Admin #195 (93)

United States Department of the Interior

FISH AND WILDLIFE SERVICE

300 Westgate Center Drive
Hadley, MA 01035-9589

In Reply Refer To:
FWS/Region 5/ES

☐ ORIGINAL

DEC 20 2006

2006 DEC 26 A 10:03

OFFICE OF THE SECRETARY

Magalie Roman Salas, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

P-1893-042

Dear Ms. Salas:

Enclosed for filing are eight copies of the Department of the Interior's (Department) Prescription for Fishways for the Merrimack River Project (Project). The Administrative Record in support of this Prescription for Fishways was filed with the Federal Energy Regulatory Commission (FERC) on July 12, 2006.

We have submitted hard copies of the Modified Prescription for Fishways with the Public Service Company of New Hampshire (PSNH). We have also distributed copies to American Whitewater Affiliation, which intervened in the Department's proceedings on PSNH's request for a Trial Type Hearing and submittal of its Alternative Fishway Prescription. We have distributed this cover letter to the remainder on FERC's Service List for the Project.

An additional copy of this letter is enclosed so that you may file stamp and return it in the enclosed self-addressed envelope. If you have any questions, please contact Michael G. Thabault, Assistant Regional Director, Ecological Services, at 413-253-8304, or Alex Hoar, Ecological Services, at 413-253-8631. Thank you for your cooperation in filing these documents.

Sincerely,

Acting

Marvin E. Moriarty
Regional Director

Enclosures

cc: FERC Service List

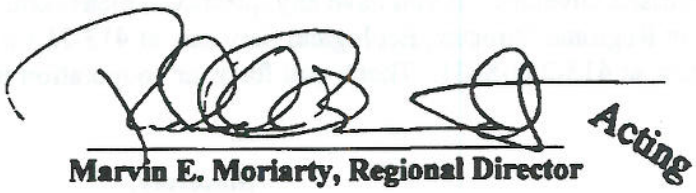
ORIGINAL

BEFORE THE
UNITED STATES OF AMERICA
FEDERAL ENERGY REGULATORY COMMISSION

Public Service of New Hampshire, Applicant	)	**Merrimack River Project**
	)	**Merrimack River**
	)	**Hillsborough and Merrimack**
	)	**Counties**
	)	**New Hampshire**
	)	**FERC No. 1893-042**

UNITED STATES DEPARTMENT OF THE INTERIOR'S
DECISION DOCUMENT,
PRESCRIPTION FOR FISHWAYS
PURSUANT TO SECTION 18 OF THE FEDERAL POWER ACT

Approved this 20 day of Dec., 2006, by:



Marvin E. Moriarty, Regional Director

United States Department of the Interior
Fish and Wildlife Service
300 Westgate Center Drive
Hadley, MA 01035-9589

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UNITED STATES DEPARTMENT OF THE INTERIOR'S DECISION DOCUMENT, PRESCRIPTIONS FOR FISHWAYS PURSUANT TO SECTION 18 OF THE FEDERAL POWER ACT

1. Introduction

The United States Department of the Interior (Department) hereby submits its Prescription for Fishways for the Merrimack River Project[1] (Project), pursuant to Section 18 of the Federal Power Act, as amended. The Department is submitting this Decision Document to the Federal Energy Regulatory Commission. The Department's supporting Administrative Record for this prescription was filed with the Commission on July 12, 2006.

The Department developed its Prescription for Fishways through a review process that included consultation among fisheries biologists and fishway engineers from the Department's U.S. Fish and Wildlife Service (Service) and the New Hampshire Fish and Game Department (NHFGD), as well as the applicant, Public Service of New Hampshire (PSNH), and the American Whitewater Affiliation.

During the development of the Prescription for Fishways for the Project, the procedures for prescribing fishways under Section 18 of the Federal Power Act were modified by provisions of the Energy Policy Act of 2005 (EPAct).[2] The Department's Preliminary Fishway Prescription (PFP) was submitted under provisions of the Policy for Review of Mandatory Conditions Developed by the Departments of the Interior and Commerce in the Context of Hydropower Licensing (MCRP).[3] Pursuant to this process, the Department solicited comments on its PFP and would have addressed them in this Prescription for Fishways. The EPAct, however, required the Department to develop new regulations and procedures for fishway prescriptions. These regulations afford two new rights to participants in any licensing proceeding in which the Department exercises its mandatory authority under the Federal Power Act: an opportunity for Trial-Type Hearing (TTH) on material issues of disputed fact, and an opportunity to file Alternative Fishway Prescriptions (AFP) for consideration by the Department. The TTH offers applicants the opportunity to challenge material facts that the Department relied on for its PFP, while the AFP provides applicants the opportunity to propose an alternative to the Department's PFP.

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1 The Merrimack River Project includes the Amoskeag, Hooksett and Garvins Falls Dams and hydroelectric generating stations.

2 Pub. L. No. 109-58 (2005).

3 Policy for Review of Mandatory Conditions Developed by the Departments of the Interior and Commerce in the Context of Hydropower Licensing. January 18, 2001.

The Department submitted its PFP by letter dated May 13, 2005. PSNH submitted comments on the PFP by letter dated July 15, 2005. The Department's regulations, issued November 17, 2005, allowed participants in ongoing licensing proceedings to avail themselves of their rights under the EPAct until December 19, 2005. PSNH timely raised concerns similar to those presented in its comments in a petition for a TTH and AFP, filed on December 19, 2005. On August 25, 2006, the Service and PSNH signed a Settlement Agreement (SA) resolving the TTH dispute and agreeing to terms of this Prescription for Fishways. Subsequently, on August 28, 2006, PSNH submitted a motion for dismissal of the TTH with the Department's Office of Hearings and Appeals and withdrew its AFP.

As PSNH's July 15, 2005 letter was submitted under the old MCRP process, and ultimately, issues of disagreement on the prescription were resolved with the August 25, 2006 Settlement Agreement (SA), we will treat the issues raised in that letter as resolved under the same process resolving the petition for TTH and the AFP. Accordingly, those comments are not specifically addressed herein. No comments were received from any other party.

This Prescription for Fishways covers the three developments that make up the project: Amoskeag, Hooksett and Garvins Falls, all three of which utilize existing dams and powerhouses. All three developments currently operate in a daily store-and-release/peaking mode, though the Hooksett development has limited daily storage capacity and therefore largely operates in a run-of-river mode.

The three developments have a combined generating capacity of 29.7 MW. The three project dams are located in succession on the river, with Amoskeag the most-downstream dam and Garvins Falls the most upstream of the project developments. There is an existing pool-and-weir upstream fishway and a temporary American eel trap at the Amoskeag tailrace but no other upstream passage measures at the other project dams. All three project dams have downstream fish bypasses which range from a simple fish bypass gate at Hooksett to a state-of-the-art louver system at Garvins Falls. The effectiveness of the upstream and downstream fish passage facilities for all species has not yet been established. Additional information on the project and their operation is included in PSNH's license application and supporting documents and in the Commission's Environmental Assessment for the Project, dated January 2006 (EA).[4]

Two dams—the Essex or Lawrence Dam, site of the Lawrence Project (FERC No. 2800) and the Pawtucket Dam or Lowell Dam, site of the Lowell Project, (FERC No. 2790)—are located downstream from Amoskeag. Both dams have existing upstream and downstream fishways, although passage efficiency of the Lowell fish lift is a concern and is currently being investigated.

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[4] FERC (Federal Energy Regulatory Commission). 2005. Environmental Assessment for Hydropower License, Merrimack River Project, FERC Project No. 1893-042. January 2006.

As discussed below in greater detail, the Department's Prescription for Fishways focuses on the need for eel passage, evaluations of existing downstream fishways and future upstream passage needs at the Hooksett and Garvins Falls developments. The Department's Prescription for Fishways will ensure that fish passage is provided at the three project developments in a safe, timely and effective manner.

2. Resource Description

The Merrimack River is located in central New Hampshire and northeastern Massachusetts and drains an area of approximately 5,014 square miles. As such, it is the second largest river in New England. The Merrimack is formed by the confluence of the Pemigewassett and Winnipesaukee Rivers in Franklin, New Hampshire and flows 116 miles southeast to its mouth in the Gulf of Maine in Newburyport, Massachusetts (Application, p. E-1).

The Merrimack River has a long industrial history. The river was utilized for transportation and diverted for industrial use in the early 1800s. The first complete barrier dam on the river was built at Amoskeag Falls in the 1830s and the Essex/Lawrence Dam was completed in 1847. There are currently five dams on the mainstem Merrimack, including the three Merrimack River Project dams.

Water quality in the river is generally good, and is classified as Class B waters by the State of New Hampshire. Additional background information on the Merrimack River can be found in the license application and the Commission's EA.

2.1 Historical Fisheries

The Merrimack River historically supported populations of anadromous Atlantic salmon, American shad, alewife and blueback herring that extended to the upper Merrimack River Basin. (License Application p. E-38). Atlantic salmon historically occurred in the Merrimack River until the mid-1800s when construction of impassable dams extirpated the population from the Merrimack. Shad and herring populations also declined largely from the construction of impassable barrier dams on the mainstem Merrimack and tributaries (Strategic Plan p. 18).

American eel were also present in the Merrimack River watershed, although information of historical population abundance and distribution is limited.

2.2 Current Fisheries

The Merrimack River supports a mixture of riverine, as well as anadromous[5] and catadromous[6] fish species. Migratory fish occurring in or near the Merrimack River estuary include American shad, alewife and blueback herring (collectively referred to as river herring), Atlantic salmon, shortnose sturgeon, striped bass and American eel. However, anadromous species are currently limited in distribution to below the Hooksett Dam, although some river herring have been observed passing the Hooksett Dam under some flow conditions.[7]

A fish lift was installed and began operating at the Lawrence Project in 1983. A similar fish lift at the powerhouse and a vertical slot fishway at the spillway were installed at the Lowell Project in 1986. Anadromous species and some riverine species have been recorded passing these facilities, although efficiency of the facilities is uncertain. In 1995, the Lawrence lift system was modified to improve passage effectiveness and resulted in improved passage (Strategic Plan, p. 57). Similar modifications were made at the Lowell Project, but the numbers of shad or herring that have been recorded passing Lowell since that time have been limited. In 2002, the Service's Central New England Fishery Resources Office conducted a study of shad migration and passage at the Lowell Project and found only 6% of radiotagged shad tagged at Lawrence passed the Lowell fish lift. This passage efficiency was similar to the overall percentage of shad that passed Lawrence and then passed Lowell that year of 10% (Sprankle 2004). Efforts to evaluate the causes of poor passage efficiency and to investigate ways to improve passage have been ongoing with ENEL Energy, the project owner. However, abnormally high flows during the spring passage seasons in 2005 and 2006 have prevented adequate assessment.

A variety of riverine fish species exist in the project waters, including indigenous (blacknose dace, white sucker, yellow perch and fallfish) and introduced (largemouth bass, smallmouth bass, walleye and bluegill) species (License application at Table E-4).

2.2.1 Atlantic Salmon

Atlantic salmon restoration on the Merrimack began in 1963 with a survey of basin habitat by NHFGD and in 1969, a formal cooperative was established among NHFGD, the Massachusetts Division of Fisheries and Wildlife, and the Bureau of Sport Fisheries and Wildlife (now the Service) and Bureau of Commercial Fisheries (now NOAA Fisheries). The U.S. Forest Service joined the cooperative in 1982. The program is managed by the Policy Committee for Anadromous Fishery Management (Policy Committee) of the Merrimack River and Technical Committee for Anadromous Fishery Management of the Merrimack River (Technical

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[5] Anadromous fish begin their life cycle in freshwater, migrate to sea where they grow to maturity over one or more years, and return to their natal rivers, streams, lakes or ponds to spawn.

[6] Catadromous fish begin their life cycle at sea, migrate to freshwater to grow to maturity over a several-year period, and return to sea to spawn and die.

[7] Letter dated July 15, 2005 from Catherine E. Sively, PSNH, to Secretary, FERC.

Committee). Restoration activities have included stocking of hatchery-reared salmon smolts and fry, habitat assessment and assessment of production. The Service and other member agencies worked with the Policy and Technical Committees to achieve upstream and downstream fish passage at hydro projects in the basin.

Atlantic salmon fry and smolts are stocked into the Merrimack River and its tributaries as part of the restoration program. Since 1975, approximately 20 million fry have been stocked in basin tributaries. Currently, approximately 1.4 million salmon fry are stocked annually. Of these, approximately 85% of these are stocked upstream from the project dams. Salmon smolts have also been an integral part of the restoration plan, though all salmon smolts are stocked downstream from the project below the Essex Dam in Lawrence.

The Atlantic salmon has a relatively complex life history which includes the spawning of adults and maturation of juveniles in natal rivers and associated water bodies, as well as a migration into the open ocean by juvenile smolts and adults. Due to its anadromous life history, salmon must obtain safe and unrestricted access to their natal streams and the young must reach the ocean to successfully sustain local populations. The existing downstream bypasses at the project dams have largely been proven to be reasonably effective in safely passing salmon smolts downstream past the project turbines. Review of existing data and possibly additional evaluations on plunge pool conditions at Amoskeag are necessary, however, to assure safely bypassed smolts and post-spawned adult salmon are not injured when using the bypass gate.

Based on the current Strategic Plan, all returning adult salmon are transported to a hatchery to be spawned artificially, or will be transported to the Pemigewassett River upstream from the project.

2.2.2 American Shad, Alewife and Blueback Herring

Like salmon, American shad, blueback herring and alewife (collectively river herring) are managed by the Policy and Technical Committees. Prior to the start of the restoration program to restore these species, a limited population of American shad and river herring still inhabited the lower Merrimack downstream from the Lawrence Dam.

Habitat for shad and river herring exists in both the mainstem Merrimack and in major tributaries both upstream and downstream from the project. In total, there are 187,600 100 square yard units of shad habitat upstream of the project, which accounts for 44% of the estimated total habitat for the basin (USFWS 1982). The principal spawning habitat for alewives is likely to be in more ponded areas on tributaries, while blueback herring utilize more riverine habitat for spawning.

Management efforts to restore these species have included stocking of pre-spawned adult shad and herring into mainstem and tributary habitat, mostly upstream from the project. These efforts have yielded a range of results. Since the start of fish passage operations at Lawrence Dam, shad passage numbers have increased from approximately 5,500 in 1983 and 1984 to as high as 76,717 in 2001 (USFWS 2006). Shad totals in 2005 and 2006 have been severely suppressed by high spring flows that render the Lawrence fishway inefficient in passing fish. River herring passage totals have been variable, with as many as 387,970 herring passing Lawrence in 1989, but as few as 51 passing in 1996. The cause of such variation is thought to be a variety of biological and possible harvest issues in the ocean, predation by striped bass and other abundant predators offshore and in the river, and poor passage conditions, especially for alewives at Lawrence in early spring.

Like salmon, juveniles and post-spawned adults must migrate downstream to the sea. As such, downstream passage for these species/life stages is needed. The existing downstream bypass facilities may provide effective downstream passage for shad and herring, but they have not been fully evaluated. Such evaluations of effectiveness are needed.

2.2.3 American eel

The American eel is a catadromous species and is also panmictic (single spawning site and complete mixing of the gene pool at each spawning), with all adults spawning in the Sargasso Sea. The Sargasso Sea is situated in the Atlantic Ocean, northeast of the Bahamas. American eel eggs hatch into a transparent, protracted larval stage, called "leptocephali." Leptocephali drift and swim with the ocean currents for several months before changing shape to resemble miniature, transparent eels. These "glass eels" or "elvers" enter estuaries in spring and begin an active migratory river ascent of Atlantic coast waterways. Migrations to upriver tributaries may continue for many months or years, and generally coincide with warmer temperatures (peak activity occurring in July and August). Colonization of the upper reaches of a river is continued by the older, but still juvenile, individuals called "yellow eels." Yellow eels may remain in freshwater for up to 24 years.[8]

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[8] ASMFC (Atlantic States Marine Fisheries Commission). 2000. Interstate Fishery Management Plan for American Eel (*Anguilla rostrata*). Fishery Management Report No. 36 of the Atlantic State Marine Fisheries Commission. 92 pp.

As sexual maturity begins, yellow eels metamorphose into the sub-adult "silver eel" and begin the out-migration back to the Sargasso Sea where maturity is attained prior to spawning and subsequent death. Downstream movement generally starts for the silver eels with the onset of the fall rainy season and escalates until colder temperatures begin. [8]

Throughout the Atlantic seaboard, American eels traditionally have been used for regional and ethnic food markets, domestic trot line bait, and sport fishing. Glass eels and elvers harvested in the United States are often exported for aquaculture ventures and direct consumption. Consequently, each life history stage of the American eel, except the egg and larval stages, represents a targeted fishery. [8]

The Merrimack River currently supports a population of maturing American eel, although the size of the historic or current eel population is unknown. Large numbers of eels were known to have migrated downstream from Lake Winnipesaukee, upstream of the project, in the 1980s, when large numbers were found killed by passage through hydroelectric turbines at the Lakeport Project (FERC No. 6440).[9] More recently, mortality of adult eels at the same project were noted, demonstrating that at least some eels continue to inhabit this lake well upstream from the river mouth.[9]

There are no current estimates of eel populations in the Merrimack Basin. A study of eel abundance conducted by the Service in 2001 and 2002 found large numbers of eels downstream from the Lawrence Dam but limited numbers upstream from Lawrence due to lack of upstream passage facilities at Lawrence and Lowell Dams (Sprankle 2002).

Declines in the American eel population in the Merrimack River and elsewhere are attributed to a combination of causes, including commercial harvest, pollution, changes in oceanic currents, and the negative effects of dams and hydropower facilities.[10] More specifically, hydropower facilities block or restrict migration routes into freshwater rearing habitats, and cause mortality to eels both during their residency in freshwater and as they migrate back to the Sargasso Sea. Passage through multiple hydropower turbines, as is the case on the Merrimack River, often results in significant cumulative mortality of eels.

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[9] Letter from the New Hampshire Department of Fish and Game to Hydro Dynamics Corporation. August 29, 1988.

[10] Haro, A., W. Richkus, K. Whaler, A. Hoar, W.D. Busch, S. Lary and D. Dixon. 2000. Population Decline of the American Eel: Implications for Research and Management. Fisheries Vol. 25, No. 9, pp. 7-16.

The Atlantic States Marine Fisheries Commission's Interstate Fishery Management Plan for American Eel contains the following goal:

> Protect and enhance the abundance of American eel in inland and territorial waters of the Atlantic States and jurisdictions, and contribute to the viability of the American eel spawning population.

Improvements in upstream passage at dams on the Merrimack and tributaries will enhance the abundance of eels in the basin, consistent with regional fishery management goals. There are no downstream passage measures for eels currently in place at any mainstem Merrimack River dams. It is possible that the existing downstream passage facilities designed for anadromous species may pass outmigrating eels, however, these facilities are not designed for demersal species like eel and are untested. If, after evaluation, these facilities do not prove to be effective, additional physical structures or modifications to project operations will likely be needed to provide for safe, timely and effective passage for sexually maturing eels that are migrating downstream to the ocean.

2.2.4 Other anadromous species

Other species of anadromous fish that are present in the lower Merrimack River below Essex Dam include shortnose sturgeon and striped bass. Shortnose sturgeon have not been recorded upstream of the Lawrence Project. Small striped bass have been known to pass upstream in limited numbers using the fish lifts at the Lawrence and Lowell Projects. No striped bass are known to have passed Amoskeag using the existing fishway.

3. Management Goals

3.1 Published Plans

A number of published state, federal and regional fishery plans contain management goals that pertain to the Merrimack River. These plans include:

> Strategic Plan and Status Review – Anadromous Fish Restoration Program – Merrimack River. 1997. Technical Committee for Anadromous Fishery Management of the Merrimack River Basin.
>
> Fishery Management Plan for the American Shad and River Herring. 1985. Atlantic States Marine Fisheries Commission (amended in 1998).
>
> Interstate Fishery Management Plan for American Eel. April 2000. Atlantic States Marine Fisheries Commission.

3.2 Restoration Objectives

The Strategic Plan and Status Review – Anadromous Fish Restoration Program – Merrimack River has three broad strategies: (1) implement a watershed approach to anadromous fish restoration; (2) develop partnerships to achieve restoration; and (3) implement education and outreach to promote anadromous fish restoration. Specific final target fish restoration goals are not included in the Strategic Plan. However, interim objectives of 300 or more Atlantic salmon adults, 35,000 adult shad, and 300,000 river herring past at the Lawrence Project have been established. Also, strategy 1.A.2 of the Plan relates to improvement of upstream and downstream fish passage for salmon, shad and river herring.

In 1986, a Comprehensive Plan for Provision of Anadromous Fish Passage Measures and Facilities at PSNH's Merrimack–Pemigewassett River Hydroelectric Dams, FERC Projects 1893, 2456, and 2457 was developed by the Policy and Technical Committees and PSNH. The Merrimack River Basin Fish Passage Action Plan for Anadromous Fish (Appendix to Strategic Plan), which guides passage actions at PSNH's project and other hydroelectric projects, incorporated the provisions of the 1986 Plan as they relate to upstream passage at PSNH's projects. The Action Plan called for operational upstream passage facilities for anadromous species at Hooksett and Garvins Falls Dams within five years after passage of 15,000 shad at Amoskeag and Hooksett Dams respectively. The Plan did not address passage for river herring or American eel. As such, the Plan for implementing passage at the Merrimack River Project needs to be revised. As part of this relicensing, the trigger numbers for implementing passage were reviewed and new triggers were developed for shad, river herring and eels (see PFP).

4. Statutory Authority

Section 18 of the Federal Power Act, 16 USCS §811, as amended, states in pertinent part:

> the Commission shall require the construction, maintenance and operation by a licensee at its own expense of...such fishways as may be prescribed by the Secretary of Commerce or the Secretary of the Interior.

Section 1701(b) of the National Energy Policy Act of 1992, P.L. 102-486, Title XVII, §1701(b), 106 Stat. 3008, states:

> the items which may constitute a 'fishway' under Section 18 [16 USCS §811] for the safe and timely upstream and downstream passage of fish shall be limited to physical structures, facilities, or devices necessary to maintain all life stages of such fish, and project operations and measures related to such structures, facilities or devices necessary to ensure the effectiveness of such structures, facilities, or devices for such fish.

The Prescription for Fishways herein is issued under authority delegated to the Regional Director from the Secretary of the Interior; the Assistant Secretary for Fish, Wildlife and Parks; and the Director of the Service pursuant to Section 18 of the Federal Power Act (see 64 Stat. 1262; 209 Departmental Manual 6.1; 242 Departmental Manual 1.1A.).

5. Procedural Background

The Department, through the Service, has been actively involved in the evaluation of fish and wildlife issues at the project since before the current license was issued in 1980. In 1979, the Service's Regional Engineering Office fishway engineer developed conceptual designs for future fish passage facilities at the project developments. Involvement in the project continued through the 1980s with negotiations and planning for fishway construction at Amoskeag in 1988. Subsequent to fishway construction, the Service continued consultation with PSNH on studies of and implementation of upstream and downstream passage measures at the project developments through the start of the current relicensing proceeding. The Department, through both the Service and the National Park Service, has been involved in all aspects of the current licensing proceeding since its commencement in 2001.

5.1 Initial Consultation Document

The Service provided comments on PSNH's Initial Consultation Document (ICD) by letter dated March 15, 2002. Those comments noted the impacts to fishery resources related to incomplete and untested fish passage facilities, project operation regime and diversion of flows from bypassed reaches, and recommended studies to assess adverse effects and develop mitigation. Fishway issues identified in the ICD included:

- Impacts of project-induced flow fluctuations on upstream movements and passage by American shad
- Need to evaluate the effectiveness of the Amoskeag fish ladder
- Need for upstream passage of American eel
- Need to address resident fish passage
- Need for future upstream fishways at Hooksett and Garvins Falls Dams
- Completion of salmon smolt downstream passage evaluations
- Downstream bypass evaluations for shad, river herring and American eel

The ICD comments also indicated the likelihood that the Service would, through the Department, prescribe fishways for the project pursuant to Section 18 of the Federal Power Act.

5.2 Draft License Application

The Service's comments on the draft license application (DLA), dated November 12, 2003, again indicated that a Fishway Prescription for the project would likely be issued by the Service. The DLA comments discussed many of the same issues identified in the ICD comments, noting that future upstream fishways at Hooksett and Garvins Falls, plans to evaluate upstream passage for

anadromous species and eels at Amoskeag, and downstream passage evaluations needed to be addressed in the final license application.

The DLA comments noted that the proposed conversion of the project to run-of-river operations would resolve the issue of the impacts that flow fluctuations have on fish migration and passage.

5.3 Additional Information Requests

On February 26, 2004, the Service provided comments in response to the Commission's Notice of Application Tendered for Filing with the Commission, Soliciting Additional Study Requests and Establishing a Schedule for Relicensing and a Deadline for Submission of Final Amendments. In that filing, the Service identified the need for PSNH to complete ongoing downstream passage evaluations and identified the need for PSNH to develop conceptual design drawings for eelways and future fishways at Hooksett and Garvins Falls.

5.4 Commission Notice of Applications Ready for Environmental Analysis

In its May 13, 2005 comments on the Commission's March 17, 2005 Notice of Applications REA and Soliciting Comments, Recommendations, Terms and Conditions, and Prescriptions, the Department reviewed project impacts and submitted the Service's Section 10(j) recommendations for the protection, mitigation of damages to, and enhancement of fish and wildlife resources.

The Department's May 13, 2005 comments also included the PFP. This document was prepared consistent with the Department's MCRP, and provided justification for fishways at the project, based on existing and developing plans for fish restoration. The PFP also provided estimates of design populations based on available information, a preliminary description of the types of facilities and project operations that would be needed for safe and effective fish passage at each of the project dams, and the triggers for installing upstream passage at Hooksett and Garvins Falls, based on the numbers of shad or herring passing the Amoskeag fishway. The PFP stated that future fishways would be designed in consultation with PSNH and other agencies and would be based on all available information at that time.

5.5 Applicant's Response to the Preliminary Fishway Prescription

By letter dated July 15, 2005, PSNH submitted comments on the Service's PFP in accordance with the existing MCRP rules that were in place at that time. In their comments, PSNH questioned the need for fishways at this time, the triggers for future fishway construction, the need to evaluate downstream fishways, the basis for the proposed rock-ramp fishway and cost-effectiveness of such a facility, and the timing of upstream eel migrations and downstream clupeid migrations.

5.6 Petition for TTH and submission of an AFP

PSNH filed a Petition for TTH and submitted an AFP on December 19, 2005. The Petition for a TTH raised questions similar to those in the July 15, 2005 comments on the PFP regarding the development of the Service's PFP. The AFP included PSNH's proposed alternative provisions to those in the PFP.

On August 25, 2006, PSNH and the Service signed an SA that resolved disputes regarding the provisions of the prescription. The SA includes language to be included in this Modified Fishway Prescription. In light of the SA on the fishway provisions, PSNH submitted a Motion for dismissal of their Petition for TTH and withdrew its AFP on August 28, 2006.

6. Administrative Record

Evidence to support the Department's Prescription for Fishways is contained in the Administrative Record before the Commission, filed on July 12, 2006.

7. Alternatives Considered

In the formulation of this Prescription, the Department has reviewed and considered a variety of alternative fish passage options, including the alternatives proposed in the Commission's DEIS and in comments provided by the applicant.

a. PSNH (applicant): PSNH proposed an AFP. However, the SA between PSNH and the Service resolves the terms of this Prescription and the AFP has been withdrawn.

b. Commission Environmental Assessment: The Commission's EA recommends a number of fishways, but does not adopt what the Department provided in its PFP.

Regarding new upstream passage facilities at Hooksett and Garvins Falls, the EA endorses the benefit that these fishways would provide in the future. The EA also generally supports the technical soundness of the proposed rock-ramp fishway at Hooksett and fish lift and Denil fishway at Garvins Falls, and acknowledges that the Department would, in the future, rely on the best available data to determine the best fishway to be installed at these dams in the future. The EA does not, however, support the proposed triggers for construction of these fishways based on the numbers of fish passed at Amoskeag, or the construction schedule for such facilities once the trigger number is reached. Instead, the EA supports the higher 1986 Comprehensive Fish Passage Plan shad trigger number and more extended construction schedules.

Regarding downstream passage effectiveness testing for shad and herring, the EA endorses the need for such evaluations, but states that such studies should not be done with test fish collected outside the project area.

Regarding eel passage, the EA endorses the need for installing upstream eelways and the benefit of evaluating eel downstream passage at the existing downstream passage facilities at each dam.

Notwithstanding the endorsements in principle of the major components of the PFP, the EA concludes by questioning why the Department did not just request a reservation of authority to prescribe fishways in the future.

- Discussion: The Commission staff's EA addresses the fish passage issues raised by the Department, and on some issues agrees with the proposals in the PFP. Regarding the installation of future upstream fishways and evaluation of existing downstream fishways for anadromous fish, however, the EA suggests that the Department should reserve authority to prescribe fishways in the future. If this alternative were adopted, no specific designs or specific schedules or triggers for passage implementation would be mandated, leaving these issues to be raised in a future proceeding.

This Prescription includes triggers for installing upstream passage for anadromous fish at Hooksett and Garvins Falls, based on the numbers of shad and/or river herring that pass the next downstream facility. These triggers are based on production capacity of habitat in each river reach in the project area. It is uncertain when the prescribed triggers will be reached, but populations shold increase given the substantial available habitat (USFWS 1982), stocking upstream habitat with shad and herring as part of the restoration program (USFWS 1995), and ongoing efforts to improve passage at the Lowell Project.

Given that passage numbers above Amoskeag have been limited to date and have not reached the proposed trigger numbers, upstream fishways for anadromous fish would not be immediately required under the terms in the PFP. Prescribed designs, while justifiable given the state of knowledge on fishways at this time, could change in the future. If so, the Prescription includes provisions to make design changes as appropriate.

However, these facts do not outweigh the benefits of having specific designs identified or a definitive trigger for fishway construction which would expedite fishway construction when needed without further Fishway Prescription proceedings.

Under the provisions of the PFP, PSNH will be required to file downstream passage evaluation plans and schedules. As such, the downstream passage evaluations would not necessarily be implemented now. However, we cannot concur with the EA that the evaluation of these facilities requires there to be "enough naturally occurring clupeids" in the river. This conclusion appears to be based on the misconception that previous attempts at clupeid downstream passage evaluations were unsuccessful because the test fish used in the study were collected elsewhere and transported to the test site. This is not correct. While collections of clupeids from other locations and transportation to a test site can be time consuming and the numbers collected can be uncertain, the listed studies did not fail for these reasons. The Amoskeag evaluation failed

because the recapture net device was improperly designed to handle the flow and debris load encountered at the site. Similarly, the Garvins Falls evaluation was inconclusive due to heavy debris load in the recapture net and along the canal louver array.

Since the restoration of shad and herring into the Merrimack utilizes transfers of these species from downstream or from other river systems to areas upstream from the project, evaluation of downstream passage is needed for these fish, and such stocking programs can provide and have provided enough fish for evaluations in the past.

Given the need to evaluate clupeid downstream passage and benefits of requiring definitive upstream fishway designs and schedules in the license, the Department did not select the Commission staff's alternative for fish passage at the Merrimack River Project as described in the EA.

c. Preliminary Fishway Prescription Alternative: The PFP provided general fishway terms, including operations schedules, and specific designs and schedules for upstream fishway construction for anadromous fish, schedules for upstream eel fishway construction, and requirements for evaluation of existing downstream fishways and existing and new upstream fishways. Based on review of available information, comments from PSNH in their July 15, 2005 letter, their petition for TTH and their AFP, and discussions and negotiations on the SA, we agreed to modifications to the PFP. These modifications include changing the requirement for a rock-ramp fishway to a Denil fishway at Hooksett, flexibility in fishway design at Garvins Falls, scheduling of the construction of eelways, and flexibility in scheduling of fishway evaluations.

d. Department's Proposed Alternative: The Department considered the various alternatives described above in formulating its Prescription for Fishways for the Merrimack River Project. A "No Action" alternative, representing no improvements in fish passage at any of the five projects also was considered. The "No Action" alternative was dismissed from further analysis because it would not help accomplish fish restoration goals identified by the resource agencies, as described in this Prescription.

The basis for the Department's Prescription for Fishways is: (a) the need for evaluation of existing downstream fishways ; and (b) the need to implement upstream eelways at each of the three project dams, in a sequential manner, giving time to evaluate ideal eel fishway location before final facilities are built; (c)) the need for specified fishway designs; and (d) the need for a definitive schedule or trigger for future upstream passage implementation at Hooksett and Garvins Falls.

The Department's Prescription for Fishways is based on the SA signed between the Service and PSNH which includes changes from our PFP. The most significant changes were to the prescribed upstream fishway designs at Hooksett and Garvins Falls. For Hooksett, the PFP included a provision for installing a rock-ramp fishway based on the ability of such a fishway to operate at various pond levels and utilize varying spill amounts in its design, pass large numbers of fish, and our analysis that such a fishway would be less expensive to construct than a Denil

fishway, another alternative we considered. PSNH was concerned that a rock-ramp fishway was experimental and would, in fact, cost more than a Denil fishway. Since Denil fishways have successfully passed large numbers of clupeids at other projects, we can accept this design in lieu of the rock-ramp. The Prescription was, therefore, modified to require a Denil fishway.

At Garvins Falls, the PFP included a provision for simultaneous construction of a fish lift at the tailrace and a Denil ladder at the spillway. PSNH proposed instead that a preliminary study could determine the best location for a fishway and that it may be possible to manipulate project operations to assure that fish find a single fishway. This alternative is reasonable and would still assure that an effective fishway is constructed in a timely manner. The Reservation of Authority will permit future construction of a second fishway if the capacity or effectiveness of the constructed fishway proves to be inadequate.

Other changes from the PFP relate to eel fishway construction timing. The Service and PSNH jointly reviewed the timing of preliminary eel investigations, interim eelway installation, interim eelway evaluations, permanent eelway designing and permanent eelway construction. This analysis led to the definitive schedule for interim and permanent eelway installation in this Prescription versus an unspecified implementation schedule in the PFP.

8. Response to Public Comments

Other than the comments submitted by PSNH dated July 15, 2005 and the AFP discussed above, the Department has received no comments on its PFP.

9. Reservation of Authority to Prescribe Fishways

In order to allow for the timely implementation of fishways, including effectiveness measures, the Department requests that the Commission include the following condition in any license(s) it may issue for the Merrimack River Project:

> Authority is hereby reserved to the Commission to require the licensee to construct, operate, and maintain such fishways as may be prescribed during the term of this license by the Secretary of the Interior pursuant to Section 18 of the Federal Power Act.

10. Prescription for Fishways

Pursuant to Section 18 of the Federal Power Act, as amended, the Secretary of the Department of the Interior, as delegated to the Service, exercises his authority to prescribe the construction, operation and maintenance of such fishways as deemed necessary.

10.1 General Prescriptions for the Merrimack River Projects

To ensure the immediate and timely contribution of the fishways to the ongoing and planned anadromous and catadromous fish restoration and enhancement program in the Merrimack River, the following are included and shall be incorporated by the Licensee to ensure the effectiveness of the fishways pursuant to Section 1701(b) of the 1992 National Energy Policy Act (Pub. L. 102-486, Title XVII, 106 Stat. 3008), and the Energy Policy Act of 2005 (Pub. L. 109-58)

a. Fishways shall be constructed, operated, and maintained to provide safe, timely and effective passage for Atlantic salmon, American shad, blueback herring, alewife and American eels at the licensee's expense.

b. Design populations

The total number of returning fish reaching the project during the term of the new license will depend on a number of factors, including overall stock recruitment of fish populations undergoing restoration. Overall fishway efficiency and cumulative losses of fish attempting to use upstream and downstream fish passage facilities also will affect the total potential restored run of shad, river herring, salmon and eels.

(1) Shad and river herring:

The Merrimack River Basin includes over 430,000 100 yard units of habitat for American shad (USFWS 1982) or about 9,000 acres of habitat. This habitat has the potential to support a shad population approaching 1 million shad and 2.5 million river herring. Of this, 44% of the habitat is upstream from the project, yielding substantial returns of fish upstream from the project. However, reaching this population size would depend on at sea conditions for growth and survival, ocean harvest, effective fish passage facilities at all dams and normal river flows during the passage season.

As restoration potential is realized, passage facilities at project dams would need to pass substantial numbers of fish. However, a more immediate need is to provide shad and herring access to currently unavailable habitat. Therefore, while the prescribed facilities will pass significant numbers of shad and herring, expansion of these facilities may be needed in the future if prescribed facilities cannot pass all returning fish as full restoration potential is realized.

(2) Atlantic salmon:

Adult Atlantic salmon returning to the Merrimack River are all trapped at the Lawrence Dam fishway and either transported to the Nashua National Fish Hatchery for spawning and egg collection or are transported to the Pemigewassett River for natural spawning. Therefore, only in very rare instances are adult salmon expected to reach the project dams. Regardless, even if salmon were permitted to freely migrate upstream, runs of salmon will not be large enough to affect the design of fishways at any of the project dams. The more numerous species (shad and

river herring) typically determine the kind of fish passage that should be built at a hydroelectric project.

(3) American eel:

American eels are currently present in the area occupied by the three project developments, although problems with upstream migration past the downstream dams and the lack of upstream passage at the project dams restrict the numbers of eels in the project area or areas upstream from the project. While the Department does not have a precise estimate of the numbers of eels that would be expected to use fish passage at the project developments, upstream and downstream passage would enhance the eel stocks and help achieve overall management goals. In addition, upstream passage needs for eels differ from those of salmon, shad, and river herring. Separate upstream eel fishways typically are installed at barriers in addition to those that are provided for anadromous fish.

(4) Other species:

Fish passage facilities provided at the project dams would also be used by white sucker, trout, and other riverine species. The numbers of riverine fish using the fishways are, however, likely to be small, relative to anadromous and catadromous species.

c. Upstream fishways at Amoskeag shall be operational during the designated migration period at river flows up to 19,400 cfs as measured at the USGS gage at Goffs Falls (#01092000). Fishways at Hooksett and Garvins Falls shall be operational at river flows of up to 19,000 and 17,000 cfs respectively, based on the Goffs Falls gage prorated as appropriate for drainage area differences between the gage location and these dams. Downstream fishways shall be operated during the designated migration periods whenever turbines are operated at the three project developments.

d. Scheduling

The timing of installation of upstream fish passage at Hooksett and Garvins Falls will be based upon the growth of migratory and riverine fish populations in the Merrimack River. American eels are currently present in the river, and would benefit from the immediate implementation of safe, timely, and effective upstream and downstream eel fishways. The Commission's EA also recommends permanent upstream eel fishways at all three developments.

A fishway must be installed at Hooksett Dam within three years after 9,500 shad or 22,500 river herring pass Amoskeag. A fishway at Garvins Falls must be installed within three years after passage of 9,800 shad or 23,200 river herring at Hooksett Dam, or passage of 19,300 shad or 45,800 herring at Amoskeag Dam if the Hooksett fishway design does not permit counting of

fish.

Installation of eelways now at all three dams would be a benefit to the species. However, proper eelway construction at the Amoskeag spillway and at Garvins Falls will require some initial study to assess proper eelway location. At all three dams, assessment of eelway location and design using interim eelways will also be needed prior to permanent eelway installation. Interim eelways shall be fully operational at Hooksett during the second spring/summer period after licensing, and at the Amoskeag spillway and at Garvins Falls within three spring/summer periods after license issuance. Following assessment and design, permanent eelways shall be installed and operational by the spring/summer of 2012.

e. The timely installation of the prescribed fishway structures, facilities, or devices is a measure directly related to those structures, facilities, or devices and is necessary to ensure the effectiveness of such structures, facilities, or devices. Therefore, the Department's Prescription includes the express requirement that the licensee (1) notify, and (2) obtain approval from the Service for any extensions of time to comply with the provisions included in the Department's Prescriptions for fishways.

f. Timing of Seasonal Fishway Operations:

Fishways shall be maintained and operated, at the licensee's expense, to maximize fish passage effectiveness throughout the upstream and downstream migration periods for American shad, river herring, American eel and white sucker:

Upstream passage:	April 1 to July 15	All species except American eel
	April 1 to Nov. 15	American eel
Downstream passage:	April 1 to June 15	Atlantic salmon
	June 1 to July 15	Spent adults of all species
	Sept. 15 to Nov. 15	Adult eel; juvenile shad & herring

Upon mutual agreement, the Licensee and the Service may modify the above schedules in the event that upstream or downstream passage of fish has not yet begun, migration has substantially declined, or operating conditions (i.e. high flows, drought) or other conditions make continued operation of the fishways unnecessary or inappropriate under the circumstances. If monitoring

indicates that these dates should be permanently adjusted, the Service shall use its reservation of authority to modify the operating schedule.

g. The licensee shall keep the fishways in proper order and shall keep fishway areas clear of trash, logs, and material that would hinder passage. Anticipated maintenance shall be performed sufficiently before a migratory period such that fishways can be tested and inspected, and will operate effectively prior to and during the migratory periods.

h. Evaluation of Fish Passage Facilities

The licensee shall develop plans for and conduct fishway effectiveness evaluations on all prescribed fish passage, in consultation with the Service and other fishery agencies. For each fishway to be constructed, the plans for fishway effectiveness evaluations shall be submitted to the Service for final review and approval simultaneously with the construction plans and schedule for each fishway. Each plan shall include proposed evaluation methods, and schedules for conducting the study and providing the results to the Service and the Commission. If the Service and the licensee cannot agree on the evaluation plan, the licensee shall submit the proposed plan to the Commission for approval, including all comments received from the Service.

i. The licensee shall provide personnel of the Service, and other Service-designated representatives, access to the project site and to pertinent project records for the purpose of inspecting the fishways to determine compliance with the fishway Prescriptions.

j. The licensee shall develop in consultation with and submit for approval by the Service, all functional and final design plans, construction schedules, and any hydraulic model studies for the fishways or modifications to existing fishways described herein.

10.2 Specific Prescriptions for the Merrimack River Projects

10.2.1 Amoskeag

a. The licensee shall operate the existing tailrace pool-and-weir fish ladder according to the upstream passage operation schedule (Section 10.1 f).

Justification - Fish passage facilities must be operated throughout the period that target species of anadromous, catadromous and resident fish are migrating. The specified operation dates are intended to encompass the full extent of the passage seasons for respective fish species and life stages and are based on known information regarding run timing on the Merrimack and other New England rivers. The identified operation dates are consistent with the operation dates of the downstream Lawrence (FERC Project No. 2800) and Lowell (FERC Project No. 2790)

hydroelectric projects. As noted in Section 10.1 f, exact operation dates in any given year can be adjusted depending on the timing of fish migrations in that year.

b. The licensee shall operate the existing downstream fish bypass facility according to the passage operation schedule (Section 10.1 f).

Justification - See Section 10.2.1, prescription item a above.

c. The licensee shall evaluate the effectiveness of the existing upstream tailrace fishway in passing American shad and river herring that reach the project. Within six (6) months from the date of issuance of the license, the licensee shall submit to the Service for review and approval, a proposed evaluation plan and a schedule for the evaluation. The plan shall include proposed methods of capture, tagging and monitoring fish, and provisions for filing results with the Service. Upon approval by the Service, the licensee shall submit the plan to the Commission for approval.

The licensee shall conduct the evaluation and file the results with the Service according to the approved schedule. Following review of the results of the evaluation and consultation between the licensee and the Service, any modifications to the fishways or additional evaluations shall be submitted for review and approval by the Service and subsequently filed with the Commission for approval. If agreement cannot be reached between the Service and the licensee concerning any modifications to the fishways or additional evaluations, the Service may require modifications to the fishway and/or additional evaluations pursuant to FPA § 18, or submit the matter to the Commission for approval.

Justification - The tailrace pool-and-weir fishway was completed in 1988 and has operated each year since then. Over those years, relatively few American shad have successfully passed the fishway and river herring passage has varied widely. For both species, the number of fish that could reach Amoskeag varies year to year and is based on the numbers of returning adults to the river and the success these fish have in passing the Lawrence and Lowell fishways downstream. However, the effectiveness of the Amoskeag tailrace fishway in passing those fish trying to move upstream is unknown. Preliminary evaluation of the facility in 2002 and 2003 suggests that the fishway is not passing all shad attempting to migrate upstream. A complete evaluation of the fishway is needed to assure its effective in passing fish or to identify measures to improve effectiveness. Plans for such an evaluation and a schedule for its completion are needed.

d. The licensee shall evaluate the effectiveness of the existing downstream passage facility for passing American shad, river herring and American eels. Within six (6) months from the date of issuance of the license, the licensee shall submit to the Service for review and approval, a proposed evaluation plan and a schedule for the evaluation. The plan shall include proposed

methods of capture, tagging and monitoring fish, and provisions for filing results with the Service. Upon approval by the Service, the licensee shall submit the plan to the Commission for approval.

The licensee shall conduct the evaluation and file the results with the Service according to the approved schedule. Following review of the results of the evaluation and consultation, any modifications or additional evaluations shall be submitted for review and approval by the Service and subsequently filed with the Commission for approval. If agreement cannot be reached between the Service and the licensee concerning any modifications or additional evaluations, the Service may require modifications to the fishway and/or additional evaluations pursuant to FPA § 18, or submit the matter to the Commission for approval.

Justification - The existing downstream fishway at Amoskeag is a 10-foot-wide modified crest gate located on the west end of the spillway adjacent to the powerhouse intakes. Based on evaluations done in 2001 and 2004, this facility has proven to be reasonably effective in bypassing downstream migrating Atlantic salmon smolts at a gate discharge of 125 cfs and with the hydro units dispatched such that Unit 3 (closest to bypass) is the first-on/last-off unit and Unit 1 (far end of the powerhouse) is the last-on/first-off unit. A study in 2003 attempted to evaluate the effectiveness of this facility in passing juvenile clupeids (shad and river herring), but results were inconclusive. The effectiveness of the fishway in passing American eels has not been evaluated.

Shad and river herring can access habitat upstream from Amoskeag at this time using the tailrace fishway. Progeny of adult shad and river herring stocked in mainstem Merrimack and tributary habitat upstream from Amoskeag as part of fish restoration activities must also pass Amoskeag. The existing fish bypass, therefore, must be evaluated to assure that the fishway is effective in providing safe, timely and effective passage for outmigrating clupeids and/or to identify measures that could be implemented to improve passage success.

e. Within 24 months from the date of issuance of the license, the licensee shall, after consultation with the Service on eel fishway design and evaluation, submit to the Service for review and approval: 1) design plans for an interim spillway eel fishway and a schedule for its installation; and 2) a proposed evaluation plan and a schedule for the evaluation(s) of the interim eel fishways (i.e., the existing tailrace facility and the new spillway facility). The evaluation plan shall include proposed methods of capture, tagging and monitoring fish, and provisions for filing results with the Service. Upon approval by the Service, the licensee shall submit the plans to the Commission for approval. The licensee shall install the eel fishway and conduct the evaluation(s) and file the results with the Service and the Commission according to the approved schedule.

Justification - American eel currently access the Merrimack River below Amoskeag. An interim upstream eel fishway is in place inside the entrance gallery of the tailrace pool and weir fishway during late spring, summer and fall periods when the pool and weir fishway is not in operation.

This facility has captured and permitted the upstream transfer of 6,300 eels over the four years the eelway has been in operation. Under the existing license, there is no flow requirement to release flow to the Amoskeag bypass reach. As such, there is flow to this area only periodically during periods when eels would likely move upstream.

The new license, however, will include a requirement for a continuous habitat flow to be provided in the bypass reach. As such, eels are likely to be attracted to the project bypass reach and spillway and would be unable to access the eelway located in the tailrace. A separate eelway is needed in the bypass reach. However, the design and location of such a facility needs to be developed. Initial studies of eel locations and an interim eelway are appropriate steps to undertake prior to installing a permanent eelway at the site. As such, it is appropriate to provide 24 months after license issuance for the submittal of interim eelway design plans.

Evaluations of the effectiveness of the interim tailrace and spillway eelways are needed to assess if the location of these facilities is appropriate for placement of permanent eelways and to assess the adequacy of design features of the interim eelways that could be incorporated into permanent eelway designs. Plans and schedules for such evaluations are needed.

f. Within 120 days after the date of submission of the evaluation results for the interim eel fishways to the Commission, the licensee shall, after consultation with the Service on eel fishway design, submit to the Service for review and approval, plans for permanent eel fishway(s) and a schedule for completion of installation of the permanent eel fishway(s) by the 2012 spring/summer passage season. The number, design and siting of permanent eel fishway(s) will be based on the interim eel fishway evaluations and will be developed in consultation with and approved by the Service. Upon approval by the Service, the licensee shall submit the plan to the Commission for approval. The eel fishway(s) shall be installed according to the approved schedule.

Justification - The evaluations of the interim eelways will provide needed information to locate and design permanent eelways that would likely be more formidable structures and provide continuous passive upstream movement by eels, versus capture, holding and transporting eels. Given the need for conducting initial evaluations, filing interim eelway design plans, constructing interim eelways and evaluating the interim eelways, it is appropriate to extend the installation date for the eelways to 2012 to provide the necessary time for these activities.

10.2.2 Hooksett

a. The licensee shall operate the existing downstream fish bypass facility according to the passage operation schedule. (Section 10.1 f)

Justification - See Section 10.2.1, prescription item a above.

b. The license shall install upstream passage facilities for anadromous fish at the Hooksett Dam, to be operational within three years after passage of either 9,500 or more shad or 22,500 or more river herring in any given year at the Amoskeag development. Within one (1) year after passage of the trigger number of fish at Amoskeag, the licensee shall file design drawings and a construction schedule for the fishway with the Service and obtain approval of the Service for any such fish passage design drawings and construction schedule. Upon approval by the Service, the licensee shall submit the plan to the Commission for approval.

The permanent upstream passage facilities shall consist of (1) a 4-foot-wide Denil fishway on the west side of the project spillway, including a counting facility and measures for the provision of the necessary attraction water; or (2) an alternative design approved by the Service.

Justification - The fishery agencies' plans for restoring runs of American shad and river herring require upstream passage facilities at the Hooksett development in the future. River herring and, to a lesser extent shad, have passed the Amoskeag fish ladder in some years. Although there have been sightings of herring ascending the western side of the Hooksett spillway during years of very high herring passage at Amoskeag, successful passage is likely to occur only under very specific river flow and spill conditions. Even if some herring may pass under these conditions, the efficiency of passage is likely poor. In addition, we do not expect that shad can similarly ascend this dam at all without installation of a fishway or substantial channel and spillway modifications.

The construction of such a fishway is not warranted at this time, as in recent years, passage of herring and shad at the downstream Lawrence and Lowell Dams have been low, and subsequently few fish were counted passing Amoskeag. However, when passage numbers upstream from Amoskeag increase, construction will be warranted. To establish a criteria or trigger for such construction, we calculated the production capacity of the Amoskeag impoundment using formulas used by the Connecticut Department of Environmental Protection and the Maine Department of Marine Resources (MDMR). As described in the PFP, we selected the use of the MDMR formula given the proximity of the Merrimack to Maine rivers.

We calculated that the Amoskeag impoundment could support the production of shad and river herring that would produce a run of 47,500 shad and/or 112,800 river herring. We based our passage construction trigger on the MDMR criteria that passage at the next upstream dam be based on passage of 20% of the carrying capacity of the downstream impoundment. This criteria

permits expansion of the returning fish to substantially increased habitat in advance of intraspecific competition due to population density or reaching the carrying capacity.

As such, we have established triggers for constructing a fishway at Hooksett on passage of 9,500 or more shad or 22,500 or more river herring at Amoskeag. Construction would need to be undertaken and completed within three years after passage of the trigger number of fish. This time frame provides ample time for final designs, approval by the Service and the Commission, permitting and construction.

A standard full-size Denil fish ladder that includes provisions for operation and attraction flow discharges would meet agency objectives for safe, timely, and effective passage of anadromous fish at Hooksett. A standard Denil fishway is expected to be able to pass up to 25,000 shad or 250,000 river herring, based on the Service fishway sizing criteria,[11] though more or fewer fish could pass the facility depending upon run timing and duration. If the capacity of this fishway is exceeded, additional passage measures can be prescribed at that time using the Reservation of Authority.

Some of the upstream migrating fish may be attracted to discharge from the project powerhouse. Therefore, the fishway design may need to include a tailrace exclusions screen to guide fish past the powerhouse to the spillway to permit access to the fishway entrance.

c. Within nine (9) months from the date of issuance of the license, the licensee shall, after consultation with the Service on eel fishway design and evaluation, submit to the Service for review and approval: 1) design plans for an interim eel fishway and a schedule for its installation; and 2) a proposed evaluation plan and a schedule for the evaluation of the interim eel fishway(s). The evaluation plan shall include proposed methods of capture, tagging and monitoring fish, and provisions for filing results with the Service. Upon approval by the Service, the licensee shall submit the plans to the Commission for approval. The licensee shall install the eel fishway and conduct the evaluation(s) and file the results with the Service and the Commission according to the approved schedule.

Justification - American eel currently access the Merrimack River below Amoskeag. An interim upstream eel fishway is in place inside the entrance gallery of the tailrace pool and weir fishway at Amoskeag during late spring, summer and fall periods when the pool and weir fishway is not in operation. This facility has captured and permitted the upstream transfer of 6, 300 eels over the four years the eelway has been in operation. Under the existing license, there is no flow requirement to release flow to the Amoskeag bypass reach. As such, there is flow to this area only periodically during periods when eels would likely move upstream.

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[11] U.S. Fish and Wildlife Service. 1986-2002. Fish Passage Facilities Design, Siting and Sizing Criteria and Standards Used in the Northeast. Northeast Region, Hadley, MA.

The new license, however, will include a requirement for a continuous habitat flow to be provided in the bypass reach. As such, eels are likely to be attracted to the project bypass reach and spillway and would be unable to access the eelway located in the tailrace. A separate eelway is needed in the bypass reach. However, the design and location of such a facility needs to be developed. Initial studies of eel locations and an interim eelway are appropriate steps to undertake prior to installing a permanent eelway at the site. As such, it is appropriate to provide 24 months after license issuance for the submittal of interim eelway design plans.

Evaluations of the effectiveness of the interim tailrace and spillway eelways are needed to assess if the location of these facilities is appropriate for placement of permanent eelways and to assess the adequacy of design features of the interim eelways that could be incorporated into permanent eelway designs. Plans and schedules for such evaluations are needed.

d. Within 120 days after the date of submission of the evaluation results for the interim eel fishways to the Commission, the licensee shall, after consultation with the Service on eel fishway design, submit to the Service for review and approval, plans for permanent eel fishway(s) and a schedule for completion of installation by the 2012 spring/summer passage season. The number, design and siting of permanent eel fishway(s) will be based on the interim eel fishway evaluations and will be developed in consultation with and approved by the Service. Upon approval by the Service, the licensee shall submit the plan to the Commission for approval. The eel fishway(s) shall be installed according to the approved schedule.

Justification - The evaluations of the interim eelways will provide needed information to locate and design permanent eelways that would likely be more formidable structures and provide continuous passive upstream movement by eels, versus capture, holding and transporting eels. Given the need for conducting initial evaluations, filing interim eelway design plans, constructing interim eelways and evaluating the interim eelways, it is appropriate to extend the installation date for the eelways to 2012 to provide the necessary time for these activities.

e. The licensee shall evaluate the effectiveness of the existing downstream passage facility for passing American shad, river herring and American eels. Within six (6) months from the date of issuance of the license, the licensee shall submit to the Service for review and approval, a proposed evaluation plan and a schedule for the evaluation. The plan shall include proposed methods of capture, tagging and monitoring fish, and provisions for filing results with the Service. Upon approval by the Service, the licensee shall submit the plan to the Commission for approval.

The licensee shall conduct the evaluation and file the results with the Service according to the approved schedule. Following review of the results of the evaluation and consultation, any modifications or additional evaluations shall be submitted for review and approval by the Service and subsequently filed with the Commission for approval. If agreement cannot be reached between the Service and the licensee concerning any modifications or additional evaluations, the Service may require modifications to the fishway and/or additional evaluations pursuant to FPA § 18, or submit the matter to the Commission for approval.

Justification - The existing downstream fishway at Hooksett consists of a 2.5-foot-wide modified ice and trash sluice that passes a minimum of two feet of spill over the bypass gate (approximately 20 cfs discharge), located on the east side of the project spillway adjacent to the powerhouse. Based on evaluations done in 2005, all released salmon smolts passed the dam in spill. The project is generally undersized for spring flows and spills flow frequently and at substantial volume during the smolt downstream passage season. This is the likely route for

emigrating salmon smolts. PSNH is compiling data on the history of spill and river flow to verify that spill will effectively protect emigrating smolts. The effectiveness of this facility in passing juvenile clupeids (shad and river herring) or outmigrating mature American eels, however, has not been evaluated and passage of these species comes during lower flow periods.

Shad and river herring can access habitat upstream from Amoskeag at this time using the tailrace fishway. Progeny of adult shad and river herring stocked in mainstem Merrimack and tributary habitat upstream from Hooksett as part of fish restoration activities must safely pass Hooksett Dam. In addition, it is possible that limited numbers of river herring may be able to traverse Hooksett Dam via the west-side spillway under certain flow conditions. The progeny of these fish would also need safe downstream passage. The existing fish bypass, therefore, must be evaluated to assure that the fishway is effective in providing safe, timely and effective passage for outmigrating clupeids or to identify measures that could be implemented to improve passage success.

10.2.3 Garvins Falls

a. The licensee shall operate the existing downstream fish bypass facility according to the

passage operation schedule (Section 10.1 f).

Justification - See Section 10.2.1, prescription item a above.

b. The license shall install upstream passage facilities at the Garvins Falls Dam for anadromous fish, to be operational within three years after the trigger number of fish is reached. The trigger number shall be:

(1) passage of either 9,800 American shad or 23,200 river herring at the Hooksett development;
(2) if fish passage has been constructed at the Hooksett Development without a fish counting facility, passage of either 19,300 American shad or 45,800 river herring at the Amoskeag Development.

Within one (1) year after passage of the trigger number of fish, the licensee shall file design drawings and a construction schedule for the fishway with the Service and obtain approval of the Service for any such fish passage design drawings and construction schedule. Upon approval by the Service, the licensee shall submit the plan to the Commission for approval.

The upstream fishway at the Garvins Falls development shall consist of either (1) an upstream fish lift located adjacent to the discharge of the older, river-side powerhouse, with an exit flume to convey fish to the headpond as depicted in Conceptual Design Drawings 19 through 24; or (2) an alternative design and/or location approved by the Service.

Justification - The fishery agencies' plans for restoring runs of American shad and river herring require upstream passage facilities at the Garvin Falls development in the future. As noted for Hooksett above, the fishway construction trigger for Garvins Falls is based on the production capacity of the Hooksett impoundment and the number of shad or herring passing the Hooksett fishway.

The prescribed design of a Denil fishway at Hooksett would permit counting of shad and herring passing the facility. However, alternative designs for a fishway at Hooksett could include a rock-ramp fishway. This more natural fishway design does not permit fish enumeration. If this were to be the approved and installed facility, the construction of an upstream fishway at Garvins Falls would be triggered based on passage counts at Amoskeag.

We calculated that the Hooksett impoundment could support the production of shad and river herring that would produce a run of 48,500 shad and/or 116,100 river herring. Using MDMR criteria, fishway construction at Garvins Falls will be required when 9,800 or more shad or 23,200 or more river herring pass Hooksett. If counting fish is not possible at the Hooksett fishway, the construction trigger would be 19,300 American shad or 45,800 river herring passing Amoskeag. Construction would need to be undertaken and completed within three years after

passage of the trigger number of fish. This time frame provides ample time for designs, approval by the Service and the Commission, permitting and construction.

Given site configuration, fishways may be needed at the tailrace and/or spillway. Attraction of shad and herring to the tailrace is most likely and would likely provide more consistent attraction to fish. Given site constraints, a fish lift would be the most effective fishway design for Garvins Falls, and design drawings of such a facility have been prescribed and attached herein for such a facility. The licensee may propose any other alternatives for Service approval, should alternative and equally effective designs become available between license issuance and construction.

Upstream habitat is estimated to support future populations of over 200,000 shad and over 500,000 river herring. The estimated maximum capacity of the prescribed lift is 6,000 shad per hour or 5,000 shad and 80,000 river herring per hour (or an equivalent biomass involving both species). If the capacity of this fishway is exceeded, or if, upon evaluation of the installed fishway, it is determined that additional fishways are required, additional passage measures can be prescribed at that time using the Reservation of Authority.

c. The licensee shall evaluate the effectiveness of the existing downstream passage facility for passing American shad, river herring and American eels. Within six (6) months from the date of issuance of the license, the licensee shall submit to the Service for review and approval, a proposed evaluation plan and a schedule for the evaluation. The plan shall include proposed methods of capture, tagging and monitoring fish, and provisions for filing results with the Service. Upon approval by the Service, the licensee shall submit the plan to the Commission for approval.

The licensee shall conduct the evaluation and file the results with the Service according to the approved schedule. Following review of the results of the evaluation and consultation, any modifications or additional evaluations shall be submitted for review and approval by the Service and subsequently filed with the Commission for approval. If agreement cannot be reached between the Service and the licensee concerning any modifications or additional evaluations, the Service may require modifications to the fishway and/or additional evaluations pursuant to FPA § 18, or submit the matter to the Commission for approval.

Justification - The existing downstream fishway at Garvins Falls consists of a 240-foot-long louver array in the project power canal, a fish collections chute, and fishway plunge pool and a conveyance sluice to the river. Based on evaluations done in 2000, this facility has proven to be reasonably effective in bypassing downstream migrating Atlantic salmon smolts. A study in 2003 attempted to evaluate the effectiveness of this facility in passing juvenile clupeids (shad and river herring), but results were inconclusive. The facility has not been evaluated with outmigrating mature American eels.

Shad and river herring can access habitat upstream from Amoskeag at this time using the tailrace fishway. Progeny of adult shad and river herring stocked in mainstem Merrimack and tributary

habitat upstream from Garvins Falls as part of fish restoration activities must safely pass Hooksett Dam. The existing fish bypass, therefore, must be evaluated to ensure that the fishway is effective in providing safe, timely and effective passage for outmigrating clupeids or to identify measures that could be implemented to improve passage success. A plan for this evaluation and a schedule for completing this study is needed.

d. Within 24 months from the date of issuance of the license, the licensee shall, after consultation with the Service on eel fishway design and evaluation, submit to the Service for review and approval: 1) design plans for an interim eel fishway(s) and a schedule for installation; and 2) a proposed evaluation plan and a schedule for the evaluation(s) of the interim eel fishway(s). The evaluation plan shall include proposed methods of capture, tagging and monitoring fish, and provisions for filing results with the Service. Upon approval by the Service, the licensee shall submit the plans to the Commission for approval. The licensee shall install the eel fishway and conduct the evaluation(s) and file the results with the Service and the Commission according to the approved schedule.

Justification - American eel currently access the Merrimack River below Amoskeag. An interim upstream eel fishway is in place inside the entrance gallery of the tailrace pool and weir fishway at Amoskeag during late spring, summer and fall periods when the pool and weir fishway is not in operation. This facility has captured and permitted the upstream transfer of 6,300 eels over the four years the eelway has been in operation. Under the existing license, there is no flow requirement to release flow to the Amoskeag bypass reach. As such, there is flow to this area only periodically during periods when eels would likely move upstream.

The new license, however, will include a requirement for a continuous habitat flow to be provided in the bypass reach. As such, eels are likely to be attracted to the project bypass reach and spillway and would be unable to access the eelway located in the tailrace. A separate eelway is needed in the bypass reach. However, the design and location of such a facility needs to be developed. Initial studies of eel locations and an interim eelway are appropriate steps to undertake prior to installing a permanent eelway at the site. As such, it is appropriate to provide 24 months after license issuance for the submittal of interim eelway design plans.

Evaluations of the effectiveness of the interim tailrace and spillway eelways are needed to assess if the location of these facilities is appropriate for placement of permanent eelways and to assess the adequacy of design features of the interim eelways that could be incorporated into permanent eelway designs. Plans and schedules for such evaluations are needed.

e. Within 120 days after the date of submission of the evaluation results for the interim eel fishways to the Commission, the licensee shall, after consultation with the Service on eel fishway design, submit to the Service for review and approval, plans for permanent eel fishway(s) and a schedule for completion of installation by the 2012 spring/summer passage season. The number, design and siting of permanent eel fishway(s) will be based on the interim eel fishway

evaluations and will be developed in consultation with and approved by the Service. Upon approval by the Service, the licensee shall submit the plan to the Commission for approval. The eel fishway(s) shall be installed according to the approved schedule.

Justification - The evaluations of the interim eelways will provide needed information to locate and design permanent eelways that would likely be more formidable structures and provide continuous passive upstream movement by eels, versus capture, holding and transporting eels. Given the need for conducting initial evaluations, filing interim eelway design plans, constructing interim eelways and evaluating the interim eelways, it is appropriate to extend the installation date for the eelways to 2012 to provide the necessary time for these activities.