

FEDERAL ENERGY REGULATORY COMMISSION
Washington, DC 20426
September 3, 2014

OFFICE OF ENERGY PROJECTS

Project No. 2485-063—Massachusetts
Project No. 1889-081—Massachusetts
FirstLight Hydro Generating Company

Mr. John S. Howard
Director – FERC Hydro Compliance
FirstLight Hydro Generating Company
Northfield Mountain Station
99 Millers Falls Road
Northfield, MA 01360

**Subject: Resolution of Dispute on Entrainment Study, and Clarification on Study
3.1.2**

Dear Mr. Howard:

This letter provides closure for the study dispute filed by the U.S. Fish and Wildlife Service (FWS) on the study plan determination (SPD) issued February 21, 2014, and provides clarification on the September 13, 2013 SPD with regard to Study 3.1.2 - Northfield Mountain/Turner Falls Operations Impact on Existing Erosion and Potential Bank Instability.

Background

The SPD on the non-aquatic studies proposed by FirstLight Hydro Generating Company (FirstLight) in support of its relicensing of the Turners Falls Hydroelectric Project and Northfield Mountain Pumped Storage Project was issued September 13, 2013. On February 21, 2014, a subsequent SPD was issued to address the proposed aquatic studies.

Study Dispute

The February 21, 2014, SPD did not approve a FWS-requested entrainment study to evaluate the effects of the Northfield Mountain Pumped Storage Project (Northfield Project) on American shad eggs and larvae (ichthyoplankton). Subsequently, the FWS

filed a notice of study dispute pursuant to section 5.14(a) of the Commission's regulations.

Pursuant to section 5.14(d) of the Commission's regulations, a three-person Dispute Resolution Panel (Panel) convened on March 28, 2014. The Panel consisted of: the Panel Chair from the Commission's staff, an agency panelist designated by the FWS, and a third party panelist selected by both the Panel Chair and the agency panelist.

In addition, during March and April 2014, Commission staff and representatives of the FWS and FirstLight conducted a series of informal meetings attempting to resolve the dispute independent of the Panel.¹ As a result of these meetings, on May 2, 2014, FWS filed a revised study request (Appendix B) to evaluate ichthyoplankton entrainment at the Northfield Project. In a May 2, 2014, supplement to its revised study request, FWS states that if the Commission approves the revised study, it will consider its dispute resolved.²

Based on the staff analysis presented in Appendix A, the approved study plan is modified to include the FWS's revised study on ichthyoplankton entrainment at the Northfield Project. Because the FWS's revised study request provides only a conceptual framework for the study, FirstLight must develop a more detailed plan for the study in consultation with the FWS, Massachusetts Department of Fish and Game, New Hampshire Department of Fish and Game, and the Vermont Agency of Natural Resources. The study plan must be filed for Commission approval when FirstLight files its initial study report meeting summary on October 15, 2014. The study plan must document FirstLight's consultation efforts, consider comments received from the agencies, and if recommendations are not adopted, provide FirstLight's reasons based on project-specific information.

Stakeholders will have an opportunity to comment on the study plan when they file comments on FirstLight's initial study report meeting summary as specified under section 5.15(c)(4) of the Commission's. FirstLight will have an opportunity to respond to stakeholders' comments on the study plan, pursuant to section 5.15(c)(5) of the Commission's regulations. Because the study dispute has been resolved, the Panel is dismissed with our appreciation for its time and technical expertise.

¹ The panelists did not participate in the informal meetings.

² To allow for the careful consideration of the FWS's proposed resolution of the dispute, pursuant to section 5.29(f)(2) of the Commission's regulations, the Panel's activities were suspended on May 2, 2014.

Study 3.1.2

On May 23, 2013, FirstLight requested clarification of the SPD regarding Study 3.1.2, noting that the SPD had mischaracterized the proposed stream bank geometry survey methods outlined in its revised study plan filed on August 14, 2013. Based on a review of the record, the September 13, 2013, SPD unintentionally modified Study 3.1.2's methodology. Specifically, the SPD characterized FirstLight's proposed study methodologies as including stream bank geometry surveys four times per year and after significant flood events.³ Instead, FirstLight's proposed methodology would collect data on stream bank geometry one time in 2014 only, and use 15 years of historical data to model riverbank geometry.

The objective of study 3.1.2 is to assess the factors that cause stream bank erosion, including mass wasting along the Turners Falls reservoir. In its request for clarification, FirstLight explains that the 2014 bank geometry data along with 15 years of existing data with information to be acquired through other approved studies will provide the necessary information on stream bank erosion processes.

Using 15 years of existing historical stream bank geometry data and 2014 survey data as proposed by FirstLight, along with other field collected data will provide the information necessary to determine the relative causes of erosion, including mass wasting along the Turners Falls reservoir consistent with the approved study objectives and the Commission's study criteria, (section 5.9(b)(6)). Therefore, FirstLight's proposed methodology for collecting stream bank geometry data, as outlined in its revised study plan filed on August 14, 2013, is approved.

If you have any questions, please contact Bob Easton at 202-502-6045.

Sincerely,

Jeff C. Wright
Director
Office of Energy Projects

³ See page B-8 of the SPD issued on September 13, 2013.

Project Nos. 2485-063 and 1889-081

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Attachments: Appendix A - Staff's Recommendations on FWS's Requested
Ichthyoplankton Entrainment Study.

Appendix B – FWS's Conceptual Framework for Northfield Mountain
Pumped Storage Project Ichthyoplankton Entrainment Assessment

cc: Mr. William Connelly
Dispute Resolution Panel, Chair
Federal Energy Regulatory Commission
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APPENDIX A

Staff's Review of the U.S. Fish and Wildlife Service's (FWS) May 2, 2014 Requested Ichthyoplankton Entrainment Study

Background

On March 1, 2012, the U.S. Fish and Wildlife Service (FWS) requested ichthyoplankton sampling in the vicinity of the Northfield Mountain Pumped Storage Project (Northfield Project) intake to quantitatively determine the level of entrainment of American Shad ichthyoplankton (eggs and larvae).

The February 21, 2014, study plan determination (SPD) concluded that FWS's requested study was not warranted, because the study did not meet the Commission's study criteria as outlined in section 5.9 of the regulations. Instead, the SPD adopted staff's recommendation that FirstLight Hydro Generating Company (FirstLight) reevaluate the need for further investigation into the potential effects of entrainment of American shad eggs and larvae if the results of its proposed juvenile shad entrainment study (study 3.3.3), demonstrated a need for the additional information. While Commission staff acknowledged a nexus between operation of the Northfield Project and shad entrainment (section 5.9(b)(5)), it also noted that "Generally, fish that are smaller in size experience higher entrainment survival" and that "...eggs and larvae experience high rates of survival – generally 95% or greater" (section 5.9(b)(4)). As such, Commission staff ultimately concluded that a survival study for fish eggs and larvae at the Northfield Project is not warranted, given the known relatively high turbine survival rate of eggs and larvae at hydropower projects and because survival studies are expensive and challenging (section 5.9(b)(7)).

In its request for dispute resolution, the FWS stated that the SPD mischaracterized its study request and clarified that it did not request an evaluation of survival as a component of its ichthyoplankton sampling. The FWS noted that the Northfield Project is a pumped storage project and FirstLight has acknowledged that all fish entrained at the project are lost to the Connecticut River (i.e., 100 percent mortality); therefore, it saw no need to request a survival study at the Northfield Project. FWS further clarified that its requested study was based on a study previously conducted in 1992 on shad egg and larval entrainment at the Northfield Project by Lawler, Matusky, and Skelly Engineers (LMS).¹ FWS suggested that because operation of the Northfield Project had changed since the LMS study was completed, the study should be repeated.

¹ Lawler, Matusky and Skelly Engineers. 1993. Northfield Mountain Pumped-Storage Facility – 1992 American Shad Studies. February 1993. Northeast Utilities Service Company, Berlin, CT. (Filed on March 18, 2014).

Results of Informal Meetings Between Commission staff, FWS, and FirstLight

Following the filing of FWS's request for formal dispute resolution, Commission staff initiated informal discussions with the FWS and FirstLight in an effort to resolve the dispute.² During these discussions, Commission staff acknowledged that it had misinterpreted the FWS's request for study on shad egg and larval entrainment, and had based its recommendation on the existing information on turbine survival rates of fish eggs and larvae and the cost of such studies (sections 5.9(b)(4) and (7)).

In response to the FWS contention that operation of the Northfield Project had changed, FirstLight provided information demonstrating that project operations had not significantly changed since the 1992 LMS study had been completed, but that generally, project pumpback operation during the shad spawning season has been reduced since 1992.³ As a result, Commission staff affirmed its prior conclusion that FWS's requested repeat of the LMS entrainment study was not necessary (sections 5.9(b)(4) and (7)). However, as discussed below, Commission staff, FWS, and FirstLight discussed several factors that called into question the results of the LMS entrainment study.

The LMS Study

The LMS study examined the Northfield Project's rate of ichthyoplankton entrainment over a 13-week sampling period. The LMS study estimated that 14,445,500 shad eggs and/or larvae were entrained during the sampling period. However, due to the difficulty associated with sampling water entrained within the facility intake, the study sampled the entire river channel's width and depth in the vicinity of the facility intake, with the result that the reported 14,445,500 shad eggs and/or larvae entrained is likely a substantial overestimate of the actual number that were entrained. Further, the number of adult shad returning to the Connecticut River and passing the Turners Falls Project's Gatehouse Fishway into the Northfield Project's lower reservoir and presumably spawning in 1992 when the study was conducted, was the largest run on record with 60,089 adult shad passed. Therefore, the estimate of 14,445,500 shad eggs and/or larvae within and near the intake is likely not representative of a typical year.⁴

² Commission staff met with FWS and FirstLight on multiple occasions; memos documenting the meetings were filed into the Commission's public record for the project on March 28, 2014, and April 7, 16, and 22, 2014.

³ See FirstLight's letter filed March 28, 2014.

⁴ The annual average number of shad passed at the Turners Falls Project's Gatehouse Fishway between 1980 and 2013 is 12,715 (the median is 9,216) [source data: Pre Application Document for the Turners Falls Hydroelectric and the Northfield Mountain Pumped Storage projects, table 4.4.6-1, (filed on October 31, 2012), and the

As a result of the review of the LMS study and based on discussions among FWS, Commission staff, and FirstLight, FWS filed a revised study request for ichthyoplankton entrainment (Appendix B) with the following objectives: (1) calculate the number of American shad eggs and larvae entrained at the Northfield Project; (2) estimate the loss of adult and juvenile shad equivalents based on shad egg and larvae entrainment at Northfield; (3) compare entrainment rates with one through four turbine/pump units pumping; and (4) determine the temporal distribution of entrainment within the prevailing pumping period.

FirstLight stated that it supports the FWS's revised study request because it believes that the study would likely yield more realistic estimates of shad egg and larval entrainment at the Northfield Project compared to existing information.⁵

FWS's Revised Study Request

We evaluate FWS's revised study request for a direct enumeration of shad eggs and larvae entrainment at the Northfield Project with respect to the Commission's study criteria (section 5.9 of the Commission's regulations).

Discussion and Recommendation

American shad broadcast spawn in congregations and fertilized eggs drift downstream until hatching. Shad are known to spawn upstream and downstream of the Northfield Project. Because early life stages of shad are not motile, they are unable to avoid project intakes, and thus are susceptible to entrainment at the Northfield Project (section 5.9(b)(5)).

The LMS study data demonstrate that the potential for shad ichthyoplankton entrainment at the Northfield Project warrants further study. However, for reasons noted above, simply repeating the methods used in the LMS study would not provide specific information on project effects needed to inform potential license requirements (section 5.9(b)(5)) and thus Commission staff continues to conclude that the cost associated with conducting the original study requested by the FWS is not warranted (section 5.9(b)(7)). However, the revised study request filed by the FWS would supplement the existing LMS entrainment data and would provide more specific information on project operational effects (section 5.9(b)(6)). Specifically, the revised study would directly sample shad ichthyoplankton in the project's pumpback water providing accurate estimates of shad

U.S. Fish and Wildlife Service at: <http://www.fws.gov/r5crc/Fish/hist.html>, (retrieved on July 8, 2014)].

⁵ See FirstLight's letter filed on May 2, 2014.

egg and larvae entrainment at the Northfield Project. Additionally, the revised study would evaluate the magnitude of entrainment under varying pumpback operation (1, 2, 3 and possibly four pumps operating) and during different periods of time. The estimated cost of this revised study is \$55,000, which is about half that of the study initially requested by the FWS (section 5.9(b)(7)).⁶

In summary, Commission staff's analysis and recommendation in the SPD was inappropriately based on a misunderstanding of FWS' initial study request. However, the FWS' initial study request would essentially duplicate the LMS ichthyoplankton entrainment study and would not substantially add to the exiting knowledge of project effects (section 5.9(b)(4) and (7)); and therefore, it is not appropriate.

However, the revised study requested by the FWS, provides a more direct estimate of the magnitude of entrainment at the Northfield Project than the LMS study and the FWS's initial study request. The resulting information: (1) would provide more data on the magnitude of ichthyoplankton entrainment at the project, as compared to existing information from the LMS study; and (2) if appropriate, could be used to craft potential license requirements that would modify project facilities or operation and reduce the level of shad egg and larvae entrainment (e.g., installation of screens or baffles, set the maximum/minimum number of operating pumps for pump back operation, and/or restrict evening pumpback operations to periods when entrainment rates would be lower)(section 5.9(b)5)).

Therefore, we recommend FirstLight develop a study plan to evaluate American shad ichthyoplankton entrainment at the Northfield Project consistent with the FWS's new study request (see Appendix B). FirstLight should develop the study after consultation with FWS, New Hampshire Department of Fish and Game, Vermont Agency of Natural Resources, and the Massachusetts Department of Fish and Wildlife. Implementation of the study should occur during the 2015 field season.

⁶ We estimate the cost of the March 1, 2012 ichthyoplankton sampling study requested by the FWS to be \$112,000.

APPENDIX B**FWS's CONCEPTUAL FRAMEWORK FOR
NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT
ICHTHYOPLANKTON ENTRAINMENT ASSESSMENT****U.S. FISH AND WILDLIFE SERVICE
MAY 2, 2014**Goal and Objectives

§5.9(b)(1) – *Describe the goals and objectives of each study proposal and the information to be obtained.*

Goal: Quantify entrainment of ichthyoplankton into NMPS during pump-back operation in a manner that will allow evaluation of diurnal differences in larval density and the effects of the number of units pumping on entrainment rate.

Objectives:

- Calculate the number of American shad eggs and larvae entrained at Northfield;
- Estimate the loss of adult and juvenile shad equivalents based on shad egg and larvae entrainment at Northfield;
- Compare entrainment rates with one through four units pumping; and
- Determine the temporal distribution of entrainment within the prevailing pumping period.

§5.9(b)(2) – *If applicable, explain the relevant resource management goals of the agencies or Indian tribes with jurisdiction over the resource to be studied.*

The Connecticut River Atlantic Salmon Commission (CRASC) developed *A Management Plan for American Shad in the Connecticut River* in 1992. Management objectives in the plan that relate to the requested study include: (1) achieving and sustaining an adult population of 1.5 to 2 million individuals entering the mouth of the Connecticut River annually and (2) maximizing outmigrant survival for juvenile shad.

In addition, the Atlantic States Marine Fisheries Commission's Amendment 3 to the Interstate Fishery Management Plan for Shad and River Herring (ASMFC 2010) has a stated objective of maximizing the number of juvenile recruits emigrating from freshwater stock complexes.

One way to maximize outmigrant survival of juvenile shad is to minimize anthropomorphic sources of mortality on early life stages in order to maximize recruitment to the juvenile phase.

The ichthyoplankton sampling will collect data needed to quantify entrainment at NMPS. This information will be used to determine if and what measures may be appropriate to minimize entrainment mortality at the project.

§5.9(b)(3) – *If the requester is not a resource agency, explain any relevant public interest considerations in regard to the proposed study.*

The requester is a resource agency.

Background and Existing Information

§5.9(b)(4) – *Describe existing information concerning the subject of the study proposal, and the need for additional information*

Prior entrainment studies conducted at the Northfield Mountain Project include an entrainment study targeting juvenile (including egg and larvae) American shad in 1992 (LMS, 1993), a strobe light exclusion efficiency study (Cook, et al., 1994), and a guide net exclusion efficiency study (NUSCO, 1999). These studies were conducted to evaluate the impacts of the Project operation on anadromous fish species in the Connecticut River. Specific methods used in these studies included radio telemetry, entrainment netting, and mark/recapture to investigate the probability of entrainment.

Results demonstrated seasonally-influenced entrainment rates of pre-juvenile life stages of American shad. The LMS (1993) study also suggested the possibility of a diurnal component regarding rates of entrainment; however the study methodology was not designed to produce reliable inferences regarding sub-daily variations in entrainment rates. Additionally, the LMS (1993) study made certain assumptions that may have resulted in higher than actual entrainment rates (e.g., shad eggs and larvae in the river channel are evenly mixed throughout the water column and the Northfield Mountain intakes draw water evenly from the water column). A study that would directly sample the intake water, rather than the river channel, multiple times during a 24-hour cycle could be used to evaluate varying entrainment rates on a sub-daily basis.

Project Nexus

§5.9(b)(5) – *Explain any nexus between project operations and effects (direct, indirect, and/or cumulative) on the resource to be studied, and how the study results would inform the development of license requirements.*

Factors that influence entrainment at a hydroelectric projects include the size and depth of the intakes, the hydraulic capacity and configuration of the turbines, the velocity of water as it enters the intake relative to fish swim speeds, the location of the intake relative to fish habitat, and the characteristics of fish species present in the study area.

American shad broadcast spawn in congregations and fertilized eggs drift downstream until hatching. Shad are known to spawn upstream and downstream of the Northfield Mountain Project. Because early life stages of shad are non- or barely-motile, they are unable to avoid project intakes, and thus are susceptible to entrainment.

The economic feasibility of pumped storage projects is highly dependent upon the daily timing of operations. Therefore, an entrainment study that allows for a more comprehensive evaluation of diel variations of shad larval/egg entrainment is will be useful to better understand if and how within-day operations of the project affect shad larval/egg entrainment rates.

Requested Methodology

§5.8(b)(6) – *Explain how any proposed study methodology (including any preferred data collection and analysis techniques, or objectively quantified information, and a schedule including appropriate field season(s) and the duration) is consistent with generally accepted practice in the scientific community or, as appropriate, considers relevant tribal values and knowledge.*

Sampling of Ichthyoplankton entrainment at Northfield Mountain would be implemented by sampling water within the cooling water system of the Northfield Mountain Project and as described below. The sampling of power plant cooling water intakes is an accepted sampling approach, to determine entrainment rates of ichthyoplankton.

Ichthyoplankton Sampling

1. Cooling Water System Sampling
 - a. Sample period is from May 15 through July 31. Biological Triggers (e.g., number of shad passed Turners Gatehouse) will be developed in consultation with the FWS and Commission Staff to establish when sampling will begin and end within the sample period.
 - b. Weekly samples every 2 hrs. during a pumping cycle. Sample collection to be initiated 30 minutes after pumping cycle begins.
 - i. Collect samples during any daytime pumping and uncommon nighttime hours to the extent possible given pumping scheduling decision lead time
 - ii. At a minimum, take samples once each during the following periods:; 1am to 4am; 5am to 8am
 - c. In addition, manipulate pumpback operations to specifically sample operations with 1, 2, 3, and if possible, 4 pumps running (sampling scenario). Each of the four sampling scenarios would occur once during the 4 week period of peak shad spawning (between May 23 and July 5, 2015), as follows:

Scenario 1: 1 pump operational (Unit 2)

Scenario 2: 2 pumps operational (Unit 2 and one other)

Scenario 3: 3 pumps operational (Unit 2 and two others)

Scenario 4: All 4 pumps operational¹

¹ A potential Unit 1 outage, which is anticipated, may prevent Scenario 4 from occurring, in which case, an analytical analysis of entrainment rates with 4 pumps operating will be performed provided sample scenarios 1-3 indicated a linear relationship of the entrainment rates between those sampling scenarios. In the event there is no linear relationship, follow-up

The timing of this sampling can be one scenario in each week or multiple scenarios within a week, dependent on available storage. Sampling will be randomized or scheduled if possible such that scenarios are not run in a sequence of an increasing or decreasing number of pumps (e.g., evaluate 2 then 4 then 1 then 3 pumps or 1, then 3 then 2 then 4 pumps)

- d. Identify the appropriate netting mesh size sufficient to effectively capture eggs, Yolk Sac Larvae and Post Yolk Sac Larvae
 - e. Develop in consultation with the Fish and Wildlife Service, MADFW, the Connecticut River Watershed Council and Commission Staff, methods to measure flow during sampling in order to determine ichthyoplankton density
 - f. Develop in consultation with Fish and Wildlife Service, MADFW, the Connecticut River Watershed Council and Commission Staff, appropriate protocols for processing samples and QA/QC procedures
2. Pipe Sample Validation
- a. Validate that larval densities in cooling water pipe are representative of densities in the intake tunnel through:
 - i. Paired sampling of both cooling water pipe and intake tunnel/channel at the start of the study period (Minimum of 3 replicates), or computational fluid dynamic modeling, or other methods deemed appropriate and developed in consultation with the Fish and Wildlife Service, MADFW and Commission Staff.
 - ii. If differences found, develop, a correction coefficient for entrainment calculations.
3. Entrainment Calculation
- a. Use standard methods to calculate ichthyoplankton densities
 - i. by life stage: egg, YSL, PYSL
 - ii. by date/time
 - b. Ancillary data that should be collected include:
 - i. NMPS Project operation: # units operating, which units, at what output
 - ii. TF Project operation: headpond level
 - iii. Environ. Info: river flow, precipitation, etc.

Acknowledgement of the Potential Need for Additional Study

Pending 2015 study plan results, modeling of juvenile shad abundance estimates in 2016 may be appropriate. Additionally, upon review of this study's results and the results of Study 3.3.9 *Two-Dimensional Modeling of the Northfield Mountain Pumped Storage Project Intake/Tailrace Channel and Connecticut River Upstream and Downstream of the Intake/Tailrace*, it may be appropriate to study the vertical distribution and abundance of early life stage shad (eggs and larvae) in the vicinity of the Northfield Mountain intake in 2016.

sampling may be appropriate pending review of study results.

Level of Effort and Cost

§5.9(b)(7) – *Describe considerations of level of effort and cost, as applicable, and why any proposed alternative studies would not be sufficient to meet the stated information needs.*

The estimated cost for this study is \$55,000.

Literature Cited

Atlantic States Marine Fisheries Commission. 2010. Amendment #3 to the Interstate Fishery Management Plan for Shad and River Herring (American Shad Management). Washington, D.C.

Cook, T.C., E.P. Taft, S.V. Amaral, F.C. Winchell & R.A. Marks. 1994. Strobe Light Demonstration: Northfield Mountain Pump Storage Project. Alden Research Laboratories. Report to Northeast Utilities Service Company.

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