l. This range is well below the acute and chronic limits calculated above, (29.27 ug/l) and 20.82 ug/l, respectively. Thus, it has been determined that no reasonable potential exists to cause, or contribute to an in-stream excursion above the criteria.

Copper should continued to be sampled as part of Whole Effluent Toxicity (WET) testing. If copper is determined to be a problem as a result of WET testing, effluent limits for copper will be set in the future.

Calculation of Water Quality Criteria and Limits for Zinc:

Zinc data was taken from sampling analyses that were submitted as part of the quarterly WET tests conducted between September 2001 and March 2004. A total of eleven rounds of samples were collected during this time period. Federal Register, December 10, 1998, National recommended Water Quality Criteria is used with a hardness of 49.1 ug/l. This hardness value is the most conservative reported value reported in the December 2002 and June 2003 quarterly WET tests.

Water Quality Criteria for hardness-dependent metals:

Acute criteria (dissolved) = exp{ m_a [ln(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

Calculation of acute limit for zinc:

$m_a = 0.8473$ $b_a = 0.884$ CF = 0.978 h = 49.1

Acute criteria (dissolved) = exp {0.8473 [ln (49.1)] + 0.884} * (0.978) = 64.13 ug/l
Dilution factor = 4.1
Effluent limitation for dissolved zinc = 64.13 ug/l * 4.1 = 262.9 ug/l
Effluent limitation for total recoverable zinc = 262.9 ug/l/0.978 = 268.8 ug/l***

Chronic criteria (dissolved) = exp{ m_c [ln(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

Calculation of chronic limit for zinc:

$m_c = 0.8473$ $b_c = 0.884$ CF = 0.986 h = 49.1

Chronic criteria (dissolved) = exp {0.8473 [ln (49.1)] + 0.884} * (0.986) = 64.66 ug/l
Dilution factor = 4.1
Effluent limitation for dissolved zinc = 64.66 ug/l * 4.1 = 265.1 ug/l
Effluent limitation for total recoverable zinc = 265.1 ug/l / 0.986 = 268.8 ug/l***

*** The conversion factor is used to determine total recoverable metal. EPA Metal Translator Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion (EPA-823-B96-007) is used as the basis for using the criteria conversion factor. National guidance requires that permit limits be based on total recoverable metals and not dissolved metals. Consequently, it is necessary to apply a translator in order to develop a total recoverable permit limit from a dissolved criteria. The translator reflects how a discharge partitions between the particulate and dissolved phases after mixing with the receiving water. In the absence of site specific data on how a particular discharge partitions in the receiving water, a default assumption is equivalent to the criteria conversion factor used in accordance with the Translator Guidance.

Reasonable Potential: Zinc

Effluent zinc concentrations collected for quarterly WET tests (September 2001 to March 2004) ranged between 22.9 ug/l to 55.00 ug/l. This range is well below the calculated limit of 268.8 ug/l, for both the acute and chronic limits. Thus, it has been determined that no reasonable potential exists to cause, or contribute to an in-stream excursion above the criteria.

Zinc should continued to be sampled as part of Whole Effluent Toxicity (WET) testing. If zinc is determined to be a problem as a result of WET testing, effluent limits for zinc will be set in the future.

Water Quality Criteria and Limits Calculation for Aluminum:
Aluminum data was reviewed from sampling analyses submitted as part of the quarterly WET tests conducted between September 2001 and March 2004. A total of eleven rounds of samples were collected during this time period. Effluent aluminum values ranged between 72.0 ug/l and 384 ug/l. The Federal Register, December 10, 1998, National recommended Water Quality Criteria for aluminum are 87 ug/l (CCC) and 750 ug/l (CMC). It has been determined that there is reasonable potential for aluminum concentrations discharged in the effluent to cause or contribute to an exceedance of the water quality criteria given that effluent concentrations are well above the criteria; in particular, the chronic criteria. Therefore, effluent limits are imposed for aluminum. The limits are calculated below.

Given;

CMC = 750 ug/l (National Recommended Water Quality Criteria: 2002)
CCC = 87 ug/l (National Recommended Water Quality Criteria: 2002)
Dilution Factor (DF) = 4.1

Effluent Limit Calculations:

CMC * DF = acute aluminum criterion
750 ug/l * 4.1 = 3075 ug/l

CCC * DF = chronic aluminum criterion
87 ug/l * 4.1 = 356.7 ug/l

Whole Effluent Toxicity

National studies conducted by the Environmental Protection Agency have demonstrated that domestic sources contribute toxic constituents to POTWs. These constituents include metals, chlorinated solvents and aromatic hydrocarbons among others. The Region's current policy is to include toxicity testing requirements in all municipal permits, while Section 101(a)(3) of the CWA specifically prohibits the discharge of toxic pollutants in toxic amounts.

Based on the potential for toxicity resulting from domestic and industrial contributions, and in accordance with EPA regulation and policy, the draft permit includes acute toxicity limitations and monitoring requirements. (See, e.g., "Policy for the Development of Water Quality-Based Permit Limitations for Toxic Pollutants", 50 Fed. Reg. 30,784 (July 24, 1985); see also, EPA's Technical Support Document for Water Quality-Based Toxics Control and MA DEP's Implementation Policy for the Control of Toxic Pollutants in Surface Waters. EPA Region I and MA DEP have developed toxicity control policies. The policies requires wastewater treatment facilities to perform toxicity bioassays on their effluents. The Commonwealth of MA DEP requires bioassay toxicity testing for state certification.

The MA DEP, in its "Implementation Policy for the Control of Toxic Pollutants in Surface Waters" (February 23, 1990) sets forth toxicity limits which have been adopted by EPA Region I. This document assigns effluent toxicity limits according to dilution factors based on perceived risk. The DEP prefers the use of acute toxicity tests in permits which may be measured with an LC50, or the concentration that is lethal to 50% of the test organisms. This value may also be expressed as a toxic unit (TU) which is defined as 100 divided by the LC50. Thus, an LC50 of 100% would equal 1.0 TU. The DEP prefers to use acute toxicity limits, based on dilution available to the effluent, and its recommended criterion to prevent acutely toxic effects is 0.3 TU. This value is based on an adjustment factor of one-third used to extrapolate the LC50 to an LC1, the concentration at which 1% of the test organisms die. In order to assure that the limit is met within a short distance of the effluent pipe, the DEP has recommended an end of pipe limit of 1.0 TU (LC50 = 100%) for dilution factors 100 or below and 2.0 TU (LC50 = 50%) for dilution factors above 100. Therefore, an LC50 limit of 100% has been maintained in this permit. Pursuant to MA DEP and EPA Region 1 policy, discharges having a dilution of less than 10:1 also require chronic toxicity testing four times per year. A chronic NOEC limit of 24% or greater has also been maintained in this permit along with the LC50 limit. This value is derived by taking the inverse of the receiving water concentration (dilution) of 4.1. As follows;

Chronic NOEC Limit Calculation

$$\frac{1.0}{4.1} * 100 = 24\%$$

The principal advantages of biological techniques are: (1) the effects of complex discharges of many known and unknown constituents can be measured only by biological analyses; (2) bioavailability of pollutants after discharge is best measured by toxicity testing including any synergistic effects of pollutants; and (3) pollutants for which there are inadequate chemical analytical methods or criteria can be addressed. Therefore, toxicity testing is being used in conjunction with pollutant specific control procedures to control the discharge of toxic pollutants.

The draft permit requires that the Billerica WTP conduct WET testing for the Outfall 001 effluent four times per year and that each test include the use of the daphnid, Ceriodaphnia and the fathead minnow, Pimephales promelas. EPA Region I WET protocol found in Permit Attachment A shall be followed.

VI. Pretreatment Program

The permittee is required to administer a pretreatment program based on the authority granted under 40 CFR §122.44(j), 40 CFR §403 and section 307 of the CWA. The Town of Billerica's pretreatment program received EPA approval on June 28, 1985, and as a result, appropriate pretreatment program requirements were incorporated into the previous permit commensurate with that approval and Federal Pretreatment Regulations in effect when the permit was issued.

In October 1988 and July 1990, the Federal Pretreatment Regulations at 40 CFR §403 were amended. Those amendments established new requirements for implementation of pretreatment programs. By reissuing this NPDES permit, the permittee is obligated to modify, if necessary, and implement its pretreatment program to be consistent with current Federal Regulations. Those activities that the permittee must address include, but are not limited to, the following: (1) develop and enforce specific effluent limits (technically-based local limits); (2) revise its local sewer-use ordinance, as appropriate, 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 significant industrial user. These requirements are necessary to ensure continued compliance with the POTW's NPDES permit and its sludge use or disposal practices.

In addition to the requirements described above, the draft permit requires the permittee to provide EPA in writing within 120 days of the permit's effective date a technical report analyzing the adequacy of existing local limits and the need for additional local limits. The permittee must continue to annually submit, on June 15, a pretreatment report detailing the activities of the program for the 12 month period ending 60 days prior to the due date.

VII. Sewage Sludge Information and Requirements

The Billerica WWTP generates about 1576 dry metric tons of sludge per year. This sludge is composted on site and marketed for home and garden use by BFI Organics. In February 1993, EPA promulgated standards for the use and disposal of sewage sludge. The regulations were promulgated under the authority of §405(d) of the CWA. Section 405(f) of the CWA requires that these regulations be implemented through permits. This permit is intended to implement the requirements set forth in the technical standards for the use and disposal of sewage sludge, commonly referred to as the Part 503 regulations.

Section 405(d) of the CWA requires that sludge conditions be included in all municipal permits. The sludge conditions in the draft permit satisfy this requirement and are taken from EPA's proposed Standards for the Disposal of Sewage Sludge to be codified at 40 CFR Part 503 (February 19, 1993 - Volume 58, pp 9248-9415). These conditions are outlined in the draft permit and accompanying guidance document.

VIII. State Certification Requirements

EPA may not issue a permit unless the Massachusetts Department of Environmental Protection certifies that the effluent limitations contained in the permit are stringent enough to assure that the discharge will not cause the receiving water to violate State Water Quality Standards. The staff of the Massachusetts Department of Environmental Protection has reviewed the draft permit and advised EPA that the limitations are adequate to protect water quality. EPA has requested permit certification by the State pursuant to 40 CFR 124.53 and expects that the draft permit will be certified.

IX. 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 (SPA), 1 Congress Street, Suite 1100, Boston, Massachusetts 02114-2023. 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. A public hearing may be held after at least thirty days public notice whenever the Regional Administrator finds that response to this notice indicates 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 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.

X. EPA & MA DEP 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 the EPA and DEP contacts below:

Jeanne Voorhees
USEPA
Congress Street
Suite 1100 - CPE
Boston, MA 02114-2023
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e-mail: voorhees.jeanne@epa.gov

Paul Hogan
Massachusetts Department of Environmental Protection
Division of Watershed Management
Surface Water Discharge Permit Program
627 Main Street, 2nd Floor
Worcester, Massachusetts 01608
Telephone: 508-767-2796

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Date

Linda M. Murphy, Director
Office of Ecosystem Protection
U.S. Environmental Protection Agency

ATTACHMENT A: 7Q10 CALCULATION

To obtain an estimate of a 7Q10 flow at a point between the two USGS gages listed below, the drainage areas (DA) between them must be calculated and other flows included or excluded as explained below. All drainage area values for the locations below are estimated from USGS topographic maps and the USGS gazetteer of 1984 for the SUASCO (Sudbury-Assabet-Concord) river basin.

Lowell, MA USGS gage, 7Q10 for the period 1971 - 2000: **38 cfs**
Maynard, MA USGS gage, 7Q10 for the period 1971 - 2000: **14 cfs**[1]

Flow factor calculation for main stretch of river between Maynard and Lowell gages:

400 square miles	-	116 square miles	=	284 sq. mi.
(Lowell gage DA)		(Maynard gage DA)		(DA between Maynard to Lowell)

Low flow attributable to this stretch of river:

38 cfs	-	14 cfs	-	1.5 cfs[2]	=	22.5 cfs
(7Q10 @ Lowell)		(7Q10 @ Maynard)				

Flow factor for this stretch of river:

22.5 cfs / 284 square miles = **0.079 cfs/sq. mile**

7Q10 estimate: (drainage area)(flow factor)

Estimated 7Q10 flow at Concord MCI:

14 cfs + 1.5 cfs + (168 mi^2 - 116 mi^2) 0.079 = **20 cfs**
(DA between Maynard gage
and Concord MCI discharge)

Estimated 7Q10 flow at Concord POTW:

20 cfs + (345 mi^2 - 168 mi^2) 0.079 = **34 cfs**
(DA between Concord MCI
and Concord POTW)

Estimated 7Q10 flow at Billerica POTW:

34 cfs + (365 mi^2 - 345 mi^2) 0.079 = **36 cfs**
(DA between Concord and Billerica POTWs)

Since the Town of Billerica has a water withdrawal from the Concord River above the Billerica POTW discharge point, the average daily withdrawal for the period of June to September for 1999 of 6.1 MGD will be subtracted to get a better estimate of the actual flow. The 36 cfs figure is converted from cfs to MGD. See Attachment B for 1999 Billerica water withdrawal information.

(36 cfs)(0.646) - 6.1 = **17.1 MGD**

(1). This is the estimated 7Q10 at the Maynard USGS gage. See Attachment C for a graphical estimation of the 7Q10 flow for the period.

(2). This is the average effluent flow from the Maynard WWTF average flow from the period of June to Sept of 1989 - 1999, reflecting the low flow season over that period. This flow is subtracted because the Town's water supply is Taylor Brook, which does not contribute to the drainage area of the Assabet River.

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