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

FACT SHEET

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

PUBLIC NOTICE START DATE:

NPDES PERMIT NO.: NH0100790

NAME AND ADDRESS OF APPLICANT:

City of Keene
City Hall
580 Main Street
Keene, New Hampshire 03431

NAME AND ADDRESS OF FACILITY WHERE DISCHARGE OCCURS:

Keene Wastewater Treatment Plant
420 Airport Road
Swanzey, New Hampshire 03446

The municipalities of Marlborough and Swanzey are co-permittees for specific activities required by the permit, as set forth in Section IV.H of this Fact Sheet and Sections I.B, I .C, and I.D of the Draft Permit. The responsible municipal departments are:

Town of Marlborough
Board of Selectman
P.O. Box 487
Marlborough, NH 03455

Swanzey Sewer Commission
P.O. Box 10009
Swanzey, New Hampshire 03446

RECEIVING WATER: Ashuelot River (Hydrologic Unit Code: 01158000)

CLASSIFICATION: B

I. Proposed Action, Type of Facility and Discharge Location

The applicant has applied to the U.S. Environmental Protection Agency (EPA) for reissuance of its NPDES permit to discharge treated effluent into the Ashuelot River, which is the designated receiving water. The Ashuelot River is used for fishing, swimming, boating and other primary contact recreation. The effluent from the facility does not discharge directly to a designated beach area.

The existing permit was issued on April 15, 1994, and expired on April 15, 1999. The expired permit (hereafter referred to as the Existing Permit) has been administratively extended pursuant to 40 Code of Federal Regulations (CFR) § 122.6(a)(1) because the applicant filed a complete application for permit reissuance under 40 CFR § 122.21. The Existing Permit authorizes discharge from Outfall 001.

The Keene Wastewater Treatment Plant (WWTP) collects and treats domestic, commercial and industrial wastewater from the City of Keene, about 123,000 gallons per day of wastewater from the Town of Marlborough, and about 10,000 gallons per day from the Town of Swanzey (personal communication Donna Hanscom, 2006). The facility also accepts septage and holding tank waste. The Towns of Marlborough and Swanzey have been made co-permittees for conditions related to the operation and maintenance of their collection systems. See Section H (Operation and Maintenance) for a further discussion of these requirements.

The collection system discharging to the treatment plant consists of separate sanitary sewers. In addition to wastewater, separate sanitary sewers convey inflow and infiltration (I/I). 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, tide gates, 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 secondary treatment. I/I greatly increases the potential for sanitary sewer overflows (SSO) in separate sanitary sewer systems. Specific requirements for I/I control and reporting of SSOs are discussed in Section H.

The Keene Wastewater Treatment Plant is designed as a 6.0 million gallon per day (MGD) wastewater treatment facility using activated sludge aeration as the plant's treatment process. The influent, after being aerated by injecting liquid oxygen at the main pumping station and passing through an aerated grit chamber, is split between two primary clarifier tanks. Settled sludge is pumped to two aerated holding tanks, while the wastewater stream continues to two aeration basins. After leaving the two aeration basins the wastewater enters two secondary clarifiers for further settling. Sludge deposited in these clarifiers is pumped to the sludge holding tanks. The effluent from the two secondary clarifiers is combined before entering the ultraviolet light disinfection chamber. After disinfection by ultraviolet light the effluent is discharged into the

Ashuelot River. Sludge disposal is accomplished by first thickening and then dewatering the sludge by a belt filter press. Sludge is then hauled offsite by commercial firms which process the sludge into compost. A map showing the location of the treatment plant is shown in Figure One (see attached).

II. Description of Discharge

A quantitative description of the treatment plant's discharge in terms of recent effluent-monitoring data from January 2004 through July 2005 is shown in Tables One and Two. The data was compiled from discharge monitoring reports (DMRs) submitted to the New Hampshire Department of Environmental Services, Water Division (NHDES-WD) and EPA. The Draft Permit contains limitations for Carbonaceous Biochemical Oxygen Demand ($CBOD_5$), Total Suspended Solids (TSS), pH, Total Recoverable Zinc, Total Recoverable Copper, Total Recoverable Lead, Total Phosphorous, *Escherichia coli* (*E. coli*), Dissolved Oxygen (DO), Ammonia as Nitrogen (NH_3-N), and Whole Effluent Toxicity (WET).

III. Limitations and Conditions

Effluent limitations, monitoring requirements, and any implementation schedule (if required) are found in PART I of the Draft Permit. The basis for each limit and condition is discussed in Sections IV.C through IV.J of this Fact Sheet.

IV. Permit Basis and Explanation of Effluent Limitations Derivation

A. General Statutory and Regulatory Background

Congress enacted the Clean Water Act (CWA or Act), "to restore and maintain the chemical, physical, and biological integrity of the Nation's waters." CWA § 101(a). To achieve this objective, the CWA makes it unlawful for any person to discharge any pollutant into the waters of the United States from any point source, except as authorized by specified permitting sections of the Act, one of which is Section 402. See CWA §§ 301(a), 402(a). Section 402 establishes one of the CWA's principal permitting programs, the National Pollutant Discharge Elimination System ("NPDES"). Under this section of the Act, EPA may "issue a permit for the discharge of any pollutant, or combination of pollutants" in accordance with certain conditions. See CWA § 402(a). NPDES permits generally contain discharge limitations and establish related monitoring and reporting requirements. See CWA § 402(a)(1)-(2).

Section 301 of the CWA provides for two types of effluent limitations to be included in NPDES permits: "technology-based" limitations and "water quality-based" limitations. See CWA §§ 301, 303, 304(b); 40 CFR Parts 122, 125, 131. Technology-based limitations, generally developed on an industry-by-industry basis, reflect a specified level of pollutant-reducing technology available and economically achievable for the type of facility being permitted. See CWA § 301(b). As a class, POTWs must meet performance-based requirements based on available wastewater

treatment technology. CWA § 301(b)(1)(B). The performance level for POTWs is referred to as "secondary treatment." Secondary treatment is comprised of technology-based requirements expressed in terms of BOD_5, TSS and pH. 40 C.F.R. Part 133.

Water quality-based effluent limits, on the other hand, are designed to ensure that state water quality standards are met regardless of the decision made with respect to technology and economics in establishing technology-based limitations. In particular, Section 301(b)(1)(C) requires achievement of, "any more stringent limitation, including those necessary to meet water quality standards...established pursuant to any State law or regulation..." See 40 C.F.R. §§ 122.4(d), 122.44(d)(1) (providing that a permit must contain effluent limits as necessary to protect state water quality standards, "including State narrative criteria for water quality") (emphasis added) and 122.44(d)(5) (providing in part that a permit incorporate any more stringent limits required by Section 301(b)(1)(C) of the CWA).

The CWA requires that states develop water quality standards for all water bodies within the state. CWA § 303. These standards have three parts: (1) one or more "designated uses" for each water body or water body segment in the state; (2) water quality "criteria," consisting of numerical concentration levels and/or narrative statements specifying the amounts of various pollutants that may be present in each water body without impairing the designated uses of that water body; and (3) an antidegradation provision, focused on protecting high quality waters and protecting and maintaining water quality necessary to protect existing uses. CWA § 303(c)(2)(A); 40 C.F.R. § 131.12. The limits and conditions of the permit reflect the goal of the CWA and EPA to achieve and then to maintain water quality standards.

The applicable New Hampshire water quality standards can be found in Surface Water Quality Regulations, Chapter Env-Ws 1700 et seq. See generally, Title 50, Water Management And Protection, Chapter 485A, Water Pollution and Waste Disposal Section 485-A. Hereinafter, New Hampshire's Surface Water Quality Regulations are referred to as the NH Standards.

Receiving stream requirements are established according to numerical and narrative standards adopted under state law for each stream classification. When using chemical-specific numeric criteria from the state's water quality standards to develop permit limits, both the acute and chronic aquatic life criteria are used and expressed in terms of maximum allowable in stream pollutant concentrations. Acute aquatic life criteria are generally implemented through maximum daily limits and chronic aquatic life criteria are generally implemented through average monthly limits. Where a State has not established a numeric water quality criterion for a specific chemical pollutant that is present in the effluent in a concentration that causes or has a reasonable potential to cause a violation of narrative water quality standards, the permitting authority must establish effluent limits in one of three ways: based on a "calculated numeric criterion for the pollutant which the permitting authority demonstrates will attain and maintain applicable narrative water quality criteria and fully protect the designated use"; on a "case-by-case basis" using CWA

Section 304(a) recommended water quality criteria, supplemented as necessary by other relevant information; or, in certain circumstances, based on an "indicator parameter." 40 CFR § 122.44(d)(1)(vi)(A-C).

All statutory deadlines for meeting various treatment technology-based effluent limitations established pursuant to the CWA have expired. When technology-based effluent limits are included in a permit, compliance with those limitations is from the date the issued permit becomes effective. See 40 CFR § 125.3(a)(1). Compliance schedules and deadlines not in accordance with the statutory provisions of the CWA cannot be authorized by an NPDES permit.
The regulations governing EPA's NPDES permit program are generally found in 40 CFR Parts 122, 124, 125 and 136.

B. Development of Water Quality-based Limits

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 standard, including narrative water quality criteria. See 40 CFR §122.44(d)(1). An excursion occurs if the projected or actual in-stream concentration exceeds the applicable criterion.

Reasonable Potential
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 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*, March 1991, EPA/505/2-90-001 in Section 3; and, where appropriate, (5) dilution of the effluent in the receiving water. In accordance with New Hampshire Standards (RSA 485-A:8,VI, Env-Ws 1705.02), available dilution for rivers and streams is based on a known or estimated value of the lowest average flow which occurs for seven (7) consecutive days with a recurrence interval of once in ten (10) years (7Q10) for aquatic life and human health criteria for non-carcinogens, or the long-term harmonic mean flow for human health (carcinogens only) in the receiving water at the point just upstream of the outfall. Furthermore, 10 percent (%) of the receiving water's assimilative capacity is held in reserve for future needs in accordance with New Hampshire's Surface Water Quality Regulations Env-Ws 1705.01.

Anti-Backsliding
Section 402(o) of the CWA generally provides that the effluent limitations of a renewed, reissued, or modified permit must be at least as stringent as the comparable effluent limitations in the previous permit. Unless certain limited exceptions are met, "backsliding" from effluent limitations contained in previously issued permits is prohibited. EPA has also promulgated anti-backsliding regulations, which are found at 40 CFR § 122.44(l). Unless applicable anti-backsliding requirements are met, the limits and conditions in the reissued permit must be at least

as stringent as those in the previous permit.

State Certification

Section 401(a)(1) of the CWA requires all NPDES permit applicants to obtain a certification from the appropriate state agency stating that the permit will comply with all applicable federal effluent limitations and state water quality standards. See CWA § 401(a)(1). The regulatory provisions pertaining to state certification provide that EPA may not issue a permit until a certification is granted or waived by the state in which the discharge originates. 40 C.F.R. § 124.53(a). The regulations further provide that, "when certification is required....no final permit shall be issued...unless the final permit incorporates the requirements specified in the certification under § 124.53(e)." 40 CFR. § 124.55(a)(2). Section 124.53(e) in turn provides that the State certification shall include "any conditions more stringent than those in the draft permit which the State finds necessary" to assure compliance with, among other things, state water quality standards, see 40 CFR. § 124.53(e)(2), and shall also include "[a] statement of the extent to which each condition of the draft permit can be made less stringent without violating the requirements of State law, including water quality standards," see 40 C.F.R.§ 124.53(e)(3).

However, when EPA reasonably believes that a state water quality standard requires a more stringent permit limitation than that reflected in a state certification, it has an independent duty under CWA § 301(b)(1)(C) to include more stringent permit limitations. See 40 C.F.R. §§ 122.44(d)(1) and (5). It should be noted that under CWA § 401, EPA's duty to defer to considerations of state law is intended to prevent EPA from relaxing any requirements, limitations or conditions imposed by state law. Therefore, "[a] State may not condition or deny a certification on the grounds that State law allows a less stringent permit condition." 40 CFR § 124.55(c). In such an instance, the regulation provides that, "The Regional Administrator shall disregard any such certification conditions or denials as waivers of certification." Id. EPA regulations pertaining to permit limits based upon water quality standards and state requirements are contained in 40 CFR § 122.4 (d) and 40 CFR § 122.44(d).

C. Development of Water Quality-based Effluent Limitations for Impaired Waters

The State of New Hampshire's 2004 303(d) list of impaired waters identifies surface waters which do not currently meet state water quality standards (NHDES 2004). Segments of the Ashuelot River have been identified as violating water quality standards for percent Dissolved Oxygen (DO) saturation, aluminum, pH, and *Escherichia coli*. States are required to prepare Total Maximum Daily Load (TMDL) analyses for receiving waters listed on the 303(d) list. A TMDL is a scientific analysis which identifies the amount of a pollutant from point, nonpoint and background sources that may be discharged to a water quality-limited receiving water. Any pollutant loading above the TMDL will result in violation of the applicable water quality standards. The State of New Hampshire has performed sampling necessary to perform a TMDL on the segment of the Ashuelot River from the Keene Wastewater Treatment Plant to the West Swanzey Wastewater Treatment Plant, but does not anticipate completing the TMDL until 2009. Although it is EPA's understanding that the TMDL will contain an allocation for phosphorus,

EPA believes that it is reasonable to move forward with a water quality-based phosphorus effluent limitation in light of the existing severe nutrient impairment of the receiving water, which is exhibiting cultural eutrophication. As discussed below, effluent discharges from the Keene WWTP result in the majority of phosphorus loading to such waters. Uncertainty (heightened by numerous past delays) regarding the date for completion and final approval of the TMDL is another factor in the decision to proceed with a water quality-based limit at this time.

In the absence of a TMDL, EPA is required to use available information to establish water quality limits when issuing NPDES permits to impaired waters. See generally 40 CFR §122.44 (d). EPA has used the data collected by NHDES for the TMDL, and has established water quality-based limits for total phosphorous using this data, applicable narrative state water quality standards, federal water quality criteria guidance and other relevant information discussed in the "Nutrients" section below. The EPA believes that the proposed limits represent the minimum levels of control necessary to achieve water quality standards.

While the permit will be issued for the normal five year term, it can be reopened and modified during its term under certain circumstances. A permit may be modified or revoked and reissued in accordance with 40 CFR § 122.62(a) (Causes for modification) or (b) (Causes for modification or revocation and reissuance). One basis for reopening and modifying the permit during its term is the receipt of information that was not available at the time of permit issuance and that would have justified application of different permit conditions ("New Information"). See 40 CFR §122.62(a)(2). New Information may include, but is not limited to, an applicable final Total Maximum Daily Load ("TMDL"); other relevant water quality data or studies provided by any party; and the results of ESA Section 7 consultation with the U.S. Fish and Wildlife Service and/or National Marine Fisheries Service. In addition to constituting New Information, the outcome of the ESA Section 7 consultation may also satisfy the requirements of 40 CFR § 122.62(b)(1). A reopener provision reflecting the foregoing has been added to the permit.

Any modified permit resulting from the reopener must be consistent with applicable anti-backsliding provisions. See e.g., CWA §§ 402(o)(1); 303(d)(4)(A)(i); 402(o)(2)(B) (and final paragraph); 40 CFR § 122.44(l).

D. Flow

The design flow rate of 6.0 MGD is used to calculate the mass and concentration limits for Five-Day Carbonaceous Biochemical Oxygen Demand and Total Suspended Solids, as discussed below.

Influent and effluent flow must be continuously monitored. If the effluent discharged for a period of three consecutive months exceeds 80 percent of the 6.0 MGD design flow (4.8 MGD), the permittee must notify EPA and NHDES-WD, and implement a program for maintaining satisfactory treatment levels. See Part I.A.6 of the proposed Draft Permit.

E. 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 Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) 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 pH range 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.

Five-day Carbonaceous Biochemical Oxygen Demand ($CBOD_5$) and Total Suspended Solids (TSS)

During the review period, January 2004 through July 2005, there were no permit violations for $CBOD_5$ and TSS. Based on DMR data submitted during the review period, the average values for $CBOD_5$ monthly average, weekly average and maximum daily were 3.64 mg/l (range 2.12 mg/l - 4.9 mg/l; n = 19), 4.75 mg/l (range 2.5 mg/l - 8.4 mg/l; n = 19) and 6.03 mg/l (range 2.9 mg/l - 13.1 mg/l; n = 19), respectively. These values are well below the respective permit limits 25 mg/l, 40 mg/l and 45 mg/l. Additionally, the percent removal $CBOD_5$ averaged 93%, which is well above the requirement of 85% removal.

The TSS average values during the review period for the monthly average, weekly average and maximum daily were 5.89 mg/l (range 3.04 mg/l - 7.96 mg/l; n = 19), 9.88 mg/l (range 3.9 mg/l - 25.1 mg/l; n = 19), and 11.1 mg/l (range 5.0 mg/l - 26 mg/l; n = 19), respectively. These values are well below the respective permit limits 30 mg/l, 45 mg/l and 50 mg/l. Additionally, the percent removal TSS averaged 93 %, which is well above the requirement of 85% removal.

$CBOD_5$ and TSS Mass Loading Calculations:
The draft permit also contains average monthly, average weekly and maximum daily mass-based limits (lbs/day) for $CBOD_5$ and TSS. Mass-based limits are incorporated into the permit are consistent with 40 CFR § 122.45(f). See also, *NPDES Permit Writers' Manual* at p. 76 (USEPA 1996).

Calculations of maximum allowable mass-based loads for average monthly $CBOD_5$ 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; 6.0 MGD.

8.34 = Factor to convert effluent concentration in mg/l and design flow in MGD to lbs/day.

$CBOD_5$ Average Monthly and Average Weekly Limits

[25] (Concentration limit) X 6.0 (design flow) X 8.345 (Conversion Factor) = 1,251.75; rounded to 1,252 lbs/day*

[40] (Concentration limit) X 6.0 (design flow) X 8.345 (Conversion Factor)= 2,002.8; rounded to 2003 lbs/day**

[45] (Concentration limit) X 6.0 (design flow) X 8.345 (Conversion Factor)= 2,253.15; rounded to 2,253 lbs/day

TSS Average Monthly and Average Weekly Limits

[30] (Concentration limit) X 6.0 (design flow) X 8.345 (Conversion Factor)= 1,502.1; rounded to 1,502 lbs/day

[45] (Concentration limit) X 6.0 (design flow) X 8.345 (Conversion Factor) = 2,253.15; rounded to 2,253 lbs/day

[50] (Concentration limit) X 6.0 (design flow) X 8.345 (Conversion Factor)=2,503.5; rounded to 2,504 lbs/day***

*The existing permit Average Monthly $CBOD_5$ limit is 1,251 lbs/day. Due to a minor rounding error in the Existing Permit, this draft limit is proposed to be changed to 1,252 lbs/day.

**The existing permit Average Weekly $CBOD_5$ limit is 2002 lbs/day. Due to a minor rounding error in the Existing Permit, the draft limit is proposed to be changed to 2,003 lbs/day.

***The existing permit Maximum Daily $CBOD_5$ limit is 2,506 lbs/day. Due to a minor rounding error in the Existing Permit, the draft limit is proposed to be changed to 2,504 lbs/day.

Eighty-Five Percent $CBOD_5$ and TSS Removal Requirement

The provisions of 40 CFR § 133.102(3) requires that the 30-day average percent removal for $CBOD_5$ and TSS be not less than 85%. These limits are maintained in the draft permit.

pH

The pH limit range of 6.5 to 8.0 Standard Units (su) in the draft permit is based upon applying New Hampshire Code of Administrative Rules Part Env-Ws 1703.18(b) at the point of discharge with no allowance for dilution. These limitations are based on State Certification requirements under section 401(d) of the CWA, 40 CFR §§ 124.53 and 124.55.

Examining discharge monitoring reports (DMRs) from January 2004 to July 2005 (review period),

the pH values ranged between 6.5 su to 7.3 su (n= 19). Based on this data, no violations of the existing limits occurred during the review period.

Escherichia coli

The basis for this limitation is found in New Hampshire's State statutes (N.H. RSA 485-A:8) and ENV-WS 1703.06, which requires bacteria criteria to be applied at the end of the wastewater treatment facility's discharge pipe. The average monthly limit, 126 colonies/100 ml, and maximum daily limit, 406 colonies/ml, are for Class B waters not designated as beach area. The calculation for compliance with the average monthly limit for *Escherichia coli* shall be determined by using the geometric mean.

During the review period, the average monthly limit ranged between 14 col/100 ml and 215 col/100 ml (n=21). Thus, no violations occurred. The maximum daily values during this period ranged between 8 col/ 100 ml and 8,900 col/100 ml. The maximum daily limit was exceeded on two occasions; March and April 2005 with values of 8,900 col/100 ml and 670 col/100 ml, respectively.

Dissolved Oxygen (DO)

Env-WS 1703.07 establishes minimum DO levels for Class B waters, the class to which the Keene WWTP discharges. The State's Class B waters shall have an instantaneous minimum DO concentration of at least 5.0 mg/l. The minimum DO limit for the Keene treatment plant is set at 7.0 mg/l. This DO limit was determined by the NHDES in the late 1980's through an effort which sampled the River and modeled the effects of Keene's effluent discharge on the River's water quality. The 7.0 mg/l minimum DO limit is to ensure that the facility's effluent is treated to a sufficient level so any biochemical activity in the effluent does not result in violations of the water quality criteria.

D. Non-Conventional and Toxic Pollutants

Water quality-based limits for specific toxic pollutants such as ammonia, metals, etc. are determined from numeric chemical-specific criteria derived from extensive scientific studies. The EPA has summarized and published specific toxic pollutants and their associated toxicity criteria in *Quality Criteria for Water*, 1986, EPA 440/5-86-001 as amended, commonly known as the federal "Gold Book." Each criterion consists of two values: an acute aquatic-life criterion to protect against short-term effects, such as death, and a chronic aquatic-life criterion to protect against long-term effects, such as poor reproduction or impaired growth. New Hampshire adopted these "Gold Book" criteria, with certain exceptions and included them as part of the NH Standards adopted on December 10, 1999. EPA uses these pollutant-specific criteria along with available dilution in the receiving water to determine a specific pollutant's draft permit limit. Available dilution is discussed in the next subheading.

Available Dilution

The available dilution (also referred to as the dilution factor) in the receiving water was

determined to be 2.08. The available dilution was calculated by the NHDES-WD and is based on a plant's design flow of 6.0 million gallons/day (MGD) or 9.3 cubic feet/second (cfs), a calculated 7Q10 low flow in the Ashuelot River nearest to the treatment plant's outfall of 12.19 cfs, and a State of New Hampshire prescribed minimum 10% reserve. The State has reserved 10 percent of the Assimilative Capacity of the receiving water for future uses pursuant to RSA 485-A:13,I(a) and Env-Ws 1705.01.

Given:

7Q10 = 12.19 cfs
Plant Design Flow = 9.3 cfs
Dilution Factor = 0.9 X (7Q10 + Plant Design Flow)/ Plant Design Flow

Dilution Factor = 0.9 X (12.19 cfs + 9.3 cfs)/9.3cfs
Dilution Factor = 2.08

The Existing Permit's 7Q10 flow is 6.4 cfs. NHDES routinely updates the 7Q10 flows of impaired surface waters for which a TMDL is being developed (personal communication, Dudley 2006). Additionally, the Existing Permit's 7Q10 flow was based on an analysis conducted in 1989. Since 1989, additional flow data have been recorded, and the West Swanzey gage station was installed (1994) which provided another new source of flow data.

For the purpose of establishing the Asheulot River TMDL, NHDES conducted an investigation of the river's 7Q10 in the vicinity of the WWTP's outfall incorporating new data (Dudley 2004). The revised 7Q10 flow, 12.19 cfs, represents an increase from the existing 7Q10 flow (6.3 cfs) As a result of the increase in 7Q10 flow, the available dilution applied to Keene's Draft Permit has also increased from a dilution factor of 1.7 used in the existing permit to 2.08.

Ammonia

Elevated ammonia levels present two distinct environmental threats. First, short-term acute effects of high levels of ammonia will cause death of aquatic organisms. Long-term chronic effects of an elevated average ammonia levels will cause reproductive or growth difficulties. Secondly, high levels of ammonia can catalyze the growth of nitrifying bacteria. Nitrification caused by the bacteria breaks down ammonia and combines the freed nitrogen with oxygen to produce nitrites which are further metabolized by bacteria to nitrates. If the WWTP's effluent is discharged with high ammonia levels, the nitrification induced by the ammonia can cause the dissolved oxygen levels of the receiving water to drop because oxygen is taken out of solution from the receiving water to form the nitrogen compounds. For example, the oxygen required to oxidize ammonia is approximately 4.3 mg oxygen/mg ammonium-nitrogen (Metcalf & Eddy, 1991).

The existing permit contains summer and winter ammonia limits. The summer monthly average limit is 2.1 mg/l and the maximum daily limit 3.1 mg/l. The existing summer limits were derived using the NH DES water quality standards ammonia criterion of 1.23 mg/l (pH 6.5 su at 25^{0}C;

dilution factor 1.7). The winter monthly average limit is 12 mg/l and the maximum daily limit 18 mg/l. These effluent limits were included to prevent ammonia toxicity in the Ashuelot River.

Review of DMR data from January 2004 through July 2005 revealed that the average monthly values for both summer and winter were below the existing limits (see above) with ranges between 0.3 mg/l-1.56 mg/l (n=6) and 0.54 mg/l and 3.97 mg/l (n=12), respectively. Maximum daily values for winter ranged between 1.21 mg/l - 12.1 mg/l (n=12), which are below the maximum daily limit (18 mg/l). Summer maximum daily values ranged between 0.51 and 4.0 mg/l (n=6).

Since Keene's existing NPDES permit became effective, the New Hampshire water quality standards for ammonia were revised. If the revised water quality criteria for ammonia were applied to the Draft Permit, the resulting draft ammonia limits would be higher (less stringent) than the existing permit limits. For example, during the summer months, the ambient chronic criterion for ammonia is 3.08 mg/l based on a pH of 7.0 standard units (su). See Env-Ws 1703.4. (A pH value of 7.0 su was used instead of 6.5 su given that it is more representative of pH values downstream of the Keene WWTP. For example, data collected by NHDES for the development of the TMDL ranged between 6.60 su to 7.09 su (n=3). The resulting permit limit would be 6.41 mg/l, derived by multiplying the ammonia criterion (3.08 mg/l) by the dilution factor (2.08). This limit is approximately three times the existing limit.

Proposed Summer Ammonia Limits:
Neither the revised water quality criteria nor updated 7Q10 flow were used in the development of the summer ammonia limits, because elevating the levels of ammonia during the summer months would contribute to the additional depletion of instream oxygen levels through the nitrification of ammonia to nitrate. The Ashuelot River is already impaired by low dissolved oxygen, and thus does not have capacity to assimilate increased loadings of potentially oxygen depleting pollutants such as ammonia. See *Final List of Threatened or Impaired Waters That Require a TMDL* (NHDES 2004). Therefore, the existing summer ammonia limits will be retained in the Draft Permit to ensure that ammonia does not contribute to the further depletion of dissolved oxygen levels in the Ashuelot River.

Proposed Winter Ammonia Limits**:**
New Hampshire DES has informed EPA of its determination that use of an ammonia concentration regime based on EPA recommended criteria (temperature, pH, and early life stage dependent) during the cold season rather than NH criteria (pH; early life stage dependent) can fully support beneficial fisheries in compliance with Env-Ws 1703.25(b).

Winter ammonia chronic and acute limits were re-evaluated in recognition that the dissolved oxygen impairment in the Ashuelot River is caused by eutrophication and is thus primarily of concern during summer conditions. Based on this re-evaluation, the monthly average limit remains unchanged given a chronic criterion of 5.9 at a pH of 7.0 su (USEPA 1999) (5.9 mg/l multiplied by the dilution factor, 2.08).

The maximum daily limit was also recalculated. Using the acute criterion of 24.1 mg/l at pH of 7.0 su (salmonids present) (USEPA 1999) multiplied by the dilution factor (2.08) yields a maximum daily limit of 50 mg/l. During the review period, the maximum daily values for winter ranged between 1.21 mg/l - 12.1 mg/l, which is well below 50 mg/l. Based on these values, it has been determined that no reasonable potential exists for water quality standards to be violated. Thus, the maximum daily limit has been eliminated in the Draft Permit.

Metals:
Certain metals in water can be toxic to aquatic life. Toxic metal concentrations must be limited where the discharge has the reasonable potential to cause or contribute to an exceedance of water quality standards. The current permit includes acute and chronic effluent concentration limits for zinc, copper and lead. Limits on these pollutants have been retained in the Draft Permit. However, the limitations have been recalculated because a new 7Q10 value was used, subsequently resulting in a new dilution factor, and in the case of copper, because the criteria have been revised. Refer to Attachment A for the calculations of the effluent concentrations limits for zinc, copper and lead contained in the Draft Permit.

Aluminum: In the Draft Permit, aluminum monitoring is proposed to occur on a twice per month basis. This monitoring requirement is proposed given that polyaluminum chloride is currently used for copper removal. Data collected from the monitoring will be used to determine whether there is a reasonable potential for aluminum to cause or contribute to a water quality exceedance of criteria.

Also, it is recognized that some form of alum may be used to remove phosphorous. Thus, the draft permit proposes that aluminum sampling be conducted simultaneously with phosphorous sampling, if, and when, it is used for phosphorous removal.

Copper: Existing Monthly average and maximum daily copper limits are 6.2 mg/l and 8.2 mg/l, respectively. Review of monthly Discharge Monitoring Reports (DMR) from January 2004 to July 2005 (review period) indicate that average maximum daily and monthly average values for copper were 21.3 ug/l (range 6.3 ug/l - 43.0 ug/l, n=19) and 17.5 ug/l (range 5.9 ug/l - 37.5 ug/l, n=19), respectively (see attached Table Two).

Based on the DMR data, it has been determined that a reasonable potential exists for copper concentrations in the effluent to cause or contribute to an exceedance of water quality criteria for copper given that effluent concentrations are well above the calculated limits. Thus, pursuant to 40 CFR § 122.44(d)(1)(iii), the Draft Permit includes monthly average and maximum daily limits of 5.9 mg/l and 7.9 mg/l, respectively. See Attachment A for the calculations**.** The proposed limits are more stringent than the existing limits given that the copper criteria have changed since the issuance of the existing permit.

Lead: Existing average monthly and maximum daily limits for lead are 0.92 ug/l and 23.8

ug/l, respectively. Monthly DMR data for the review period indicates that all reported values for both the average maximum daily and monthly average were below the minimum level (5 ug/l) for total lead (see Table 2). However, a more recent minimum level of detection (ML) has been established as 3 ug/l for total lead using the Furnace Atomic Absorption analytical method (EPA Method 220.2). This lower ML will provide better data to evaluate compliance with the monthly average limit of 1.1 ug/l. However, because the average monthly limit is lower than the ML, compliance/non-compliance will be determined based on the ML. Sample results of less than 3 ug/l for the average monthly value will be reported as zero on the DMRs (see attached Table Two).

In accordance with statutory anti-backsliding provisions, reissued permit effluent limits must be at least as stringent as the effluent limitations in the existing permit. However, since the issuance of the existing permit, NHDES recalculated the Ashuelot River's 7Q10 flow for the development of a TMDL. The recalculated 7Q10 flow was subsequently used to recalculate the dilution factor for the Keene WWTP and resulted in raising the dilution factor from 1.7 to 2.08. Thus, the existing permit's average monthly and maximum daily lead limits, 0.92 ug/l and 23.8 ug/l, respectively, were changed to 1.1 ug/l and 29.1 ug/l, respectively. Although the proposed limits are higher than the existing limits, this increase is consistent with applicable anti-backsliding provisions because water quality standards would still be attained. See CWA §§ 402(o)(1), 304(d)(4)(B) and 402(o)(3). Given that the increase in the lead limit is directly correlated to the increased assimilative capacity associated with the new 7Q10 flow in the Ashuelot River, the proposed limits will be sufficiently protective of existing uses to comply with the anti-degradation provisions of the NH Standards. See Section 402(o)(2)(B)(i); Env-Ws 1708.

Zinc: Existing maximum daily and monthly average zinc limits are 61.5 mg/l and 55.7 mg/l (n=19), respectively. Review of the DMR data (see Table Two) reveals that the maximum daily effluent concentrations ranged from 36 to 90 ug/l and average monthly effluent concentrations ranged from 33.5 ug/l to 61.8 ug/l (n=19). Effluent limitations were recalculated based on the updated dilution factor which resulted in monthly average and daily maximum limits of 77 ug/l (see Attachment A for the calculations).

Based on the DMR data, it has been determined that a reasonable potential exists for zinc to cause or contribute to an exceedance of water quality criteria given that effluent concentrations have approached or exceeded the existing limits and the recalculated limits, which are based on state water quality criteria. Thus, pursuant to 40 CFR § 122.44(d)(1)(iii), the Draft Permit must include a limit for zinc. The Draft Permit includes effluent limits of 77 mg/l for both the monthly average and maximum daily zinc limits. Although the proposed limits are higher than the existing limits, this increase is allowable pursuant to antibacksliding requirements set forth in CWA § 402 (o)(1) and 303(d)(4) since it will ensure that water quality standards are attained, the receiving water is in attainment for zinc, and the revision is consistent with antidegradation.

Nutrients

Phosphorous 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. 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.

EPA has produced several guidance documents which contain recommended total phosphorous criteria for receiving waters. The 1986 Quality Criteria of Water (Gold Book) recommends in-stream phosphorous 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), which was 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. Swanzey is within Ecoregion VIII, *Nutrient Poor Largely Glaciated Upper Midwest and Northeast*. Recommended criteria for this eco-region is a Total Phosphorous criterion of 10 ug/l (0.010 mg/l) and chlorophyll *a* criteria of 0.63 ug/l (0.0063 mg/l). These recommended criteria are found in the *Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Ecoregion VIII* (USEPA 2001).

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 phosphorous 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 phosphorous concentration was based on more recent data than the National Ecoregional nutrient criteria, and has 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 New Hampshire Surface Water Quality Regulations contain a narrative criterion which states that phosphorous contained in effluent shall not impair a water body's designated use. Specifically, Env-Ws 1703.14(b) states that, "Class B waters shall contain no phosphorous or

nitrogen in such concentrations that would impair any existing or designated uses, unless naturally occurring." Env-Ws 1703.14(c) further states that, "Existing discharges containing either phosphorous or nitrogen which encourage cultural eutrophication shall be treated to remove phosphorous or nitrogen to ensure attainment and maintenance of water quality standards." Cultural eutrophication is defined in Env-Ws 1702.15 as, "... the human- induced addition of wastes containing nutrients which results in excessive plant growth and/or decrease in dissolved oxygen." Although numeric nutrient criteria have not yet been developed in New Hampshire, a total phosphorous concentration of 0.05 mg/l is considered by the NHDES as a level of concern (NHVRAP & NHDES 2002, 2003, and 2005).

As noted earlier, Section 303(d) of the 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). Impaired water quality conditions persist in the Ashuelot River and have resulted in its listing in the State of New Hampshire's *Final List of Threatened or Impaired Waters That Require a TMDL* (NHDES 2004), formerly referred to as the 303(d) list. Aquatic life use is not supported in segments of the Ashuelot River due to dissolved oxygen saturation. A TMDL was scheduled to be developed for dissolved oxygen saturation in 2007, but has been extended until 2009. During the summers of 2001 and 2002, NHDES collected water samples from the Ashuelot River for the development of the TMDL. This data, and data from the NHDES OneStop Data Retieval Site, were used as the basis for developing the total phosphorous limit in the Draft Permit.

Instream Sampling in the Asheulot River: Total Phosphorous and Chlorophyll *a*

The segment of the Asheulot River between Keene and Swanzey is at particular risk of eutrophication given the rivers morphology and the existing sources of phosphorous within it (i.e., Keene and Swanzey WWTPs). The first 30 miles of the Ashuelot River drops quickly at a rate of 37 feet per mile. However, the river has a particularly low gradient through Keene, Swanzey and Winchester. For example, the gradient from the Colony Mill dam in Keene to the Homestead Dam in West Swanzey is approximately 12 feet over 8.7 miles (VHB 2005). This translates to an average of 1.4 feet per mile, which is considered quite flat, especially when compared to the upper portions of the watershed (VHB 2005). Given the low gradient and known point sources of phosphorous, the Ashuelot River is at considerable risk for eutrophication.

During 2001 and 2002, the NH DES sampled the Ashuelot River to collect data for the TMDL. The river was sampled on August 16, 23, 29, 2001, and on August 28, 2002. A summary of pertinent data obtained during the sampling is presented below in Table Three. The data represents samples taken from the two WWTPs in the study area, Keene and Swanzey, and from the Ashuelot River upstream and downstream of these facilities. A map showing the location of the WWTPs and the location of the Ashuelot River sampling sites is included in Figure One (see attached locus map). The sampling stations are numbered sequentially from upstream to

downstream, with the upstream stations having the higher numbers. Station 2- Sba is a sampling station on the South Branch of the Ashuelot River, which discharges to the main branch just downstream of Station16D - Ash.

Table Three

Station*	Ortho Phosphorous (mg/l)				Total Phosphorous (mg/l)				Chlorophyll *a* (ug/l)			
	2001			2002	2001			2002	2001			2002
	8/16	8/23	8/29	8/28	8/16	8/23	8/29	8/28	8/16	8/23	8/29	8/28
16D-Ash	0.031	<0.005	<0.005	<0.01	0.018	0.014	0.016	0.022	1.97	2.16	3.44	1.91
Keene WWTP	3.053	3.68	2.89	3.72	3.44	3.4	3.25	3.72	1.38	1.66	1.78	NA
16B-Ash	0.638	0.102	0.898	1.06	0.644	0.125	0.955	1.132	2.3	2.89	3.65	2.97
2-Sba	0.047	0.005	0.005	<0.01	0.023	0.017	0.02	0.015	3.23	2.13	2.73	2.2
16-Ash	0.145	0.241	0.246	0.245	0.16	0.271	0.287	0.268	3.44	1.8	3.84	NA
15E-Ash	0.187	0.231	0.257	0.196	0.203	0.265	0.31	0.235	4.72	10.3	6.04	3.97
15-Ash	0.179	0.169	0.206	0.209	0.197	0.197	0.265	0.263	7.09	11.4	10.43	4.93
14T-Ash	0.181	0.161	0.201	0.21	0.193	0.192	0.244	0.29	4.31	5.83	6.92	6.23
Swanzey WWTP	4.153	4.64	4.95	5.67	4.65	4.65	5.69	5.517	250.8	114	237.6	7.65
14-Ash	0.12	0.117	0.136	0.141	0.158	0.18	0.277	0.213	7.83	16.3	69.64	13.64
12-Ash	0.112	0.085	0.116	0.097	0.123	0.123	0.191	0.143	5.76	3.82	23.77	19.02

Except at stations located above the Keene WWTP and on the South Branch of the Ashuelot River (Stations 16D-Ash and 2-Sba, respectively), the data in Table Three illustrates that total phosphorous concentrations at all sampling stations on the mainstem exceed all the Gold Book recommended criteria (0.02 mg/l, 0.05 mg/l, 0.10 mg/l), New England-wide recommended criteria (0.020 mg/l - 0.022 mg/l), Ecoregion criterion (0.010 mg/l), and the NHDES level of concern (0.05 mg/l)

As discussed above, while phosphorous is often used as a causal indicator of eutrophication because its presence results in plant growth, chlorophyll *a* and dissolved oxygen are response indicators (USEPA 2000; Chapra 1997; Thomann & Mueller1987). Measures of chlorophyll *a* in surface waters may be correlated with the amount of suspended algae ("phytoplankton"). The recommended total chlorophyll *a* criteria for Ecoregion VIII, *Nutrient Poor Largely Glaciated Upper Midwest and Northeast* is 0.63 ug/l. This value can be found in the *Ambient Water Quality Criteria Recommendations, Information Supporting the Development of State and Tribal Nutrient Criteria, Rivers and Streams in Ecoregion VIII ,* EPA 822-B-01-015, December, 2001.

As illustrated in Table Three, chlorophyll *a* data exceed the recommended National Ecoregion chlorophyll *a* criterion (0.63 ug/l) at all stations. To demonstrate, the range of instream chlorophyll *a*, excluding the WWTP's, is 1.97 ug/l - 69.64 ug/l. Overall, there is a general increase in the concentration of chlorophyll *a* moving downstream. Although the available chlorphyll *a* data set for the Ashuelot River is limited by the number of sampling events, the data are useful for evaluating whether algal blooms occurred and providing general insight into the trophic status of the Ashuelot River.

Table Four provides a summary from the literature of the trophic status for fresh water systems as characterized by mean chlorophyll *a*. Although, the data for chlorophyll *a* measures in the Ashuelot River are based on single samples, a comparison of these values with those in Table 4 serves to generally demonstrate that eutrophic conditions exist in the Ashuelot River, in particular downstream of the West Swanzey WWTP. Also, during water quality surveys conducted in August of 2001 and 2002, total chlorophyll *a* concentrations increased with distance downstream, and were highest downstream of the West Swanzey WWTP. Based on the values presented in Table Four, the Ashuelot River would be considered, at a minimum, mesotrophic and, thus at risk for eutrophication, and eutrophic.

Table 4. Freshwater System Trophic Status Based on Mean Chlorophyll *a* *

Trophic Status	Wetzel (2001)	Ryding and Rast (1989)	Smith (1998)	Novotny and Olem (1994)
Eutrophic	>10 ug/l	6.7 - 31 ug/l	----------	>10 ug/l
Mesotrophic	2- 15 ug/l	3 - 7.4 ug/l	3.5 - 9 ug/l	4 - 10 ug/l
Oligotrophic	0.3 - 3 ug/l	0.8 - 3.4 ug/l	----------	< 4 ug/l

*Adapted from USEPA 2003

Another indication of eutrophication in the Ashuelot River is the macrophyte and periphyton growth observed downstream of the Keene WWTP discharge in August of 2001 (NHDES 2001). Upstream of the discharge, macrophyte and periphyton growth was sparse while downstream the channel had 75% coverage of periphyton and macrophyte growth was observed to be scattered/common (NHDES 2001).

Dissolved oxygen data was reviewed at the NHDES OneStop Data Retrieval site for the percent saturation in the Ashuelot River. Supersaturation (DO concentrations >100 % of the theoretical concentration at the observed temperature) can occur under conditions of excessive algae/plant growth which produce oxygen during photosynthesis (Thomann and Mueller 1987). Hence, the supersaturation can be indicative of eutrophic conditions. Summer data from 1990 - 1995, and 1997 and 1998 were provided for Station16 - ASH, located below the Keene WWTP. The average percent saturation for dissolved oxygen was 88.71% with a range of 67.90 % to 114 % (n=18). Although the data are limited, they indicate that supersaturated conditions occur and serve as another indicator of eutrophic conditions in the Ashuelot River.

Eutrophic conditions have also been noted by the Ashuelot River Local Advisory Committee (ARLAC). In the *Ashuelot River Corridor Management Plan* (ARLAC 2001, with the assistance of the NHDES), a number of issues are presented, which include eutrophic conditions and low dissolved oxygen during summer low flow conditions, and phosphorous loading from the Keene WWTP. The management goals in this plan recognize the need for reducing nutrient and chemical pollutant loads from the Keene WWTP (ARLAC 2001).

Conclusion: Proposed Total Phosphorous Limit

An estimate of the existing total phosphorous concentration from the Keene WWTP discharge is approximately 3.5 mg/l (based on data in Table Two). Assuming an effluent total phosphorous concentration of 3.5 mg/l and a dilution factor of 2.08, the estimated instream concentration of phosphorous due to this discharge is 1.7 mg/l (3.5 mg/l / 2.08), well above any of the EPA-recommended criteria. Thus, EPA believes that the discharge from the Keene WWTP clearly contributes to the eutrophic conditions and impairment of the Ashuelot River, and that an effluent limit for total phosphorous must be included in the permit to assure compliance with the New Hampshire narrative criteria, which requires the removal of phosphorous from effluent causing or contributing impairment of a water body (Env-Ws 1703.14(c)).

EPA has decided to apply the Gold Book criterion rather than the more stringent eco-region criteria, given that it was developed from an effects-based approach, versus the eco-region criteria that were developed on the basis of reference conditions**.** The effects-based approach is taken because it is often more directly associated with an impairment to a designated use (i.e. fishing, swimming). The effects-based approach provides a threshold value above which adverse effects (i.e., water quality impairments) are likely to occur. It applies empirical observations of a causal variable (i.e, phosphorus) and a response variable (i.e., chlorophyll *a*) associated with designated use impairments. Reference-based values are statistically derived from a comparison within a population of rivers in the same eco-region class. They are a quantitative set of river characteristics (physical, chemical and biological) that represent minimally impacted conditions.

It is estimated that a total phosphorous limit of 0.2 mg/l would result in an instream concentration of total phosphorous of 0.096 mg/l (0.2 mg/l divided by the dilution factor 2.08), which would meet the Gold Book criterion for free flowing streams (0.1 mg/l). The Gold Book- recommended criterion is applied based on the best currently available information. In the future, the phosphorus limit may change upon receipt of new information, including but not limited to the development of a numeric nutrient criterion, a TMDL allocation for phosphorus, or additional water quality data that specifically reflects the response of the Ashuelot River to the lower phosphorus limits.

The Draft Permit therefore proposes a warm weather limit of 0.2 mg/l total phosphorous and a cold weather limit of 1 mg/l. The total phosphorous warm weather limit (0.2 mg/l) is applied April 1st to October 31st, the period during which eutrophic conditions are most likely to occur and during which phosphorus effluent loading is most detrimental to water quality goals.

The total phosphorous cold weather limit (1.0 mg/l) applies November 1st to March 31st. A higher phosphorus effluent discharge limitation in the winter period is appropriate because the predominant form of phosphorus (the dissolved fraction), lacking plant growth to absorb it, will likely remain dissolved and flow out of the system. Imposing a limit on phosphorous during the cold weather months is, however, necessary to ensure that phosphorous discharged during the cold weather months does not result in the accumulation of phosphorous in the sediments, and subsequent release during the warm weather growing season. To ensure that EPA's understanding of the anticipated behavior of dissolved and particulate phosphorus is correct, a monitoring requirement for orthophosphorous has been included for the cold weather months (November 1st - March 31st) in order to determine the dissolved particulate fraction.

E. Whole Effluent Toxicity

EPA's *Technical Support Document for Water Quality-based Toxics Control*, EPA/505/2-90-001, March 1991, recommends using an "integrated strategy" containing both pollutant (chemical) specific approaches and whole effluent (biological) toxicity approaches to control toxic pollutants in effluent discharges entering the nation's waterways. EPA-New England adopted this "integrated strategy" on July 1, 1991, for use in permit development and issuance. These approaches are designed to protect aquatic life and human health. Pollutant-specific approaches such as those in the Gold Book and State regulations address individual chemicals, whereas, the whole effluent toxicity (WET) approach evaluates interactions between pollutants thus rendering an "overall" or "aggregate" toxicity assessment of the effluent. Furthermore, WET measures the "Additive" and/or "Antagonistic" effects of individual chemical pollutants which pollutant specific approaches do not, thus the need for both approaches. In addition, the presence of an unknown toxic pollutant can be discovered and addressed through this process.

New Hampshire's Water Quality Standards state that, "all waters shall be free from toxic substances or chemical constituents in concentrations or combination that injure or are inimical to plants, animals, humans, or aquatic life;...." (N.H. RSA 485-A:8, VI and the N.H. Code of Administrative Rules, PART Env-Ws 1703.21(a)). The federal NPDES regulations at 40 CFR §122.44(d)(1)(v) require whole effluent toxicity limits in a permit when a discharge has a "reasonable potential" to cause or contribute to an excursion above the State's narrative criterion for toxicity. WET tests of the Keene WWTP's effluent in June 2005 demonstrated toxicity for Daphnid (*Ceriodaphnia dubia*). Furthermore, the low dilution, 2.08, calculated for the receiving water at the Keene WWTP outfall contributes to a "reasonable potential" that the discharge could cause an excursion of the no toxics provision in the State's regulations. Inclusion of the whole effluent toxicity limit in the Draft Permit will ensure compliance with the State's narrative water quality criterion of "no toxics in toxic amounts".

The type of whole effluent toxicity (WET) test, acute and/or chronic and effluent limitations (LC50 and/or C-NOEC), are based on available dilution (See Attachment B). The draft permit requires the permittee to perform the quarterly toxicity tests using Daphnid (*Ceriodaphnia dubia*)

and contains an LC50 limit of 100% effluent concentration. The Draft Permit contains an LC50 limit of 100 percent effluent concentration (See Appendix B for the LC50 limit). The LC50 is defined as the concentration of toxicant, or in this draft permit, as the percentage of effluent lethal to 50% of the test organisms during a specific length of time.

The Chronic-No Observed Effect Concentration (C-NOEC) is defined as the highest concentration to which test organisms are exposed in a life cycle or partial life cycle test, which causes no adverse effect on growth, survival or reproduction during a specific time of observation. Based on the revised dilution factor for the Keene WWTP, the C-NOEC limit has been recalculated based on the revised dilution factor, as follows;

Chronic NOEC Limit Calculation

$$\frac{1.0 * 100}{2.08} = 48\%$$

The test results (growth, survival or reproduction) at a specific time of observation as determined from hypothesis testing should exhibit a linear dose-response relationship. However, where the test results do not exhibit a linear dose-response relationship, the Draft Permit requires the permittee to report the lowest concentration where there is no observable effect. See the Draft Permit's ATTACHMENT A (VII. TOXICITY TEST DATA ANALYSIS) for additional clarification in selecting appropriate C-NOEC values. The modified acute toxicity test required in the draft permit is measured 48 hours into the chronic test.

The quarterly sampling for the WET test requirement shall be collected and tests completed during the calender quarters ending in March 31st, June 30th, September 30th and December 31st each year. Results are to be submitted to the EPA and the NHDES-WD by the 15th day of the month following the end of the quarter sampled. For example, tests results for the quarter beginning on April 1st and ending June 30th , are due by July 15th .

The results of 20 WET tests between May 2001 and October 2005 exhibited toxicity during only one quarter, May 2002, with the remaining tests all equal to or greater than 100%. Overall, these results indicate that the receiving stream was not adversely affected by the discharge. Based on these results, the draft permit has reduced the frequency of WET testing for Fathead Minnows (*Pimephales promelas*) to once per year, during the September 30th quarter. The frequency of WET testing for Daphnids will remain at four per year given that Daphnids are generally the more sensitive species.

Results of these toxicity tests will demonstrate compliance with the no toxic provision of the CWA. If the results of these tests are consistently negative during a one year period, the monitoring frequency and testing may be reduced to not less than one per year. As a special condition of the Draft Permit (Section J) the frequency of testing may be reduced by a certified letter from the EPA. This permit provision anticipates that the permittee may wish to request a reduction in WET testing. After a minimum of four complete and consecutive WET test, all of which must be valid and demonstrate compliance with the permit limits for whole effluent

toxicity, the permittee may submit a written request to the EPA seeking a review of the toxicity test results. The EPA will review the test results and other pertinent information to make a determination. The permittee is required to continue testing at the frequency specified in the permit until the permit is either formally modified or until the permittee receives a certified letter from the EPA indicating a change in the permit conditions. This special condition does not negate the permittee's right to request a permit modification at any time prior to the permit expiration.

Alternatively, if toxicity occurs, the monitoring frequency and testing requirements may be increased. The permit may also be modified, or alternatively, revoked and reissued to incorporate additional toxicity testing requirements or chemical specific limits. These actions will occur if the Regional Administrator determines the NH Standards are not adequately enforced and uses of the waterways are not adequately protected during the remaining life of the permit. Results of these toxicity tests are considered "new information not available at permit development"; therefore, the permitting authority is allowed to use said information to modify an issued permit under authority in 40 CFR § 122.62(a)(2).

This draft permit requires the reporting of selected parameters determined from the chemical analysis of the WET tests 100% effluent samples. Specifically, parameters for the constituents of aluminum, ammonia nitrogen as nitrogen, hardness, and total recoverable cadmium, copper, chromium, lead, nickel, and zinc are to be reported on the appropriate Discharge Monitoring Reports for entry into the EPA's Permit Compliance Systems Data Base. EPA-New England does not consider reporting these requirements an unnecessary burden as the reporting these constituents is required with the submission of each toxicity report (See Draft Permit, ATTACHMENT A, page A-8).

F. Sludge

Domestic sludges which are land applied, disposed of in a surface disposal unit, or fired in a sewage sludge incinerator are subject to Part 503 technical standards and NH Standard Env-Ws 800. The Existing Permit contains conditions intended to implement the Part 503 regulations. These conditions include: required notifications for any planned changes in sludge use or disposal practices; causes for modification of the permit; and specific conditions relative to the permittee's method of sludge disposal. The Draft Permit requires that EPA and NHDES-WD be notified 180 days prior to a change in the sludge use or disposal method employed at permit reissuance.

Presently, sludge is hauled offsite by a commercial firm. The Draft Permit maintains the Existing Permit's requirements for annual monitoring of sludge for the following parameters: Arsenic; Cadmium; Chromium; Copper; Lead; Mercury; Molybdenum; Nickel; Selenium and Zinc. Reports are to be submitted to EPA by February 19 of each year.

G. Essential Fish Habitat and Endangered Species

Essential Fish Habitat
The Magnuson-Stevens Fishery Conservation and Management Act, as amended by the Sustainable Fisheries Act of 1996 (Public Law 104267), established a new requirement to

describe and identify (designate) "essential fish habitat" (EFH) in each federal fishery management plan. Only species managed under a federal fishery management plan are covered. Fishery Management Councils determine which areas will be designated as EFH. The Councils have prepared written descriptions and maps of EFH, and include them in fishery management plans or their amendments. EFH designations for New England were approved by the Secretary of Commerce on March 3, 1999.

The 1996 Sustainable Fisheries Act broadly defined essential fish habitat as "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Waters include aquatic areas and their associated physical, chemical and biological properties. Substrate includes sediment, hard bottom, and structures underlying the waters. Necessary means the habitat required to support a sustainable fishery and the managed species' contribution to a healthy ecosystem. Spawning, breeding feeding, or growth to maturity covers all habitat types utilized by a species throughout its life cycle. Adversely affect means any impact which reduces the quality and/or quantity of EFH. Adverse affects may include direct (i.e. contamination; physical disruption), indirect (i.e. loss of prey), site specific or habitat wide impacts, including individual, cumulative or synergistic consequences of actions.

The Magnuson-Stevens Act requires all federal agencies to consult with National Marine Fisheries Service (NMFS) on all actions, proposed actions, permitted, funded, undertaken by the agency, that "may adversely affect any essential fish habitat." The Connecticut River and its tributaries, including the Ashuelot River, are designated EFH for Atlantic salmon (*Salmo salar*). According to New Hampshire Fish and Game Department (NHFGD), the stocking of Atlantic salmon fry occurs in three tributaries well upstream from the Keene WWTP. NHFGD estimates there are approximately 4,087 units of suitable Atlantic salmon rearing habitat upstream from the Keene plant. One rearing unit equals a 100 square-yard area. There are no areas in close proximity to, or downstream from, the Keene plant on the Ashuelot River that are stocked, and future stocking efforts will likely remain focused on upstream areas.

While this segment of the Ashuelot River is not considered to be spawning or rearing habitat for Atlantic salmon, migrating smolts will pass by the plant as they move downstream on their seaward migration. Based on recent annual fall surveys, NHFGD estimates that approximately 5,470 smolts will migrate past the plant. In addition to Atlantic salmon, pre-spawn adult blueback herring (*Alosa aestivalis*) and American shad (*Alosa sapidissma*) are stocked in this general vicinity given the suitable habitat for juveniles of those species. Finally, the availability of forage and overall habitat value in the Ashuelot below the plant is also suitable for adult trout, and as such, this stretch is stocked annually with rainbow (*Salmo gairdneri*) and brown trout (*Salmo trutta*).

The conditions, limitations and monitoring requirements contained in this permit are designed to be protective of all sensitive aquatic species in the Ashuelot River. Accordingly, it is EPA's opinion that adverse impacts to Atlantic salmon EFH have been minimized to the extent they are negligible, and no additional mitigation is warranted. If adverse affects to EFH do occur as a result of this permit action, or if new information changes the basis for this conclusion, then NMFS will be notified and consultation will be re-initiated.

Endangered Species

Section 7 of the Endangered Species Act (16 USC 1531 et seq) and implementing regulations (50 CFR part 402) require EPA to ensure, in consultation with the U.S. Fish and Wildlife Service (USFWS) and/or NMFS, as appropriate, that any action authorized by EPA is not likely to jeopardize the continued existence of any endangered or threatened species, or adversely affect its critical habitat. See also, 40 CFR 122.49(c).

EPA is currently engaged in consultation with USFWS regarding the drawf wedge mussel (*Alasmidonta heterodon*), which resides in multiple locations in the Ashuelot River. Freshwater mussel communities, including the dwarf wedge mussel, have been sighted immediately downstream of the Keene WWTP effluent discharge. An August 2003 report titled, *Freshwater Mussels of the Ashuelot River* (2003 Report), submitted to the USFWS by the consulting firm Biodrawversity, noted that,

> "Results do not indicate that the wastewater treatment plant is affecting the mussel community...All species found at Site 9 [area extending 200 yards from outfall] were present on the right side of the river less than 20 yards downstream of the outfall, meaning that these animals were living almost entirely within the effluent plume. Animals appeared healthy and there was no evidence of mortality. Site 10 is located 700 yards downstream from the outfall and it supported the highest richeness and abundance of all surveys." (p. 8).

Because the 2003 Report was not specifically designed to study the impact of the effluent on the dwarf wedge mussel, USFWS intends to further investigate the potential for the Keene WWTP effluent discharges to negatively impact the community. USFWS plans to conduct a survey of the community and its habitat in the immediate area of the Keene WWTP effluent discharge. USFWS also intends to pursue a dye study to characterize the size and shape of the mixing zone under various flow conditions in order to confirm whether the assumption of complete mixing is correct. At this time, the service has not requested that EPA add any additional requirements or conditions to the Draft Permit.

While EPA is proceeding with the permit reissuance process at this time, EPA may decide that changes to the permit are warranted based on the results of the consultation when it is completed. A reopener provision stating that the permit may be modified or revoked and reissued based on the results of ESA Section 7 consultation with the USFWS has, therefore, been included in the permit.

H. Operation and Maintenance

Regulations regarding proper operation and maintenance are found at 40 CFR § 122.41(e). These regulations require, "that the permittee shall at all times operate and maintain all facilities and systems of treatment and control (and related appurtenances) which are installed or used by

the permittee to achieve compliance with the conditions of the permit." The treatment plant and collection system are included in the definition “facilities and systems of treatment and control”and are therefore subject to proper operation and maintenance requirements.

Similarly, permittees have a “duty to mitigate” pursuant to 40 CFR §122.41(d). This requires the permittees to “take all reasonable steps to minimize or prevent any discharge in violation of the permit which has a reasonable likelihood of adversely affecting human health or the environment.”

General requirements for proper operation and maintenance, and mitigation have been included in Part II of the permit. Specific permit conditions have also been included in Part I.B, I.C and I.D of the Draft Permit. These requirements include reporting of unauthorized discharges including SSOs, maintaining an adequate maintenance staff, performing preventative maintenance, controlling inflow and infiltration to the extent necessary to prevent SSOs and I/I related effluent violations at the wastewater treatment plant, and maintaining alternate power where necessary.

Because Marlborough and Swanzey each own and operate the respective collection systems that discharge to Keene's treatment plant, these municipalities have been included as co-permittees for the specific permit requirements discussed in the paragraph above.

I. Industrial Users (Pretreatment Program)

The permittee is required to administer a pretreatment program based on the authority granted under CWA § 307, 40 CFR §122.44(j) and 40 CFR §403. The Keene Wastewater Treatment Facility pretreatment program received EPA approval on November 6, 1984, and, as a result, appropriate pretreatment program requirements were incorporated into previous permits 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 sludge 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 WWTP's NPDES permit and its sludge use or disposal practices.

By November 1, 2006, the permittee is required to prepare and submit a final technically based local limit report. The report shall incorporate EPA’s December 16, 2005 comments regarding the City’s December 2004 Local Limit Evaluation Report. The Permittee shall carry out the local limit revisions in accordance with EPA’s *Local Limits Development Guidance (July 2004).*

In addition to the requirements described above, the Draft Permit requires the permittee to submit to EPA in writing, within 180 days of the permit's effective date, a description of proposed changes to permittee's pretreatment program deemed necessary to assure conformity with current federal pretreatment regulations. These requirements are included in the Draft Permit to ensure that the pretreatment program is consistent and up-to-date with all pretreatment requirements in effect. Lastly, the permittee must continue to submit, annually on November 1, a pretreatment report detailing the Activities of the program for the twelve month period ending 60 days prior to the due date.

J. Additional Requirements and Conditions

The effluent monitoring requirements have been established to yield data representative of the discharge pursuant to CWA § Section 308(a) and 40 CFR §§ 122.41(j), 122.44(i) and 122.48. The Draft Permit's monitoring frequency for $CBOD_5$, TSS and Ammonia have been decreased in light of the permittee's history of compliance with established limits. This decreased monitoring frequency is consistent with the EPA/NHDES-WD Effluent Monitoring Guidance, which was mutually agreed upon and implemented in July 19, 1999. The Monitoring Guidance is intended to that certain minimum monitoring frequencies are included in all NPDES permits at permit modification and/or reissuance.

As explained in the Whole Effluent Toxicity section, section IV.E., the quarterly WET testing frequency is maintained from the existing permit. Monitoring requirements for Dissolved Oxygen, Total Recoverable Copper, Lead, Zinc and Total Phosphorous have been carried over from the Existing Permit (see following table).

Parameter	Existing Permit		Draft Permit	
	Sampling Frequency	Sample Type	Sampling Frequency	Sample Type
Flow	Continuous	Recorder	Continuous	Recorder
$CBOD_5$	3/Week	24-hr Composite	**2/Week**	24-hr Composite
TSS	3/Week	24-hr Composite	**2/Week**	24-hr Composite
Dissolved Oxygen	Daily	Grab	**Continuous**	**Recorder**
pH	Daily	Grab	Daily	Grab

Escherichia coli	3/Week	Grab	3/Week	Grab
Total Aluminum	Not Required	Not Required	2/Month	24-Hour Composite
Total Ammonia	3/Week	24-Hour Composite	**2/Week**	24-Hour Composite
Total Copper	2/Month	24-Hour Composite	2/Month	24-Hour Composite
Total Lead	2/Month	24-Hour Composite	2/Month	24-Hour Composite
Total Zinc	2/Month	24-hr	2/Month	24-Hour Composite
Tot. Phosphorous April 1st -Oct. 31st	2/Month (year round)	24-Hour Composite	**1/Week** Apr. 1 - Oct. 31	24-Hour Composite
Tot. Phosphorous Nov. 1 - Mar. 31	Not Required	Not Required	**1/Week** Nov. 1 - Mar. 31	24-Hour Composite
Ortho Phosphorous Nov. 1 - Mar. 31	Not Required	Not Required	**1/Week** Nov. 1 - Mar. 31	24-Hour Composite
WET	1/3 Months	24-Hour Composite	1/3 Months[1]	24-Hour Composite

Footnotes:
1. Two species are required in the existing permit for WET tests; Daphnid (*Ceriodaphnia dubia*) and Fathead Minnows (*Pimephales promelas*) One species, Daphnid (*Ceriodaphnia dubia*) is proposed in the Draft Permit requirements for the WET test.

V. Antidegradation

With the exception of limits in Zinc, Lead and Ammonia, the effluent limitations in the draft permit are as, or more, stringent than those found in the existing permit and there has been no change in the outfall location. As discussed in the Zinc, Lead and Ammonia sections of the Fact Sheet, the effluent limits for these metals have been recalculated based on the revised 7Q10 for the Ashuelot River and/or revised water quality criteria. This recalculation has resulted in a slight increase of the pollutants' effluent limits. For the reasons set forth above, the EPA does not believe the water quality of the Ashuelot River will not be adversely affected by the increase of the limits. The State of New Hampshire has also indicated there will be no lowering of water quality and no loss of existing uses. No additional antidegradation review, therefore, is warranted.

VI. State Certification Requirements

EPA may not issue a permit unless the State Water Pollution Control Agency with jurisdiction over the receiving water(s) either certifies that the effluent limitations and/or conditions contained in the permit are stringent enough to assure, among other things, that the discharge will not cause the receiving water to violate NH Standards or waives its right to certify as set forth in 40 CFR §124.53.

Upon public noticing of the draft permit, EPA is formally requesting that the State's certifying authority make a written determination concerning certification. The State will be deemed to have waived its right to certify unless certification is received within 60 days of receipt of this request.

The NHDES-WD is the certifying authority. EPA has discussed this draft permit with the Staff of the Wastewater Engineering Bureau and expects that the draft permit will be certified. Regulations governing state certification are set forth in 40 CFR §§ 124.53 and 124.55.

The State's certification should include the specific conditions necessary to assure compliance with applicable provisions of the Clean Water Act Sections 208(e), 301, 302, 303, 306 and 307 and with appropriate requirements of State law. In addition, the State should provide a statement of the extent to which each condition of the draft permit can be made less stringent without violating the requirements of State law. Since the State's certification is provided prior to permit issuance, any failure by the State to provide this statement waives the State's right to certify or object to any less stringent condition. These less stringent conditions may be established by EPA during the permit issuance process based on information received following the public noticing. If the State believes that any conditions more stringent than those contained in the draft permit are necessary to meet the requirements of either the CWA or State law, the State should include such conditions and, in each case, cite the CWA or State law reference upon which that condition is based. Failure to provide such a citation waives the right to certify as to that condition. The only exception to this is the sludge conditions/requirements implementing Section 405(d) of the CWA are not subject to the Section 401 State Certification requirements. Reviews and appeals of limitations and conditions attributable to State certification shall be made through the applicable procedures of the State and may not be made through the applicable procedures of 40 CFR Part 124.

It should be noted that under CWA § 401, EPA's duty to defer to considerations of state law is intended to prevent EPA from relaxing any requirements, limitations or conditions imposed by state law. Therefore, "[a] State may not condition or deny a certification on the grounds that State law allows a less stringent permit condition." 40 CFR § 124.55(c). In such an instance, the regulation provides that, "The Regional Administrator shall disregard any such certification conditions or denials as waivers of certification." Id. EPA regulations pertaining to permit limits based upon water quality standards and state requirements are contained in 40 CFR § 122.4 (d) and 40 CFR § 122.44(d).

VII. Comment Period, Hearing Requests, Procedures for Final Decisions, and EPA Contact

All persons, including applicants, who wish to comment on any condition of the draft permit 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:

Ms. Jeanne Voorhees
U.S. Environmental Protection Agency
1 Congress Street
Suite 1100 (Mailcode CMP)
Boston, Massachusetts 02114-2023
Telephone: (617) 918-1686
FAX No.: (617) 918-1505

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 issue proposed to be raised in the hearing. A public hearing may be held after at least thirty (30) 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. Permits may be appealed to the Environmental Appeals Board in the manner described at 40 CFR § 124.19.

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.

_____
DATE

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

REFERENCES

ARLAC. 2001. *Ashuelot River Corridor Management Plan*. Prepared by the Ashuelot River Local Advisory Committee with assistance from the Southwest Region Planning Commission and the New Hampshire Department of Environmental Services: Rivers Program. December 2001. Http://www.des.state.nh.us/rivers.

Chapra, Steven C. 1997. *Surface Water-Quality Modeling*. McGraw-Hill Companies, Inc. New York, St. Louis, San Francisco, Auckland, Bogota, Caracas, Lisbon, London, Madrid, Mexico, Milan, Montreal, New Delhi, San Juan, Singapore, Sydney, Tokyo, Toronto.

Dudley, D. 2004. Memo from Dandiel Dudley, P.E., NHDES WWEB to George Berlandi, Jeff Andrews, and Sterg Spanos of NHDES WWEB; Regarding: *7Q10 Calculations for the Ashuelot River Upstream from the Keene POTW*. Dated March 24th, 2004.

Metcalf & Eddy, Inc. (revised by George Tchobanoglous & Frank Burton) 1991. *Wastewater Engineering: Treatment, Disposal, Reuse*. Macraw-Hill, Inc. New York, St. Louis, San Francisco, Auckland, London, Madrid.

Mitchell, D. F., M. Liebman, L. Ramseyer, and B. Card. 2004. In Draft. *Riffles vs Reservoirs-Nutrient Criteria and Downstream Effects.*

Nedeau, E. and S. Werle. 2003. *Freshwater Mussels of the Ashuelot River: Keene to Hinsdale.* Prepared for the USFWS, Concord, New Hampshire.

NHDES. 1999. *Surface Water Quality Regulations.* Chapter 1700, December 10th, 1999. Concord, New Hampshire.

NHDES. 2001/2002. *Water Quality Monitoring Data Collected 2001 and 2002 for the Development of the Ashuelot River Total Maximum Daily Load*. Concord, New Hampshire.

NHDES. 2004. *State of New Hampshire, Section 305(b) and 303(d) Surface Water Quality Report.* NHDES-R-WD-04-6.

NHDES. 2005. *OneStop Data Retrieval at NHDES*. Concord, New Hampshire.

NHVRAP & NHDES. 2002. *New Hampshire Volunteer River Assessment Program. 2002 Ashuelot River Water Quality Report.* NHDES-R-WD-03-20. Concord, New Hampshire.

NHVRAP & NHDES. 2003. *New Hampshire Volunteer River Assessment Program. 2003 Ashuelot River Water Quality Report.* NHDES-R-WD-3-44. Concord, New Hampshire.

NHVRAP & NHDES. 2005. *New Hampshire Volunteer River Assessment Program. 2004 Ashuelot River Water Quality Report.* NHDES-R-WD-05-03. Concord, New Hampshire.

Personal Communication. 2006. Telephone conversation regarding flows accepted at the Keene WWTP from Marlborough and Swanzey between Donna Hanscom, Keene WWTP and Jeanne Voorhees, USEPA; March 22, 2006

Personal Communication. 2006. Telephone conversation regarding 7Q10 recalculation between Dan Dudley, NHDES, and Jeanne Voorhees, USEPA, February 28, 2006.

Thomann, R and J.A. Mueller. 1987. *Principles of Surface Water Quality Modeling and Control* Harper & Row, Publishers. New York, NY.

USEPA. 1986. *Quality Criteria for Water* ("the Gold Book"). Office of Water. Document No. EPA 440/5-86-001. Washington, D.C.

USEPA 1991. Technical Support Document for Water Quality-based Toxics Controls, Document No. EPA/505/2-90-001. Washington, D.C.

USEPA. 1996. *US EPA NPDES Permit Writer's Manual*. Office of Water. Document No. EPA-883-B-96-003. Washington, D.C.

USEPA 1996. *Metal Translator Guidance for Calculating a Total Recoverable Permit Limit from a Dissolved Criterion*. Document No. EPA/823/B96/007. Washington, D.C.

USEPA. 1999. *1999 Update of Ambient Water Quality Criteria for Ammonia*. USEPA, Office of Water, Office of Science and Technology; Washington, D.C. and Office of Research and Development, Mid-Continent Ecology Division; Duluth, Minnesota.

USEPA. 2000. *Ambient Water Quality Criteria Recommendations. Information Supporting the Developement of State and Tribal Nutrietn Criteria; Rivers and Streams in Ecoregion XIVI.* Document No. EPA 822-B-00-022. Office of Water, Office Science and Technology, Health and Ecological Criteria Division. Washington, D.C.

USEPA. 2000. *Nutrient Criteria Technical Guidance Manual: Rivers and Streams.* Document No. EPA-882-B-00-002. Office of Water, Office of Science and Technology. Washington, D.C.

USEPA. 2002. *National Recommended Water Quality Criteria: 2002*. Office of Water, Office of Science and Technology. Document No. EPA-822-R-02-047. Washington, D.C.

USEPA. 2003. *Ambient Water Quality Criteria for Dissolved Oxygen, Water Clarity and Chlorophyll a for the Chesapeake Bay and Its Tidal Tributaries.* USEPA Region III, Chesapeake Bay Program Office and USEPA - Region III, Water Protection Division in coordination with Office of Water, Office of Science and Technology;

USEPA 2004. Federal Register: *Notice of Intent To Re-Evaluate the Aquatic Life Ambient Water Quality Criteria for Ammonia*. July 8, 2004; Volume 69, Number 130 Page 41262-41264.

Wright-Pierce. 1996. *Phosphorous Minimization Study for the Keene Wastewater Treatment Plant, City of Keene, New Hampshire.* Prepared for City of Keene by Wright-Pierce, Engineers and Surveyors, Topsham, Maine.

ATTACHMENT A

WATER QUALITY CRITERIA (WQC) BASED LIMITS

ZINC, COPPER AND LEAD EFFLUENT LIMITS

I. Freshwater Aquatic Criteria for Metals

In accordance with New Hampshire's Surface Quality Regulation Env-Ws 1703.24, criteria values displayed in Table 1703.1 of the NH WQS, are used to calculate the effluent limits for discharge to freshwater with hardness of 25 mg/l or less (see table below). Acute and Chronic limits are calculated as a product of the criterion multiplied by the dilution factor. To express the limit as total recoverable the resulting product is divided by the conversion factor. As follows,

Metal	Freshwater Acute Criteria (ug/l)	Freshwater Chronic Criteria (ug/l)	Conversion Factor
Copper	3.64	2.74	0.960*
Lead	13.88	0.54	1.46203-[(Ln Hardness)(0.145712] = 0.9930*
Zinc	36.2	36.5	0.978 (Acute) 0.986 (Chronic)

* Conversion Factor used for both acute and chronic limits to convert total dissolved to total recoverable.

Given:

Dilution Factor = 2.08
Hardness = 25 mg/l
Acute Limit (Maximum Daily Limit) = (Acute Criterion)(Dilution Factor)/Conversion Factor
Chronic Limit (Average Monthly Limit) =(Chronic Criterion)(Dilution Factor)/ConversionFactor

Copper:
Acute Limit = (3.64 ug/l)(2.08)/0.960 = 7.8867 ug/l rounded to 7.9 ug/l
Chronic Limit= (2.74 ug/l)(2.08)/0.960 = 5.9367 ug/l rounded to 5.9 ug/l

Lead:
Acute Limit = (13.88 ug/l)(2.08)/0.993 = 29.0739 rounded to 29.1 ug/l
Chronic Limit = (0.54 ug.l)(2.08)/0.993 = 1.1311 ug/l rounded to 1.1 ug/l

Zinc:
Acute Limit = (36.2 ug/l) (2.08)/0.978 = 76.9898 ug/l rounded to 77 ug/l
Chronic Limit = (36.5 ug/l) (2.08)/0.986 = 76.9980 ug/l rounded to 77 ug/l

Table 1. Outfall 001 Effluent Characteristics Based on Average Monthly Data

Date	Flow (MGD)	$CBOD_5$ (mg/l)			$CBOD_5$ % Removal	TSS (mg/l)			TSS % Removal	E.coli (thermatol col/100ml)		Ammonia Nitrogen (mg/l)		pH (su)		C-NOEL 7-Day		LC50		Dissolved Oxygen (mg/l)	Total Phosphorus (mg/l)
	MonthlyAverage	MonthlyAverage	Weekly Average	Maximum	MonthlyAverage	MonthlyAver	Weekly Average	Maximum	MonthlyAverage	Geometric Mean	Maximum Daily	MonthlyAverage	Maximum Daily	Minimum	Maximum	Ceriodaph	Pimephl	Ceriodaph	Pimephl	Minimum	MonthlyAverage
Existing Limits	***	25	40	45	85	30	45	50	85	126	406	See Note 1	See Note 1	6.5	8.0	59	59	100	100	7.0	Report
July 2005	2.947	3.11	6.6	6.4	98.0	5.7	25.1	14.6	98.0	15	71	0.7	2.10	6.6	7.1	***	***	***	***	7.0	1.9
June 2005	2.993	4.32	5.0	7.2	96.7	***	***	***	94.8	***	***	***	***	**	***	25	100	38.8	100	***	***
May 2005	3.761	2.93	3.3	3.6	97.6	5.63	6.8	7.60	97.3	3	52	0.95	3.00	6.6	7.1	***	***	***	***	7.4	1.15
Apr. 2005	5.494	4.06	8.4	5.2	95.5	6.18	18.5	9.4	95.8	75	670	3.78	8.40	6.6	7.0	***	***	***	***	7.0	0.55
Mar. 2005	3.497	3.97	3.8	13.10	97.4	7.96	7.4	26.0	96.3	28	8900	2.99	8.00	6.6	7.0	100	100	100	100	7.0	1.60
Feb. 2005	3.244	3.48	4.8	5.0	97.3	6.58	9.8	10.8	96.5	11	30	1.71	4.40	6.7	7.1	***	***	***	***	8.2	1.30
Jan. 2005	3.628	4.23	5.1	6.2	96.5	7.32	11.0	12.6	96.6	43	333	1.88	5.00	6.6	7.1	***	***	***	***	7.4	0.75
Dec. 2004	3.633	4.51	5.0	7.8	97.1	7.08	11.7	14.0	96.8	54	129	2.72	5.90	6.6	7.0	100	100	100	100	7.6	1.05
Nov. 2004	2.860	4.54	5.8	7.5	97.3	7.43	9.7	11.6	97.6	17	70	0.54	1.21	6.7	7.2	***	***	***	***	7.7	2.65
Oct. 2004	3.005	4.05	4.70	6.90	98.2	7.13	8.6	10.6	98.0	19	44	1.56	4.0	6.8	7.2	***	***	***	***	7.3	2.05
Sept. 2004	3.386	3.59	4.4	5.0	97.8	5.26	6.9	11.4	97.8	54	144	0.3	0.51	6.6	7.1	100	100	100	100	7.3	1.70
Aug. 2004	2.693	2.12	2.5	2.90	98.7	3.04	3.9	5.0	99.1	36	124	0.34	0.83	6.7	7.2	***	***	***	***	7.0	2.4
July 2004	2.557	2.91	3.7	4.5	98.2	6.25	10.1	12.4	97.8	13	126	0.39	0.90	6.6	7.2	***	***	***	***	7.0	2.95
June 2004	3.173	3.96	4.5	5.7	97.2	6.4	8.7	10.0	98.0	13	34	1.3	2.8	6.6	7.1	100	100	100	100	7.5	3.4

Date	Flow (MGD)	$CBOD_5$ (mg/l)			$CBOD_5$ % Removal	TSS (mg/l)			TSS % Removal	E.coli (thermatol col/100ml)		Ammonia Nitrogen (mg/l)		pH (su)		C-NOEL 7-Day		LC50		Dissolved Oxygen (mg/l)	Total Phosphorus (mg/l)
	MonthlyAverage	MonthlyAverage	Weekly Average	Maximum	MonthlyAverage	MonthlyAver	Weekly Average	Maximum	MonthlyAverage	Geometric Mean	Maximum Daily	MonthlyAverage	Maximum Daily	Minimum	Maximum	Ceriodaph	Pimephl	Ceriodaph	Pimephl	Minimum	MonthlyAverage
Existing Limits	***	25	40	45	85	30	45	50	85	126	406	See Note 1	See Note 1	6.5	8.0	59	59	100	100	7.0	Report
May 2004	3.985	3.3	4.0	5.1	97.1	3.8	6.2	7.0	98.5	2	60	0.78	1.4	6.6	6.9	***	***	***	***	7.5	3.35
Apr. 2004	4.934	2.89	3.8	4.4	96.8	3.47	8.0	10.4	98.1	11	94	1.86	2.7	6.5	6.8	***	***	***	***	7.5	1.60
Mar. 2004	3.141	3.01	4.0	5.6	97.4	5.01	7.8	8.2	97.9	5	22	3.97	6.10	6.7	7.2	100	100	100	100	8.0	4.20
Feb. 2004	2.704	3.3	3.9	4.7	98.1	5.6	8.1	8.2	98	3	8	7.8	12.1	6.6	7.3	***	***	***	***	8.2	2.55
Jan. 2004	3.369	4.9	6.9	7.8	94.6	6.2	9.5	10.6	96.0	5	40	6.5	10.9	6.7	7.1	***	***	***	***	8.5	2.4
Maximum	5.494	4.9	8.4	13.1	98.7	7.96	25.1	26	99.1	75	8900	7.8	12	6.8	7.3	100	100	100	100	8.5	4.2
Minumum	2.557	2.12	2.5	2.9	94.6	3.04	3.9	5	94.8	2	8	0.3	0.5	6.5	6.8	25	100	39	100	7	0.55
Average	3.421	3.64	4.75	6.03	93	5.89	9.88	11.1	93.0	22.6	608	2.226	4.5	6.6	7.1	88	100	90	100	7.51	2.09

[1]Summer: Average Monthly 2.1 mg/l; Max. Daily 3.1 mg/l; June - October
Winter: Average Monthly 12 mg/l; Max. Daily 18 mg/l; November - May

Table 2. Outfall 001 Effluent Metals Characteristics Based on Average Monthly Data

Date	Total Copper (ug/l)		Total Lead (ug/l)		Total Zinc (ug/l)	
	MonthlyAverage	Maximum Daily	MonthlyAverage	Maximum Daily	MonthlyAverage	Maximum Daily
Existing Limits	6.2	8.2	0.92	23.8	55.7	61.5
July 2005	16.0	17.0	0	0	39.5	40.0
June 2005	21.5	35.3	0	0	47.3	59.0
May 2005	7.4	10.0	0	0	43.0	48.0
Apr. 2005	5.9	6.3	0	0	34.5	43.0
Mar. 2005	7.1	8.3	0	0	42.7	45.0
Feb. 2005	7.5	10.0	0	0	47.0	52.0
Jan. 2005	14.3	17.0	0	0	47.2	59.0
Dec. 2004	14.5	22	0	0	40.5	43.0
Nov. 2004	20.5	21.0	0	0	34.0	36.0
Oct. 2004	18	20	0	0	45.3	51.0
Sept. 2004	16	16	0	0	38.0	43.0
Aug. 2004	19	25	0	0	47.5	51.0
July 2004	37.5	43.0	0	0	49.3	90.0
June 2004	35.5	43.0	0	0	43.5	53.0
May 2004	10.1	11.9	0	0	49.0	53.0
Apr. 2004	9.2	13.0	0	0	33.5	47.0
Mar. 2004	26.5	32.0	0	0	60.3	66.0
Feb. 2004	22	24	0	0	61.8	66.0
Jan. 2004	26	29	<5	<5	37.5	40.0
Maximum	37.5	43	5	5	61.8	90
Minumum	5.9	6.3	0	0	33.5	36
Average	17.6	21.25	0.263	0.263	44.28	51.84