Admin #
187

(83)

PSNH

MAR 0 4 93

March 1, 1993

Public Service of New Hampshire

U. S. Environmental Protection Agency
Region I
Wastewater Management Section
JFK Federal Building
Boston, MA 02203-2211

ATTN: Mr. Nicholas W. Prodany, Mail Code: WMN
Environmental Engineer

SUBJECT: Merrimack Station; Bow, NH
Permit No. NH0001465

Dear Mr. Prodany:

On December 1, 1992, PSNH submitted a draft Phase I Preliminary Report on the biological and hydrological investigation of the thermal discharge at Merrimack Station in Bow, NH. The findings of the report were discussed at length with the Technical Advisory Committee (TAC) on January 8 and 15, 1993. During the meetings, three specific issues were identified for further consideration. In accordance with Part I.A.18.a. of the NPDES permit, PSNH has developed the attached Phase II scope of work to investigate each issue. The document will be finalized following TAC review and incorporated as a new Section 7.0 of the Phase I Preliminary Report.

The field studies will be conducted in 1993 and 1994. A draft final report will be submitted by February 1, 1995. The information will allow the TAC to determine if additional temperature restrictions are necessary to "control the discharge from the cooling water canal into the river" per Part I.A.19. of the permit.

Please distribute this scope of work to the remaining TAC members. Comments should be directed to Allan Palmer.

Very truly yours,

DR Brown

Dennis R. Brown
Director of Fossil/Hydro Production

agp\lm\3193USEPA

cc: H. E. Keyes
J. B. Lander
A. G. Palmer

7.0 BIOLOGICAL AND HYDROLOGICAL WORK SCOPE

Part I.18.a of the NPDES Permit for Merrimack Station requires that PSNH submit to the TAC:

> **"A preliminary report summarizing the information required in Part I.A.17.g. and a projection of the biological and hydrological work to be accomplished during the Summer of 1993, on March 1, 1993."**

A draft preliminary report was submitted to the TAC on December 1, 1992. On January 8 and 15, 1993 representatives of PSNH and its consultant met with the TAC to discuss the assessments contained in the draft preliminary report and to identify any additional studies that would be required to address the issues raised in Part I.17. of the NPDES permit. During the January 15 TAC meeting three studies were identified that should be completed during 1993-1994. The studies identified include:

1. An assessment of the effects of thermal inputs from Merrimack Station on the potential duration of the anadromous fish migration season.

2. An assessment of the potential for entrainment of yellow perch larvae in the thermal plume at Merrimack Station.

3. Assessment of the abundance of yellow perch in the Hooksett Pool relative to their historic abundance and collection of additional information on the on the spatial distribution of target fish species populations in the Hooksett Pool in relation to the portions of those populations in the present discharge canal.

This section presents the scopes of work for the above studies (in fulfillment of the requirements of Part I.18.a.). Each scope of work presents the objective of the subject study; a summary of the background rationale for the study; and a description of the approach to be followed in conducting the study. A draft final report on the results of these studies will be submitted to the TAC not later than February 1, 1995.

STUDY 1. ASSESS EFFECTS OF THERMAL INPUTS ON DURATION OF MIGRATION SEASON

Objective: Assess the effects of station operation on the normal pattern of seasonal warming in areas downstream from Merrimack Station. Determine if artificially accelerated warming will prematurely impede fish migrations.

Background: USFWS expressed a concern that operation of the station will advance the onset of temperatures that would result in cessation of upstream migration by anadromous fish. Although there was general agreement that an adequate zone of passage for anadromous fish is present at low flows (see Section 4), they observed that under higher flows more typical of the shad migration season temperature stratification may be less pronounced. They also observed that spill over the flashboards at Hooksett dam could result in the warmest water being transported downstream. The persistence of elevated temperatures in combination with thermally mixed conditions downstream (i.e., in Amoskeag Pool) may prematurely curtail upstream migration. USFWS requested that PSNH provide an assessment of how much earlier in the migration season temperatures occur that may impede upstream migration. NHDES requested that a similar analysis be conducted for the fall (downstream) migration season.

Approach: Water temperature data suitable for an assessment of effects of station operation on areas downstream from Hooksett dam are generally not available in published reports. PSNH proposes to collect field data sufficient for calibration and validation of a temperature model (e.g., USFWS' Instream Water Temperature Model; Theurer, et al. 1984). The model will be used to assess the effect of operation of Merrimack Station on "mixed" temperatures between Hooksett Hydro at Amoskeag Station. The calibrated model will be used to simulate downstream temperatures with and without thermal inputs from Merrimack Station. Simulation results will then be used in conjunction with historic ambient temperature data for Station N-10 and river flow information to assess the effects of station operation on the occurrence of river temperatures at Amoskeag that could potentially impede migration.

Selection of the model to be used will be the responsibility of PSNH's consultant. The model will be able to simulate the effects of solar radiation, meteorological conditions (e.g., weekly or monthly average air temperature, relative humidity, cloud cover, wind velocity) and hydrologic conditions (e.g., transport related to flow and channel geometry) on water temperature with distance downstream. It is expected that monthly average meteorological conditions will be used as simulation input data. PSNH's consultant will also be responsible for specifying the locations and methods to be used for collection of water temperature and meteorological information to be used in model calibration. It is expected that water temperature information will be collected at a minimum of two points below the Hooksett dam.

One monitoring location will be at Amoskeag dam, the other will be at a point downstream from Hooksett dam where mixed conditions would be expected.

The response variable of interest in the simulation will be mean daily water temperature at Amoskeag. Simulations will be conducted over a range of flows representative of those that occur during the migration season and at two or more levels of plant thermal output (corresponding, for example, to "ambient" conditions of 0 MW output and the maximum output of 440 MW or, where applicable, the presently proposed summertime maximum of 370 MW). The simulation output will be used to develop a response function relating the average temperature that would be expected to occur at Amoskeag to river flow and ambient temperatures at Station N-10 (e.g., 12, 16, 20 and 24°C). A separate response function will be generated for each month during the migration season and each level of plant output.

The response functions generated by the modelling exercise will be applied to historic data on daily river flow (from USGS gage data) and daily average ambient temperatures upstream from Merrimack Station (from PSNH monitoring for Station N-10) to predict the time series of temperatures at Amoskeag that would have occurred had Merrimack operated continuously at a specified level of thermal output. The time series data for each output level will be plotted to show the timing of occurrence of temperatures potentially unfavorable for migration. Time series will be developed for the periods May 1 through June 30 (shad and alewife upstream migration) and September 1 through October 31 (juvenile clupeid downstream migration). Ten years of time series information will be developed (1981-1990). The median time at which temperatures unfavorable for migration occur will be determined for ambient conditions and each level of station operation. A temperature-duration analysis of the ten year period of record will also be prepared for each migration period. The predicted temperature-duration curve for Amoskeag assuming that Merrimack Station was not operating will be compared with the predicted temperature-duration curve assuming that Merrimack Station was operating continuously at a specified level. The duration analysis will provide information on the number of additional days (on average) that unfavorable temperatures would occur as a result of station operation.

Assessment of the results temperature time series analysis will require development of criteria for the level and duration of temperatures that are likely to curtail or temporarily halt migration. For example, one or two days of temperatures above 24°C is not likely to completely curtail shad migration while a week of such temperatures would likely result in most shad stopping to spawn by the end of that

period. In such an instance it may be more appropriate use the 7-day moving average temperature at Amoskeag to determine the time at which migration would be curtailed. PSNH and its consultant will consult with USFWS and NHFGD to determine appropriate criteria for determining the end of the migration period.

STUDY 2. POTENTIAL FOR ENTRAINMENT OF YELLOW PERCH LARVAE IN THE THERMAL PLUME

Objective: Assess potential entrainment of yellow perch larvae in Merrimack Station thermal plume. Describe the timing, duration and temporal abundance pattern of larval perch presence in the Hooksett Pool. Describe spatial distribution pattern of perch larvae in the Hooksett Pool relative to the Merrimack Station thermal discharge.

Background: Yellow perch larvae may be subject to entrainment into the Merrimack Station thermal plume. If so, it may be necessary to establish restrictions on maximum temperature and ΔT of the station discharge for their protection. Existing data are not sufficient to determine whether larval perch are presently subjected to entrainment in the thermal plume. If larval perch are being entrained, it is desirable to know both the times/ambient temperatures at which they are likely to occur and their density in the plume area relative to their densities elsewhere in the Hooksett Pool in order to assess the proportion of the population subject to entrainment in the plume when potentially lethal temperatures may occur.

Approach: Ichthyoplankton samples will be collected weekly during May and June using drift nets. Three locations in each of three areas in the Hooksett Pool will be sampled. The sampling areas represent the ambient zone upstream from the station (vicinity of Station N-10), the immediate area of the thermal plume (vicinity of Stations S-2 to S-3), and the thermally affected zone (vicinity of Stations S-19 to S-20). In each sampling area nets will be set at a mid-stream location and approximately 30-40 m from each bank. At each location samples will be collected at two depths, near-surface (approximately 0.2 m below the surface) and near-bottom (approximately 1.5-2.0 m depth).

Drift nets will be 50 cm diameter opening 505 µm (or smaller) mesh nitex with a length-to-width ratio of at least 4:1. A propeller-type flow meter (e.g., General Oceanics model 2030R) will be placed slightly off-center in the mouth of each net to allow calculation of the volume of water filtered.

On each sampling occasion nets will be fished for a 15-30 minute period to assure a minimum filtered volume of 50 m^3. Water temperature will be measured at the depth at which each net is fished at each location. If debris loads are high, sample duration will be shortened sufficiently to avoid net clogging and two or more reduced-volume subsamples will be composited to provide a sample meeting the minimum volume criterion. Samples will be preserved initially in 5-10% buffered formalin (circumneutral pH). Sample container volume will be minimized to the extent possible, consistent with adequate sample preservation. Sample containers will be labelled internally and externally and returned to the laboratory for processing.

Prior to sorting samples will be placed in a sieve to drain off preservative and rinsed. Samples will be sorted using appropriate lighting and magnification. Fish eggs and larvae will be removed from the sampled and preserved in fresh 3-5% buffered formalin pending identification. All remaining sample material will be returned to the sample container following sorting and fresh preservative will be added. Following initial sorting, three randomly selected subsamples from each weekly sampling will be re-sorted. If additional fish eggs and larvae from the re-sorted samples amount to 15 percent (average of three percentages) of the total from the original and re-sorted samples, or if any one re-sorted sample contains more than 25 percent of the total for that sample, all samples collected during that week will be re-sorted. Fish eggs and larvae will be identified to species where possible. A collection of reference specimens will be prepared and submitted to independent verification.

Estimated densities of eggs and larvae by species will be calculated for each sample based on the volume of water filtered. At a minimum, the following analyses of yellow perch larval density data will be conducted:

> A factorial analysis of variance (using log-transformed data, if appropriate) with Area, Location, Depth and Sample Date as factors. Significance tests of the effects of Area, Depth and the Depth x Area interaction will be of primary interest.
>
> An analysis of the correlation between water temperature and abundance of larval perch.

The analysis of variance will be used to describe the spatial distribution of larval yellow perch. The null hypothesis in this analysis is that perch larvae are uniformly distributed spatially (i.e., with respect to Area, Location and/or Depth). Tests of significance will be at $\alpha=0.05$. Interpretation of the results will allow determination of whether perch larvae are more abundant outside areas immediately affected by the thermal discharge due either location in the Hooksett Pool or occurrence in deeper water that is less affected by the discharge. Determination of the water temperatures at which larval perch are most abundant will provide an indication as to whether they will potentially be exposed to plume temperatures outside their likely tolerance range. The findings relative to spatial and temporal distribution of larvae will determine the need for establishing seasonal restrictions on maximum temperature or maximum ΔT of the Merrimack Station discharge.

STUDY 3. INDIGENOUS FISH COMMUNITY ABUNDANCE AND DISTRIBUTION

Objective: 1. Compare present abundances of yellow perch with abundances observed during the 1970's. 2.) Determine the times at which target species are present in the discharge canal and assess whether the numbers in the canal represent a "significant" portion of the Hooksett Pool population.

Background: 1. There was a declining trend in abundance of yellow perch in fyke net catches during the 1970's while no trend in abundance of other target species was indicated. The observed pattern in perch abundance did not appear to be directly related to start-up of Merrimack Unit 2 and may have been an artifact of high variability in recruitment known to occur naturally in perch populations. Because perch was identified as a species that could potentially be affected by the station's thermal discharge (through larval entrainment), information on the present abundance of perch will provide some insight into whether the population has remained stable since the 1970's.

2. Although there was no fish sampling data available for the present discharge canal at Merrimack Station, data for the old canal indicated that a substantial proportion of the Hooksett Pool population of some species could potentially be present in thermally enriched areas when conditions were favorable. PSNH believes that further information on the proportion of each target species population using the present discharge canal is necessary.

Approach: The fyke netting program undertaken by NAI during 1972-1978 will be repeated in 1994 to provide fish community composition and target species abundance information. In addition, two fyke netting locations will be established in the discharge canal. Boat electrofishing will also be conducted in the discharge canal and at locations sampled by NAI during 1972-1976. Sampling will be conducted monthly from late May through October and seasonally during late fall (late November - mid-December, 1993) and late winter (late March - early April, 1994), ice conditions permitting, for a total of 8 sampling periods.

Fyke netting will be conducted at four locations in the river (N-10-east, N-10-west, S-2-west and S-3-east) and at two locations in the canal (upstream and downstream from the PSM's). At each location nets will be set twice during a one-week period for two days per set for a total sampling effort of 24 net-nights per sampling period. Electrofishing will be conducted by fishing 300 m sections along both banks at five locations in the river (N-9 to N-10, N-5 to N-6, S-0 to S-1, S-4 to S-5 and S-17 to S-18). In addition electrofishing will be conducted in the old canal, and above and below the PSM's in the discharge canal. Captured fish will be identified, weighed, measured, and released. Water temperature will be measured 30 cm below surface and near the bottom at all fyke net locations and at the mid-point of each electrofishing section.

Fyke netting catch-per-unit-effort (CPUE) data for yellow perch species will be compared with CPUE data collected by Normandeau Associates during the 1970's.

Both fyke netting and electrofishing data will be used to develop an assessment of relative abundance of target species between the canal and the sampling stations located in the river. An assessment similar to that used in Section 6.0 will be used to determine whether significant portions of the populations of target species occur in the present canal.

Temperature data will be used to assess whether or not a correlation can be established between fish relative abundance and water temperature both in the canal and in the river. The results of this assessment will be used to determine whether fish using the canal are being exposed to temperatures outside the range that they would normally experience in the river. When considered in conjunction with the assessment of the proportions of the populations present in the canal, this information will further define the risk to the target populations resulting from exposure to elevated temperatures in the canal.

16. The permittee shall propose to the TAC a program and a schedule, for review and confirmation, which resolves the issues identified in Sub-part 17, below.

    a. The TAC may accept, reject, or modify the proposed program and schedule. After acceptance of the program and schedule by the TAC, the program will be submitted to the Regional Administrator and the Director for approval. Upon approval, the proposed program and schedule become enforceable elements of this permit.

    b. Annually after the effective date of this permit, the permittee may propose changes to the approved biological and hydrological programs to the Regional Administrator and the Director - (a proposed modified program for the calendar year of 1993 must be submitted prior to January 1, 1993, for review and acceptance by the TAC). After the TAC acceptance, and upon the approval of the Regional Administrator and the Director, the proposed modified program(s) will become an enforceable element of this permit.

    c. All biological and hydrological programs will be under the guidance of the TAC; i.e., review of the proposed programs, analytical protocols, and analysis of data. Based upon its conclusions, the TAC will make recommendations for modification(s) of the permit to EPA and the State to ensure protection of the aquatic community. Biological and hydrological study reports shall be submitted on a semi-annual basis with an annual report summarizing the previous year's information and conclusions.

17. Within 90 days after the effective date of the permit, the permittee shall schedule and conduct a planning meeting with the technical advisory committee. The primary objective of this meeting is the design, development and implementation of an experimental program to resolve the following issues:

    a. Determine the seasons at which the anadromous fish will migrate and the temperatures that would affect/impede this migration and life cycle temperature requirements related to each species.

    b. Determination of the thermal plume-configuration in the river and its effect(s): 1) on anadromous fish during the migration seasons and 2) upon indigenous fish under low water conditions.

c. Determination of a seasonal T_{max} at the point of discharge from the canal into the river, that would protect the anadromous and indigenous fish.

d. Determine, if found to be necessary, a summer Delta-T (downstream temperature minus upstream temperature) that would protect the anadromous and indigenous fish from artificially-heated river water that would be injurious to the aquatic community.

e. Determination of a maximum "Delta-T" (discharge temperature minus intake temperature) at the head of the canal due to a major plant/condenser shutdown. (Note: This is the maximum temperature excursion expected in the canal during an abrupt shutdown of the power plant during the winter.)

f. Assess the resident fish population in the cooling-water canal, and determine if this population is a significant portion of the local fishery and must be protected. If the resident fish require protection, recommendations are to be made as to the type of physical or operational improvements are required.

g. Assess the existing historical chemical, thermal, and biological data and determine the scope of new data that must be obtained to augment the existing data base for these studies.

h. Provide copies of a written agenda and work scope to accomplish the above objectives to each TAC member approximately 2 weeks prior to the above planning meeting. The TAC may approve, modify, or disapprove the proposed work scope in a formal meeting.

18. The permittee shall submit the following reports to the TAC for their approval unless the date(s) is extended by the Regional Administrator and the Director after recommendation by the TAC:

a. A preliminary report summarizing the information required in Part I.A.17.g. and a projection of the biological and hydrological work to be accomplished during the Summer of 1993, on March 1, 1993.

b. A draft final report on March 1, 1994.

19. Based on the results of the final report, this permit may be reopened (40 CFR 122.62) to define a T_{max} or "Delta-T" or any other parameter required to control the discharge from the cooling water canal into the river.

20. Assuming that the cooling water canal discharge temperature must be reduced by some amount, conduct a cost/benefit study for the appropriate techniques to lower the cooling water canal discharge-temperature by 2, 4, 6, etc. degrees F. This systems-study will be submitted within six (6) months of the submittal date of the final report to the TAC.

B. MONITORING AND REPORTING

1. Reporting

Monitoring results obtained during the previous month shall be summarized for each month and reported on separate Discharge Monitoring Report Form(s) postmarked no later than the 15th day of the month following the completed reporting period.

Duplicate signed copies of these, and all other reports required herein, shall be submitted to the Director and the State at the following addresses:

Environmental Protection Agency
NPDES Program Operations Section
P.O. Box 8127
Boston, MA 02114

The state agency is:

Department of Environmental Services
Water Supply & Pollution Control Division
Permits and Compliance Section
Hazen Drive, P.O. Box 95
Concord, New Hampshire 03301

C. STATE PERMIT CONDITIONS

1. The permittee shall comply with the following conditions which are included as State Certification requirements:

a. The pH for class B waters is 6.5-8.0 S.U. or as naturally occurs in the receiving water. The 6.5-8.0 S.U. range must be achieved in the final effluent unless the permittee can demonstrate to the Division: 1) that the range should be widened due to naturally occurring conditions in the