Public Service
of New Hampshire

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The Northeast Utilities System

July 25, 2006

By Express Mail

John King
U.S. Environmental Protection Agency
One Congress Street
Suite 1100
Boston, MA 02114-2023

Re: Redacted Merrimack Station Proposal for Information Collection

Dear Mr. King:

Public Service Company of New Hampshire ("PSNH") appreciates your July 17, 2006 e-mail to Allan Palmer requesting authorization for the United States Environmental Protection Agency ("EPA") to disclose the redacted version of Merrimack Station's Proposal for Information Collection ("PIC") to the Conservation Law Foundation ("CLF"). Mr. Palmer provided this redacted PIC to Sharon Zaya of EPA by e-mail on June 21, 2005. In response to your request, we have reviewed the redacted PIC in a good-faith effort to further narrow the scope of our business confidentiality claims under 40 C.F.R. Part 2, Subpart B, and attach a revised redacted version of the PIC.

Please note that we continue to believe that all of the information in the PIC from which one could obtain or infer information about Merrimack Station's operating procedures and schedule is "confidential business information" ("CBI") under 40 C.F.R. Part 2, Subpart B and New Hampshire law. As just one example, data showing the Station's actual intake flow over time could be used to discern when PSNH schedules outages at the Station's two power-generating units, which is information that could provide our competitors with an inappropriate market advantage. Such matters have the potential to have serious repercussions on the electric system, particularly market pricing, and therefore has the potential to adversely impact electric consumers in addition to PSNH. For these reasons, we expect that EPA will undertake to ensure that PSNH's CBI, and therefore the electric system, is adequately safeguarded.

Please do not hesitate to contact me (603)634-2851 or Alan Palmer (603)634-2439 with any questions or concerns you or your staff may have.

Sincerely,

William H. Smagula
Director – PSNH Generation

Enclosure

cc: Linda T. Landis, Esq., PSNH
Elise N. Zoli, Esq., Goodwin Procter
Allan Palmer, PSNH

PROPOSAL FOR INFORMATION COLLECTION TO ADDRESS COMPLIANCE WITH THE CLEAN WATER ACT § 316(B) PHASE II REGULATIONS AT MERRIMACK STATION, BOW, NEW HAMPSHIRE

APRIL 2005

Proposal for Information Collection To Address Compliance With the Clean Water Act § 316(b) Phase II Regulations at Merrimack Station, Bow, New Hampshire

Prepared for
PUBLIC SERVICE COMPANY OF NEW HAMPSHIRE
PSNH Energy Park
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Manchester, NH 03101

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P-20411.001

April 2005

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1.0 INTRODUCTION

Public Service Company of New Hampshire ("PSNH") owns and operates two separate generating units, Unit 1 and Unit 2 (collectively, the "Units"), known together as "Merrimack Station" in Bow, New Hampshire. The Units are located on the west bank of the Merrimack River ("River") adjacent to Hooksett Pool, approximately 2.9 miles upstream from the Hooksett Dam and Hydroelectric Station and about 2.9 miles downstream from the Garvins Falls Dam. The River in Hooksett Pool is fresh water.

The primary activity of each of these Units is the generation of electric power. Unit 1, which became operational in 1960, generates at a rated capacity of 120 MW, and withdraws once-through cooling water from the waters of the United States (i.e., the River) using a cooling water intake structure ("CWIS") located on the shoreline of Hooksett Pool. Unit 2, which became operational in 1968, generates at a rated capacity of 350 MW, and withdraws once-through cooling water from the River using a separate CWIS located approximately 120 feet downstream from the Unit 1 CWIS. Each Unit has a total design intake flow in excess of 50 million gallons per day ("MGD") and uses at least 25% of the water withdrawn exclusively for cooling purposes. [redacted]

The final regulations implementing §316(b) of the Clean Water Act ("CWA") at existing electricity-generating stations (the "Phase II Regulations"), among other things, establish performance standards for the reduction of impingement mortality by 80 to 95 percent and, under certain circumstances, for the reduction of entrainment by 60 to 90 percent. See 69 Fed. Reg. 41576 (July 9, 2004). The applicability of these performance standards is determined by several factors, including the type of water body from which a plant withdraws cooling water and the plant's capacity utilization factor. Under the Phase II Regulations, applicable performance standards can be met by design and construction technologies, operational measures, restoration measures, or some combination of these compliance alternatives.

The Phase II Regulations require submission of a Proposal for Information Collection ("PIC") in certain circumstances. In a December 30, 2004 letter to PSNH, the United States Environmental Protection Agency ("USEPA") requested submission of the PIC for the Units "as expeditiously as practicable and prior to the start of biological and/or information collection activities, but no later than October 7, 2006." To the extent that the Phase II Regulations apply to the Units, this document constitutes the PIC for the Merrimack Station Units. PSNH reserves its right to supplement or amend this PIC in response to comments from USEPA, the New Hampshire Department of Environmental Services ("NHDES"), or any other governmental agency, results of the activities proposed in this PIC, or any litigation challenging the Phase II Regulations (40 C.F.R. §122.21(r), §122.44(b), §123.25(a)(4) and (36), and §124.10, and 40 C.F.R. Part 125, Subpart J).

2.0 SOURCE WATER BODY DESCRIPTION

The River serves as the source of cooling water for each Unit at Merrimack Station. Merrimack Station is located in the impoundment formed by Hooksett Dam and referred to as Hooksett Pool. Each Unit operates in a once-through cooling water mode by withdrawing cooling water from and discharging it back into Hooksett Pool. Hooksett Pool averages between 6 and 10 feet deep under most flow conditions, and has a surface area of 350 acres and a volume of 130 million cubic feet at full pond elevation (approximately 190 feet at each Unit). The hydraulic retention time of Hooksett Pool is approximately eight hours under Mean Annual Flow (MAF) conditions, and about five days under 7Q10 flow conditions (both of which are less than the criterion of seven days for classification as a reservoir under the Phase II Regulations). Accordingly, for purposes of the Phase II Regulations, the source water body type for each Unit at Merrimack Station is a freshwater river or stream.

Hooksett Dam is one of three hydroelectric facilities in the immediate vicinity of Merrimack Station that are known collectively as the Merrimack River Hydroelectric Project (FERC No. 1893 - NH). In addition to Hooksett Dam, there are the Garvins Falls Dam, which forms the upstream boundary of Hooksett Pool, and the Amoskeag Dam. As noted above, Merrimack Station is 2.9 miles downstream from Garvins Falls Dam, 2.9 miles upstream from the Hooksett Dam, and 10.7 miles upstream from Amoskeag Dam. The Merrimack River Hydroelectric Project is presently being relicensed by the Federal Energy Regulatory Commission ("FERC"), and settlement discussions are underway with New Hampshire regarding its §401 water quality certification. It is expected that bypass and perhaps minimum flows required to be released by each of the three dams in this Project will be modified by the new FERC license to require a more run-of-the-river flow regime in which inflow equals outflow. A run-of-the-river plan is currently being developed by PSNH and the resource agencies for inclusion in the new FERC license. While these facilities presently store and release on an hourly basis under certain lower flow conditions, none of the dams have sufficient storage capacity to modify flows significantly on a daily or longer basis. Consequently, it is expected that both the daily historical flow record that forms the basis of the 100-year MAF estimate and the River flows for the past eight years will continue to be representative of expected future flow conditions, irrespective of any flow modifications FERC may require.

The watershed area for the River at Merrimack Station is approximately 2,535 square miles ("sq. mi.") The River discharge is not gaged at Merrimack Station, but flow is gaged downstream at Goffs Falls in Manchester (drainage area = 3,083 sq. mi., USGS Gage #01092000) and upstream at Franklin Junction in Franklin (drainage area = 1,510 sq. mi., USGS Gage #01081500). In addition, there are several major tributaries flowing into the River between the Goffs Falls gage and the Franklin Junction gage where discharge is or has been gaged (Contoocook River, USGS Gage #01088000; Soucook River, USGS Gage #s 01089000 and 01089100; Suncook River, USGS Gage #01089500; and Piscataquog River, USGS Gage #01091500). Not all of these tributary gages are currently operational. Furthermore, data availability for each gage is generally concurrent with only a portion of the dataset from one or more of the other gages, e.g., several gages may not be operating at the same time. Nonetheless, in our professional opinion, the data available were more than sufficient to create a 100-year (1903-2003) database of either actual or estimated (based on adjacent watershed gaging data) stream flow data for each gaged and ungaged portion of the watershed between Goffs Falls and Franklin Junction. To determine the long-term MAF for the River at Merrimack Station, the 100-year Merrimack River flow dataset for Goffs Falls was adjusted by subtracting out the gaged and estimated non-gaged flows contributed by the watershed between Merrimack Station and Goffs Falls. As discussed in detail below, the long-term MAF at Merrimack Station was then compared to the actual River and Station intake flows observed and recorded for the past eight years (1996-2003) to estimate the percentage of MAF withdrawn by Unit 1 or Unit 2 of Merrimack Station. This adjusted dataset is representative of both current Unit operations and current River flow and therefore appropriate for the analysis in this PIC.

The estimated MAF for the River at Merrimack Station based on the 100-year period of record was 4,551 cfs. It should be noted that according to USGS, the expected error associated with the stream gages used in this analysis ranges between ±5% to greater than ±15%, depending on the specific gage and the time of year (Coakley et al. 2002). The error estimate for the Goffs Falls gage is placed at ±10% during the open-water season and ±15% during the winter months, when ice conditions in the river may affect the accuracy of the gage measurements (Coakley et al. 2002). These potential errors, in combination with unquantifiable errors associated with the MAF estimation methods for gaged and ungaged portions of the watershed between Goffs Falls and Merrimack Station, indicate that the precision associated with the MAF estimate for Merrimack Station listed above would conservatively be estimated at least ±10%. Consequently, the most scientifically credible estimate of River MAF at Merrimack Station based on the 100-year period of record is 4,551 ±455 cfs, or 4,096 to 5,006 cfs.

3.0 COOLING WATER INTAKE STRUCTURE DESCRIPTION

A separate CWIS supplies River water to each generating Unit at Merrimack Station. The north (Unit 1) CWIS is located on the west bank of Hooksett Pool at latitude 43°08'04" and longitude 71°28'04". The south (Unit 2) CWIS is also located on the west bank of Hooksett Pool, approximately 120 feet downstream from the Unit 1 CWIS, at latitude 43°08'30" and longitude 71°28'02". The north (Unit 1) CWIS has two intake pumps, and the south (Unit 2) CWIS also has two intake pumps; however, the intake pumps at Unit 2 are larger than the intake pumps at Unit 1. The CWIS bulkhead for each Unit projects outward into the River from a rip-rap stabilized shoreline approximately 25 to 30 feet.

Each Unit's CWIS has two vertical single entry/exit traveling screens (described below), one servicing each circulating water pump and providing a basic debris and fish handling and return system. A partition wall below the deck inside each CWIS divides the CWIS into two discrete forebays, separating the flow to each pump before it passes through the associated traveling screen. Each forebay opening to the River is covered with a bar rack with a 3-inch clear space (3.5 inch on-center spacing). The bar racks for each unit are located at the outer edge of the CWIS structure, which extends approximately 25 to 30 feet outward into the River, and are inclined inward at an angle of about 9° from the floor of the forebay. Water from the two pumps at each unit merges into a common pipe at a Y-junction within the pump house a short distance past the pumps. The design through-screen velocity of the Unit 1 CWIS is [redacted]; for Unit 2, it is [redacted]

3.1 UNIT 1

The floor of the Unit 1 intake forebay is at elevation [redacted] feet, and the associated bar racks rise upward from that point at an inward angle of [redacted] to an elevation of [redacted] feet [redacted]. The Unit 1 concrete bulkhead wall extends upward from the top of the bar racks at the same angle to a deck elevation of [redacted] feet. A concrete debris barrier wall is located [redacted] from the base of the bar racks and extends the floor of Unit 1 upward by [redacted] to a point that is at elevation [redacted] feet, [redacted] The outer bulkhead wall then extends upward at the same angle to the deck elevation of [redacted]. Therefore, the Unit 1 CWIS withdraws water [redacted]

Each of the two traveling screens at Unit 1 is a FMC Model 45A LinkBelt screen with standard 3/8-inch (0.375-inch) square opening steel mesh panels. The traveling screens rotate periodically when the debris load is light and continuously when the debris load is heavy. Each screen has a single-pressure spray header to wash fish and debris into a trough in the floor of the CWIS deck for return to the river. [redacted]

3.2 UNIT 2

The floor of the Unit 2 intake forebay is at elevation [redacted] feet, and the associated bar racks rise to the full pond elevation for Hooksett Pool of [redacted] feet at an inward angle of [redacted]. The Unit 2 concrete bulkhead wall extends upward from that point to an elevation of [redacted] feet. A concrete debris barrier wall is located [redacted] from the base of the bar racks and extends the floor of Unit 2 upward by [redacted] to a point that is at elevation [redacted] feet, [redacted]. Unlike Unit 1, there is no upper portion of the outer concrete barrier wall at Unit 2. [redacted]

Each of the two traveling screens at Unit 2 is a Rex Chain Belt two-post screen with standard 3/8-inch (0.375-inch) square opening steel mesh panels. The traveling screens rotate periodically when the debris load is light and continuously when the debris load is heavy. Each screen has a single-pressure spray header to wash fish and debris into a trough for return to the river. [redacted]

4.0 COOLING WATER INTAKE SYSTEM DESCRIPTION

As detailed above, a separate CWIS supplies each generating Unit with cooling water. The north (Unit 1) CWIS has two intake pumps, each with a design intake capacity of [redacted] resulting in a combined design intake capacity for both pumps at Unit 1 of [redacted] The south (Unit 2) CWIS also has two intake pumps, each with a design intake capacity of [redacted] and a combined design intake capacity for both circulating water pumps at Unit 2 of [redacted]

While, as USEPA is aware, USGS information on River flow for 2004 is not yet available, the Station has compiled nine years (1996-2004) of monthly actual cooling water intake flow data that is realistically representative of the current and expected future CWIS operations for each Unit, and has used this information (including for year 2004, which is consistent with the prior eight-year period) where appropriate (see Tables 1 and 2). These intake flow data are representative of operating conditions at each Unit [redacted] The observed actual annual cooling water intake flows for the Unit 1 CWIS during the nine-year period of 1996-2004 ranged from [redacted] averaging [redacted] over the nine-year period of record (Table 1). The observed actual annual cooling water intake flows for the Unit 2 CWIS ranged from [redacted] averaging [redacted] over the nine-year period of record (Table 2). Therefore, based on the most recent nine-year period of record, the Unit 1 mean annual intake flow (MAIF) was [redacted], and the Unit 2 MAIF was [redacted]

Actual intake flows were [redacted] lower than design intake flows for Unit 1 (Table 1), and [redacted] lower than design intake flows for Unit 2 (Table 2), over the most recent nine years of operational records at Merrimack Station. [redacted]

Two additional features of each Unit's water distribution system further reduce the actual cooling water withdrawal flows below design intake capacity, but these reductions were not used to calculate the actual flow reductions described above. Approximately [redacted] of the actual intake flow from Unit 1 and [redacted] of the actual intake flow from Unit 2 is used for sluice water flow to carry slag into a settling pond. In addition, during the winter months, when ambient air conditions are often below freezing, approximately [redacted] of heated condenser cooling water from Unit 1 is recirculated back into the intake forebay of Unit 1 for de-icing and tempering. Similarly, for Unit 2, approximately [redacted] of heated condenser cooling water is recirculated back into the intake forebay of Unit 2. The de-icing flow is discharged at a location about [redacted] from the trash racks at an elevation of about [redacted] feet. As a result, Unit 1 design intake flows are reduced by [redacted], and Unit 2 design intake flows are reduced by [redacted] during de-icing operations. Because the Station has not included these two additional flow reductions in its calculations of intake flows, the actual intake flows presented for Unit 1 and Unit 2 in this PIC are even more conservative estimates in that they underestimate the actual flow reductions due to station operations as compared to design flows.

While intake flow data for 2004 were included in the analysis of actual intake flows, since USGS data for River flow for 2004 is not yet available, only eight years of actual intake flow data from 1996-2003 were used for comparison with River MAF. (These eight years of actual intake flow data representing 1996-2003 are virtually identical to the actual intake flows for the past nine years (1996-2004) in terms of average annual use (Tables 1 and 2)). Based on a direct comparison between the eight-year MAF of the River at Merrimack Station (1996-2003) and the concurrent eight-year record of Station cooling water intake flows (1996-2003), the actual intake flow for the Unit 1 CWIS was [redacted] and the Unit 2 CWIS cooling water flow was [redacted] Use of the 1996-2003 MAF and corresponding CWIS flows for each unit is consistent with the Phase II Regulations. (See 69 Fed. Reg. at 41635 "Representative historical data (from a period of time up to 10 years, if available) must be used to make this determination"). Furthermore, the 1996-2003 MAF is within the conservatively estimated 100-year MAF for the River (4,096-5,006 cfs). As a result, we request that the USEPA conclude, based upon the overwhelming weight of the technical evidence, that Units 1 and 2 each withdraw 5% or less of the MAF of the source water body, and therefore are exempted from the entrainment requirements of the Phase II Regulations.

5.0 DESCRIPTION OF PROPOSED AND/OR IMPLEMENTED TECHNOLOGIES, OPERATIONAL MEASURES AND/OR RESTORATION MEASURES

5.1 CURRENTLY IMPLEMENTED TECHNOLOGIES AND OPERATIONAL MEASURES

Operational measures currently implemented at each Unit of Merrimack Station to reduce impingement mortality and entrainment are [redacted] The average flow reduction for Unit 1 over the nine-year period of record was [redacted] compared to the maximum intake design flow (Table 1), while the average flow reduction for Unit 2 over the nine-year period of record was [redacted] compared to the maximum intake design flow (Table 2). The above-described de-icing flows further increase each Unit's flow reductions during the winter months of December through March by [redacted] at Unit 1 and [redacted] at Unit 2. It is important to note again that PSNH has not included these de-icing flows in the calculations presented in Tables 1 or 2. As a result, USEPA should view these flows as providing an even more conservative "buffer" of additional flow reduction when they assess each Unit's current operational measures for compliance with the Phase II Regulations.

5.1.1 Impingement

Operational flow reductions have provided an annual average reduction in impingement mortality of [redacted] for Unit 1 and [redacted] for Unit 2 compared to expected baseline conditions of maximum intake design flows and under the assumptions that [redacted] impingement is not uniform throughout the year, so it will be appropriate to calculate a flow-weighted annual impingement mortality reduction based on the results of the proposed impingement studies described in Section 8.1 below. The most recent monthly impingement data (1976-1977) did not differentiate the collections between Unit 1 and Unit 2 and therefore were not useful as a first-order estimate of the flow-weighted annual impingement mortality at each Unit (see Section 6, below); however, based on the actual timing of operational flow reductions and the historically low monthly impingement rates at the Station, the estimated annual reduction in impingement mortality due to such operational measures (an evaluation of which would be included in any Comprehensive Demonstration Study) is expected to exceed the percentages representing the unweighted flow reductions described above.

5.1.2 Entrainment

As noted above, neither Unit 1 nor Unit 2 at Merrimack Station is subject to the entrainment requirements of the Phase II Regulations.

5.2 PROPOSED TECHNOLOGIES AND OPERATIONAL MEASURES

5.2.1 Impingement

PSNH expects to evaluate three technological options for further reducing impingement mortality at Unit 1 and Unit 2: [redacted]

If appropriate, in accordance with 40 C.F.R. §125.94(a)(5), PSNH may estimate whether the costs of these technological options will be significantly greater than (a) the costs considered by USEPA for a like facility in establishing the applicable performance standards, corrected to the extent necessary to account for errors in USEPA's calculation, or (b) the demonstrable benefits of complying with the applicable performance standards [redacted] If appropriate, PSNH may request a site-specific determination of best technology available for minimizing adverse environmental impacts in accordance with 40 C.F.R. §125.94(a)(5).

USEPA estimated the §316(b) compliance costs for each Unit individually and presented these in Appendix A of the preamble to the final Phase II Regulations (See 69 Fed. Reg. 41670). For the Unit 1 CWIS, USEPA estimated that the annualized compliance cost would be $120,181, the total capital cost would be $808,777, and the total net revenue losses from net construction down time would be $5,399,114 (for both units). For the Unit 2 CWIS, USEPA estimated that the annualized compliance cost would be $218,874, the total capital cost would be $1,524,044, and the total net revenue losses from net construction down time would be $5,399,114 (for both units). The USEPA-estimated annualized 316(b) compliance costs comprise the annualized capital and operation and maintenance ("O&M") using a USEPA design intake flow (See 69 Fed. Reg. 41646). These costs also reflect a USEPA-selected technology of "addition of passive fine-mesh screen system (cylindrical wedgewire) near shoreline with mesh width of 1.75 mm."

5.2.2 Entrainment

As noted above, neither Unit 1 nor Unit 2 of Merrimack Station is subject to the entrainment requirements of the Phase II Regulations.

6.0 HISTORICAL STUDIES CHARACTERIZING IMPINGEMENT MORTALITY AND ENTRAINMENT AND/OR PHYSICAL AND BIOLOGICAL CONDITIONS

6.1 IMPINGEMENT

Existing data from annual impingement reports reveal negligible impingement rates at Merrimack Station during periods of low River flows when the proportional CWIS flow is the greatest and, therefore, impingement would be expected to be most severe (Table 3). For example, according to Merrimack Station's 2003 Annual Fish Impingement Report, submitted to the USEPA and NHDES in December 2004, the average impingement rate for 2003 was 0.04 fish per million cubic feet ("mcf") of actual intake flow (both Unit 1 and Unit 2 combined). As the report notes, "[s]imilar to all previous seasons, this rate is very low by all industry standards even though the data was collected during worst case conditions, i.e., when river flows are less than 900 cfs." Further, the Station has reported that it never experienced anything that can reasonably be construed as a significant impingement episode.

The very low rate of impingement by Merrimack Station is reflected in its permitting history. USEPA eliminated the majority of impingement sampling requirements from the Station's NPDES permit beginning in 1979 when, in a letter dated 8 May 1979 from Leslie A. Carothers, Director to Mr. Warren A. Harvey Vice President of PSNH, it stated that "[a]fter careful analysis, we have concluded that, under present environmental conditions, the location, design, and capacity of the intake structure does reflect the best technology available for minimizing adverse environmental impact as required by Section 316(b) of the Federal Water Pollution Control Act, as amended. The existing intake structure is approved and no further entrainment or impingement monitoring is required at this time." Consistent with USEPA's determination, the current NPDES permit for Merrimack Station requires that 48-hour impingement sampling be conducted only when River flow at the Goffs Falls USGS gage drops below 900 cfs, presumptively due to concerns that impingement rates would increase during low water periods. Merrimack Station impingement monitoring results have been reported annually to USEPA and to NHDES without agency response.

Further, a two year impingement study conducted at Merrimack Station from January 1976 through December 1977 also documented very low annual impingement rates across all months and flows (Table 4, reproduced from Normandeau 1979, Appendix Table E-5). In this study, impingement sampling was conducted for 48 hours per week for 104 consecutive weeks between January 1976 and December 1977. The 1976-77 study report did not differentiate whether the impinged fish came from Unit 1 or Unit 2 screens – all the fish collected on each sampling date were reported for both Units combined. The total number of fish captured in the 1976 impingement collections was 256, representing 20 taxa (Table 4). The total number of fish captured in the 1977 impingement collections was 301, representing 16 taxa (Table 4). Game fish species such as largemouth and smallmouth bass accounted for only 4.7% of the catch by number in 1976 and only 0.7% of the catch by number in 1977. Projections using the observed 1976-1977 impingement collection data (Table 4) and the hours of CWIS pump operations for Unit 1 and Unit 2 (combined) estimated a total annual impingement of 1449 fish in 1976 and 2504 fish in 1977 (Normandeau 1979). The 1977 total annual impingement of 2504 fish was composed primarily of minnow species (74% or 1853 individuals, Normandeau 1979).

Based on the results of the 1976-1977 impingement study, USEPA and NHWSPCC granted a waiver for future impingement monitoring at Unit 1 and Unit 2 with two stipulations (USEPA letter dated 8 May 1979 addressed to PSNH): (1) that impingement monitoring would resume during May and June 1978 to determine if Atlantic salmon smolts were susceptible to impingement, and (2) that sampling would resume during the fall to see if American shad juveniles introduced into Hooksett Pool were susceptible to impingement (Normandeau 1979). Accordingly, impingement monitoring was conducted during the spring and fall of 1978. During the spring downstream salmon migration, no salmon smolts were impinged, and during the fall downstream migration, only one American shad juvenile was collected. This study indicates that American shad juveniles and Atlantic salmon smolts were not impinged in substantial numbers while migrating downstream through Hooksett Pool. No further impingement monitoring requirements were specified as a condition of any of Merrimack Station's subsequent NPDES permits, other than the low flow impingement monitoring described above.

6.2 Entrainment

As noted above, neither Unit 1 nor Unit 2 is subject to the entrainment requirements of the Phase II Regulations. This section discusses historic monitoring solely for informational purposes.

The susceptibility of drifting fish larvae to entrainment at Merrimack Station was first studied using an epibenthic larval trawl to sample in the nearfield portion of Hooksett Pool just in front of the intake structure for Unit 1 and Unit 2. Sampling was conducted by taking tows using a 0.5 m by 1.0 m tucker trawl with a 505 micron mesh nylon net. Duplicate tows were taken in front of the intakes at a weekly interval during the months of June and July of 1975 (Normandeau 1976). In 1976 and 1977, the sampling period was increased to cover the spring period when larval fish were most abundant; weekly duplicate tows were conducted from April through September (Normandeau 1979). No fish eggs were collected during the 1975-1977 study, and the number of fish larvae collected was considered minimal. Sunfish (Centrarchid) larvae were the most frequently collected larvae in this study. No larvae were collected in April, May, August and September in front of the intake structures; sunfish larvae were primarily captured in June and July.

Entrainment sampling was performed again at Merrimack Station during 1978 when water entering the CWIS of Unit 1 was sampled on the diel basis using an ichthyoplankton pump system. Diel entrainment pump samples were collected from 23 May through 27 July, 1978 and encompassed 23 sampling dates (Normandeau 1979). Pumped entrainment sampling generally occurred for 48 continuous hours each week between 23 May and 27 July 1978. An exception to this sample regime occurred between 10 July and 20 July when sampling was suspended due to a pump malfunction. A recessed impeller trash pump rated at 41,000 gallons per hour maximum with 4-inch suction and discharge pipes was used to sample the Unit 1 intake at three depths. The five foot deep Unit 1 intake opening was sampled simultaneously at the top, mid-point and bottom. The three intake pipes were manifolded into one pipe before entering the pump. The pumped water was filtered through a 0.5 meter, 505 micron net suspended in a 55 gallon drum; the net suspended in water helped prevent mutilation of the fish larvae against the mesh by the water flow. The pump rate was calibrated every 24 hours by recording the time required to fill the 55 gallon drum, and converting this figure to liters per second. White sucker, golden shiner, minnows (*Notropis* spp.) and sunfish larvae were the most commonly collected larvae during the 1978 entrainment program at Unit 1. No fish eggs were collected during this pumped entrainment study. Overall, the total number of fish larvae collected during the 1978 pumped entrainment study (261 larvae) was considered to be minimal.

In 1995, nearfield ichthyoplankton tows were taken in Hooksett Pool in the vicinity of Merrimack Station; samples were collected from Merrimack Station's ambient, mixing and thermally affected zone weekly from 10 May through 27 June, 1995 (Normandeau 1996). Larvae of yellow perch and bluegill were first collected when sampling began on 10 May, suggesting that the entrainment season may have begun in late-April or early May 1995, in contrast to prior years when the first larvae were seen in June. As the 1995 study progressed, at least one larva of 13 fish species were collected, with the most abundant species being bluegill, spottail shiner, rainbow smelt and common shiner. The maximum densities of these species observed during 1995 were as follows: 7.2 bluegill larvae per 50 m^3 during the week of 10 May, 2.7 spottail shiner larvae per 50 m^3 during the week of 6 June, 5.3 rainbow smelt larvae per 50 m^3 during the week of 30 May, and 1.5 common shiner per 50 m^3 during the week of 20 June 1995 (Normandeau 1996). No fish eggs were collected during this study, corroborating observations from all prior studies.

6.3 BIOLOGICAL CONDITIONS IN THE SOURCE WATER BODY

Improved water quality due to infrastructure improvements in water treatment made at point source discharges upstream from Merrimack Station (in response to the Federal Water Pollution Control Act) is widely considered to have had a major positive impact on the River's aquatic community as a whole. The fish species assemblage that existed in Hooksett Pool during the 1960's was one that developed when the River was at its most polluted state historically (Normandeau 1979), and fish community changes in the subsequent decades have largely been in response to improved water quality. In addition, these changes also reflect a fish community response to stocking and the introduction of non-native species.

Electrofishing surveys have been performed in Hooksett Pool by consultants for PSNH using consistent and documented methods at the same sampling stations over the past four decades. The fish community sampled in 2004 exhibited significantly ($p<0.05$) greater relative diversity and evenness than in either the 1970's or 1990's, and is therefore currently more robust than was observed at any time in the past 40 years (Table 5). In the 1970's, the electrofishing catch comprised 16 fish species and was dominated by pumpkinseed (53.4%), resulting in a Shannon-Weaver diversity index (Poole 1974) of 1.32 and an evenness of 0.60 (Tables 5 and 6). By 1995, the fish community was represented by 14 species and was co-dominated by spottail shiner (43.6%) and bluegill (41.7%); the Shannon-Weaver diversity index was 1.19 and the evenness was 0.48 (Tables 5 and 6). No statistically significant differences ($p<0.05$) in species diversity were observed between the 1970's and 1995 (Table 5). During the most recent two decades (1995 and 2004), the species composition in Hooksett Pool has continued to change, most likely due to species introductions by the resource agencies and others, and their effects on existing community. For example, pumpkinseed fell from the number one fish captured in the early studies to seventh in abundance in 1995, likely due to increased competition from introduced bluegills. The 2004 fish community sampled by electrofishing comprised 18 species, and exhibited a significantly ($p<0.05$) greater Shannon-Weaver diversity index ($H' = 1.93$) and evenness ($H'/H'_{max} = 0.77$) than in either of the previous two decades sampled (Table 5), with no single or pair of species exhibiting hyper-dominance, as was seen during the 1970's and in 1994 (Table 6). Because hyper-dominance is often correlated with poor water quality, the significant recent (2004) improvements in diversity and evenness in the fish community of Hooksett Pool reveals their response to improved water quality compared to the 1970's or 1995. Spottail shiner remained the most abundant fish in Hooksett Pool in both recent decades, but decreased in relative abundance from 43.6% in 1995 to 28.3% in 2004, as other fish species increased in relative abundance. Largemouth bass was the second most abundant fish in 2004 and comprised more than 11% of the total electrofishing catch. Smallmouth bass have also increased in abundance in 2004 compared to 1995. One reason these two important gamefish have increased in relative abundance may be linked to the increase in the forage base (spottail shiners and alewives) that was observed between 1995 and 2004. Black crappie was collected for the first time in Hooksett Pool during the 2004 study, and rock bass was first collected in 1994 (Table 6). Yellow perch abundance declined after the 1970's, likely as a result of improved water quality, to its present ranking in the recent 2004 electrofishing survey.

7.0 SUMMARY OF RELEVANT CONSULTATIONS WITH FEDERAL, STATE, AND TRIBAL FISH AND WILDLIFE AGENCIES

USEPA already has determined that § 316(b) is satisfied at the two Units comprising Merrimack Station. The Station's existing permit explicitly states that "[i]t has been determined, based on engineering judgment, that the circulating water intake structure presently employs the best technology available for minimizing adverse environmental impact."

PSNH's consultations with Federal and State fish and wildlife agencies, and consultations between these agencies, addressing § 316(b) contributed to this conclusion. Documents relevant to these consultations are summarized in Appendix 1, below. PSNH reserves its right to supplement Appendix 1 in the event it determines that it inadvertently has not referenced a relevant consultation or listed a relevant document; as noted above, PSNH has been operating the Units for more than three decades and has many documents in its files relating to each Unit's operations, and it is possible that it has not located or does not have all relevant documents.

8.0 SAMPLING PLAN FOR NEW FIELD STUDIES

8.1 IMPINGEMENT

PSNH proposes a one-year impingement sampling program for Unit 1 and Unit 2 of Merrimack Station beginning in 2005 because the most recent and comprehensive annual impingement data were obtained during the 1976-1977 study described in Section 6 of this PIC, and because the fish community in the River has changed since then. PSNH may undertake a second year of impingement sampling to verify the results observed during 2005-06 if appropriate. The goal of the proposed program is to estimate the annual total potential mortality of juvenile and adult fish that become impinged on the traveling screens of the Unit 1 and Unit 2 CWISs. The impingement program will be documented in a project-specific Quality Assurance Plan (QAP) consistent with USEPA protocols (USEPA 2001). The QAP will describe the Standard Operating Procedures to be used for the field, laboratory, and data file preparation activities, and is included with this PIC as Appendix 2.

The impingement sampling protocol for each Unit will reflect appropriate peak and off-peak sampling periods of the year, using a design that is consistent with numerous impingement programs both completed or on-going at CWIS's located on freshwater rivers throughout the United States. Weekly impingement sampling will be conducted at each unit separately during the peak period beginning in mid-March and continuing through October. Biweekly impingement sampling will be conducted at each unit during the off-peak period of November through mid-March. Weekly impingement sampling at each unit will consist of collecting one 24-hour sample representing the period 0900 on Monday through 0859 on Tuesday, followed by one six-day sample. Biweekly sampling at each unit will consist of collecting one 24-hour sample representing the period 0900 on Monday through 0859 on Tuesday, followed by one thirteen-day (biweekly) sample. There is no need to collect impingement samples representative of intervals less than 24 hours, because each unit is base-loaded and therefore without the operational flexibility to implement fish conservation measures on a more frequent (diel) basis. This design will provide 33 twenty-four-hour samples and 32 six-day samples representative of the peak impingement period at each unit, and nine 24-hour samples and nine thirteen-day samples representative of impingement during the remaining portion of the year. The 24-hour impingement samples are considered the primary samples, and the "long interval" samples of six or thirteen days are considered secondary samples.

Impingement sampling will be conducted by placing baskets made from the same wire mesh as the traveling screens (3/8 inch square mesh) in the fish and debris return pipes of each of the two units to catch all of the fish and debris washed off of the operating traveling screens in each primary (24-hour) sample. Following collection of each primary sample from each unit, the collection basket will be placed back into service and allowed to sample unattended during the ensuing six-day or thirteen-day period to collect the long interval samples. The following information will be recorded for the primary impingement samples from Unit 1 and from Unit 2: fish species composition and abundance, predominant type and amount (gallons) of debris, and number of circulating water pumps and screens operating. The following environmental parameters will also be recorded at the beginning and end of each sampling interval: mid-depth water temperature, dissolved oxygen concentration, conductivity, and river surface conditions (wave height, wind direction and velocity, water level, cloud cover, and precipitation). Each long interval sample will be processed in the same way as the primary samples; however, only the four migratory species will be enumerated (American shad, Atlantic salmon, alewife, American eel). All data will be subject to a standard and appropriate quality assurance/quality control review including a 10% average outgoing quality level (AOQL) for all field and laboratory measurements, and a 1% AOQL for all data files, computations and reports. Please note, for example, that an AOQL of 1% means that the final data files will be certified through statistical inspection to document that less than one record (line of data) out of every 100 records will be in error. This level of quality meets or exceeds any industry standards for impingement and entrainment studies. Computerized operational data files from each Unit at Merrimack Station will be obtained and used to extrapolate impingement rates based on the actual total circulating water flow through each unit for each sampling period.

Any Atlantic salmon collected through impingement sampling will be handled with great care and released alive if possible. Any dead Atlantic salmon collected through impingement sampling will be identified, measured and frozen. Appropriate agencies will be contacted (NMFS, USFWS) in accordance with the scientific collector's permit.

8.2 ENTRAINMENT

As noted above, neither Unit 1 nor Unit 2 is subject to the entrainment requirements of the Phase II Regulations. Accordingly, no new entrainment studies are proposed.

9.0 LITERATURE CITED

Coakley, M.F., Ward, S.L., Hilgendor, G.S., and Kiah, R.G. 2002. Water resources data, New Hampshire & Vermont Water Year 2001: U.S. Geological Survey Water-Data Report NH-VT-01-1,194p.

Normandeau Associates, Inc. (Normandeau). 1976. Merrimack River Monitoring Program, 1975. Prepared for Public Service Company of New, Manchester, NH. 205pp.

Normandeau. 1979. Merrimack River Monitoring Program Summary Report. A report submitted to the Public Service Company of New Hampshire, Manchester, NH. 227pp.

Normandeau. 1997. Merrimack Station (Bow) Fisheries Study. A report submitted to the Public Service Company of New Hampshire, Manchester, NH. 28pp.

Poole, R.T. 1974. An Introduction to Quantitative Ecology. McGraw-Hill Book Co., New York. 532p.

USEPA. 2001. EPA Requirements for Quality Assurance Project Plans. EPA QA/R-5. EPA/240/B-01/003, March 2001.

Table 1. Monthly actual operational flow reductions for Merrimack Station Unit 1 compared to the design intake flows using the plant records available for either the nine-year period of 1996 through 2004 or the eight-year period of 1996-2003.

	Unit 1 Monthly Average Flow (cfs) or Percentage Flow Reduction (%)												
Nine Years (1996-2004)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
				[redacted]									
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table 2. Monthly actual operational flow reductions for Merrimack Station Unit 2 compared to the design intake flows using the plant records available for either the nine-year period of 1996 through 2004 or the eight-year period of 1996-2003.

	Unit 2 Monthly Average Flow (cfs) or Percentage Flow Reduction (%)												
Nine Years (1996-2004)	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
				[redacted]									
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Table 3. The average fish impingement rates reported for the Merrimack Generating Station (Unit 1 and Unit 2 combined) from 48-hour samples taken during periods of low Merrimack River flows (<900 cfs at Goffs Falls) 1997 through 2003.

	Dates	Total Number of 48 hour samples	Average Impingement Rate per million cu ft.	Total Number of Fish
1997	Aug-Oct	6	1.00	431
1998	Aug-Oct	6	0.89	384
1999	Jul-Sep	10	0.01	9
2000	Sep-Oct	3	0.09	19
2001	Jul-Oct	14	0.03	30
2002	Jul-Oct	14	0.01	12
2003	Jul-Sep	7	0.04	16

Table 4. Number of fish collected in impingement during 48 sampling hours per week at Unit 1 and Unit 2 (combined) of Merrimack Station, Bow, New Hampshire during 1976 and 1977 (Normandeau 1979).

1976	1976	1976	1976	1976	1976	1976	1976	1976	1976	1976	1976	1976	1976
Fish Taxon	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Rainbow smelt					1					1			**2**
Pickerel													**0**
Golden shiner				1	5				1				**7**
Bridle shiner					1								**1**
Common shiner					1	6			1				**8**
Spottail shiner		2	5			2							**9**
Shiners										2			**2**
Fallfish				1		1							**2**
White sucker						4	3	1					**8**
Yellow bullhead		2	3		2								**7**
Brown bullhead	1	1	5	16	32	7	2	9	1				**74**
Tadpole madtom											3	2	**5**
Margined madtom					2					2			**4**
White perch						1	1						**2**
Redbreast sunfish					1	1					1		**3**
Pumpkinseed			5	3	8	1		2	1	13	5		**38**
Sunfish								1	1				**2**
Smallmouth bass		4			1		1	1		1			**8**
Largemouth bass		1								2	1		**4**
Yellow perch		8	9	27	2	9	3	3		5	1		**67**
Unidentified				1		1		1					**3**
All taxa combined	**1**	**18**	**27**	**49**	**56**	**33**	**10**	**18**	**5**	**26**	**11**	**2**	**256**

(continued)

Table 4. (Continued)

1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977	1977
Fish taxon	**January**	**February**	**March**	**April**	**May**	**June**	**July**	**August**	**September**	**October**	**November**	**December**	**Annual**
Rainbow smelt										1			**1**
Pickerel				1									**1**
Golden shiner				9	18	2			1				**30**
Bridled shiner											16	1	**17**
Common shiner	2		2	135					1				**140**
Spottail shiner													**0**
Shiners			1	15	7					2			**25**
Fallfish													**0**
White sucker					2	1		1					**4**
Yellow bullhead				1									**1**
Brown bullhead				6	12	1	1	7	1				**28**
Tadpole madtom	1												**1**
Margined madtom					1								**1**
White perch													**0**
Redbreast sunfish													**0**
Pumpkinseed	2	1	2	10				2	1	1			**19**
Sunfish			1	3		1		1	1				**7**
Smallmouth bass								1		1			**2**
Largemouth bass													**0**
Yellow perch	3		2	10	3	1		3		1			**23**
Unidentified								1					**1**
All taxa combined	**8**	**1**	**8**	**190**	**43**	**6**	**1**	**16**	**5**	**6**	**16**	**1**	**301**

Table 5. Shannon-Weaver diversity and evenness for the fish community sampled by electrofishing during the common time period of August and September 1972-1976, 1995 and 2004 in Hooksett Pool of the Merrimack River.

Statistic	1970's	1995	2004
Number of Fish Species	16	14	18
Aug-Sep Mean CPUE	49.9	133.2	47.9
Shannon-Weaver Diversity (H')[1]	1.32	1.19	1.93
Standard Error of H'	0.17	0.09	0.14
Evenness (H'/H'_{max})[2]	0.60	0.48	0.77

[1]Diversity based on natural logs (ln), adjusted for bias (Poole 1974)
[2]Evenness based on common logs (log_{10})

Table 6. Species composition and relative abundance for the fish community sampled by electrofishing during the common time period of August and September 1972-1976, 1995 and 2004 in Hooksett Pool of the Merrimack River.

1970's			1995			2004		
Species	% Comp[1]	CPUE[1]	Species	% Comp[1]	CPUE[1]	Species	% Comp[1]	CPUE[1]
Pumpkinseed	53.4%	25.81	Spottail shiner	43.6%	58.05	Spottail shiner	28.3%	13.55
Redbreast sunfish	10.8%	5.59	Bluegill	41.7%	55.55	Largemouth bass	20.1%	9.60
Yellow perch	9.8%	4.69	Largemouth bass	4.5%	6.05	Smallmouth bass	11.2%	5.35
Largemouth bass	8.2%	4.24	Redbreast sunfish	4.4%	5.90	Alewife	8.4%	4.00
Smallmouth bass	6.7%	2.97	Common shiner	2.6%	3.50	Bluegill	6.7%	3.20
White sucker	4.3%	2.60	Smallmouth bass	1.1%	1.40	Common shiner	6.5%	3.10
Brown bullhead	1.8%	1.10	Pumpkinseed	0.7%	0.95	Redbreast sunfish	5.5%	2.65
American eel	1.6%	1.08	Rock bass	0.4%	0.50	Fallfish	3.0%	1.45
Fallfish	1.2%	0.50	Fallfish	0.3%	0.45	Golden shiner	2.8%	1.35
Chain pickerel	0.8%	0.38	Golden shiner	0.2%	0.20	White sucker	1.6%	0.75
Golden shiner	0.5%	0.40	White sucker	0.2%	0.20	Eastern silvery minnow	1.5%	0.70
Yellow bullhead	0.4%	0.20	Yellow perch	0.2%	0.20	Pumpkinseed	1.5%	0.70
Johnny darter	0.2%	0.24	Chain pickerel	0.1%	0.10	Yellow perch	1.4%	0.65
Spottail shiner	0.2%	0.07	Tessellated darter	0.1%	0.10	American eel	0.4%	0.20
Margined madtom	0.1%	0.04	Total	100.0%	133.15	Rock bass	0.4%	0.20
Common shiner	0.1%	0.02				Tessellated darter	0.4%	0.20
Total	100.0%	49.93				Chain pickerel	0.3%	0.15
						Black crappie	0.1%	0.05
						Total	100.0%	47.85

[1]CPUE and % species composition derived from the number of fish caught per 1000 ft. electrofishing transect.
CPUE was calculated as the number of individuals per 1,000 foot transect for each month, and monthly values were than averaged to provide a yearly mean CPUE for each species (1995 & 2004).
1970's CPUE values are the average of the monthly (August and September) values for 1972, 1973, 1974, 1975 (Aug. only), and 1976.

APPENDIX 1

Reports and Relevant Agency Correspondence Regarding §316(b) at Merrimack Station

Normandeau Reports

Normandeau Associates, Inc. (Normandeau). 1975. Merrimack River Monitoring Program, 1974. Prepared for Public Service Company of New, Manchester, NH. 211pp.

Normandeau Associates, Inc. (Normandeau). 1976. Merrimack River Monitoring Program, 1975. Prepared for Public Service Company of New, Manchester, NH. 205pp.

Normandeau Associates, Inc. (Normandeau). 1979a. Merrimack River Monitoring Program, 1978. Prepared for Public Service Company of New, Manchester, NH. 179pp.

Normandeau Associates, Inc (Normandeau). 1979b. Merrimack River Monitoring Program Summary Report. A report submitted to the Public Service Company of New Hampshire, Manchester, NH. 227pp.

Relevant Agency Correspondence

3/12/1975 – NHWPCC to USEPA – State certification of draft NPDES permit.

3/27/1975 – USEPA to PSNH – Final NPDES Permit: *Effective through 10/1/1979, with Section 3 that addresses effects of intake structure on fish population, and Section 10a that addresses biological monitoring.*

9/17/1975 – USEPA to PSNH: *Comments on scope of work for biological monitoring.*

1/26/1979 – PSNH to NHWSPCC – Permit Modifications from Jan 12 Meeting: *Outlines monitoring plan for juvenile American Shad and Atlantic salmon smolts to be conducted based on presence of "significant numbers" present in Hooksett Pool*

2/7/1979 – NHWSPCC to PSNH – NPDES Permit Modifications: *Addresses "significant numbers" wording.*

2/9/1979 – NHF&G to PSNH – Comments on Permit Modifications: *Addresses wording regarding numbers of shad/salmon.*

1/26/1979 – PSNH to USEPA – Permit Reapplication and Modifications: *Conditions impingement monitoring for shad and salmon on "significant numbers" being present*

6/25/1979 – USEPA to PSNH –Final NPDES Permit: *Effective through 10/1/198, with Section 5A that addresses shad and salmon monitoring.*

3/8/1985 – NHF&G to USEPA – Comments on draft NPDES permit: *Due to significant entrainment mortalities of juvenile shad, recommends impingement monitoring for salmon.*

9/30/1985 – USEPA to PSNH – Final NPDES Permit: *Section 5A addresses impingement monitoring for clupeids (from September 15 to October 31) and salmon smolt (April 15 to June 15); Section 5B addresses pump entrainment monitoring for shad (June 15 to July 15 if "significant numbers" present).*

7/29/1991 – NHF&G to NHDES – Review of draft NPDES permit: *Cites 1987 permit amendment requiring impingement monitoring when flows at Garvin's Falls Station drop below 900 cfs at any time from July through October, and recommends monitoring annually from July 1 to October 15.*

8/26/91 – NHWSPCC/NHF&G to USEPA – Comments on draft NPDES permit: *Discusses permit language relative to impingement monitoring and pump entrainment monitoring (shad and salmon).*

12/5/1991 – USEPA Fact Sheet: *Discusses §316b.*

2/18/1992 – PSNH to USEPA – Comments on draft NPDES permit – *Proposes retaining existing permit condition requiring impingement monitoring when flows at Garvin's Falls Station drop below 900 cfs at any time from July through October, with addition that NHF&G could require weekly impingement monitoring when it is determined that "significant numbers" of juvenile clupeids are likely to pass Merrimack Station.*

6/30/1992 – USEPA to PSNH - Final NPDES Permit: *Section 10b1 requires impingement monitoring when flow at Garvin's Falls drops below 900 cfs (July 1 to October 15); Section 10b2 requires reporting of "extraordinary impingement events," which are defined as "an event when 50 or more fish at any one time, of any size or species, are either distressed or killed as a result of impingement"; Section 10c requires clupeid ichthyoplankton pump entrainment monitoring from June 15 to July 15 when significant numbers of upstream migrating clupeids pass Hooksett Dam.*

9/30/1997 – PSNH to USFWS – Extraordinary impingement event at Merrimack Station

10/3/1997 – PSNH to NHF&G - Extraordinary impingement event at Merrimack Station

10/7/1997 – PSNH to NHF&G - Extraordinary impingement event at Merrimack Station

11/4/1997 – PSNH to NHF&G - Extraordinary impingement event at Merrimack Station

3/19/98 – PSNH to USEPA – Annual Fish Impingement Report (1997)

3/2/99 – PSNH to USEPA – Annual Fish Impingement Report (1998)

3/13/00 – PSNH to USEPA – Annual Fish Impingement Report (1999)

11/30/2001 – PSNH to USEPA – Annual Fish Impingement Report (2000)

12/20/02 – PSNH to USEPA – Annual Fish Impingement Report (2001)

12/18/03 – PSNH to USEPA- Annual Fish Impingement Report (2002)

12/27/2004 – PSNH to USEPA – Annual Fish Impingement Report (2003)

12/30/2004 –USEPA to PSNH: Section 308 letter describing §316(b) supplemental information requirements under Phase II Regulations.

APPENDIX 2

Merrimack Station 2005 Impingement Monitoring Quality Assurance Plan and Standard Operating Procedures

April 2005