



United States Department of the Interior



FISH AND WILDLIFE SERVICE

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In Reply Refer To:

July 15, 2013

FirstLight Hydro Generating Company
Turners Falls Hydroelectric Project, FERC No. 1889
Northfield Mountain Pumped Storage Project, FERC No. 2485

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Dear Secretary Bose:

This responds to the updated Proposed Study Plan (PSP) submitted by FirstLight Hydro Generating Company (FirstLight) on June 28, 2013 as part of the relicensing of the Turners Falls and Northfield Mountain Pumped Storage (NMPS) projects, located on the Connecticut River in Franklin County, Massachusetts.

Background

FirstLight filed its initial draft PSP on April 15, 2013. Subsequent to that filing, FirstLight scheduled and conducted eight full day meetings between May 14, 2013 and June 12, 2013. For most of the proposed studies, substantial technical comments and recommendations were provided by the U.S. Fish and Wildlife Service (Service) and other parties at the meetings. Based on those comments and recommendations, FirstLight proposed to make changes to the PSP and acknowledged the need to expand on, clarify, or modify the proposed individual study plans.

By letter dated June 13, 2013, the Service requested a 15-day extension of time (EOT) of the July 15 2013 deadline for filing comments on the PSP. By letter dated June 28, 2013, the Federal Energy Regulatory Commission (Commission) denied the Service's EOT request.

Simultaneous to the PSP development and review, FirstLight has been developing a final detailed Instream Flow Study Plan (IFSP), which will be conducted this summer/fall. FirstLight is also requesting comments on their revised IFSP and has coordinated with the interested parties to schedule the initial field work for the study in early July 2013. Based on the Commission's denial of our EOT request, the Service has requested, and FirstLight has agreed, that the initial

field work should be rescheduled to a later date in order to afford more time to review and provide comments on the updated PSP.

The Service is providing the following remarks for your consideration. These comments were prepared following our review of both the initial and updated PSP, and include information obtained from multiple study plan meetings. We note that the late filing of the updated PSP, coupled with the Commission's denial of our request for an EOT, has regrettably affected our ability to thoroughly review and prepare within a reasonable time frame, essential comments and recommendations on the updated PSP. We believe this denial will also affect other interested parties' ability to adequately review recently submitted materials, prepare and coordinate their comments with other involved parties, and restrict their input during this process. This will unfortunately result in less thorough and comprehensive comments and recommendations being developed and has the likelihood of adversely impacting the interest of all parties, including the Applicant who has expended an enormous amount of time and effort to assure that adequate studies are being considered, developed, and performed. We also note that, as a result of the reduced time frame, our hydraulic engineer will not be available to review some study plans by the July 15, 2013 submittal deadline. Therefore, additional comments on those plans may be provided at a later date, or in response to the Final Study Plan.

3.2.1 Water Quality Monitoring Study

In general, FirstLight's updated PSP is consistent with the methodology outlined in our March 1, 2013 study request. FirstLight has updated the study plan to address comments provided by the Service at the May 14, 2013 study plan meeting; therefore, the Service has no further comments on this study plan.

3.2.2 Hydraulic Study

On page 3-51, it states that water surface elevation (WSEL) monitors record hourly data, while the additional WSEL monitors to be placed upstream of Turners Falls Dam will record WSEL every 15 minutes. The shorter time interval would provide a more precise depiction of project operations, therefore it is unclear why existing monitors are set at a one-hour time interval. If changes are not made to the existing monitors to correspond to the new ones, the reason for the discrepancy should be explained in the final study plan.

3.3.1 Instream Flow Habitat Assessment

On page 3-70, the updated PSP states that a site visit has been scheduled for July 2013 to select transect locations and review 2-D options in the study area. As noted above, due to the Commission's denial of the Service's EOT request, this site visit has been postponed to later in the summer or early fall of 2013.

Habitat Suitability Index Criteria

FirstLight states that it is consulting with agencies and other stakeholders on development of appropriate habitat suitability index (HSI) curves to be used in the flow model. While agreement has been reached on some of the HSI species/life stage curves, a number have yet to be finalized. In addition, the use of guilds as a surrogate for a suite of species with similar habitat requirements has been discussed, but to date, no consensus has been reached whether to use guild curves, the species represented by those guilds, or the appropriate guild curves that could be used. The Service will continue to coordinate with other parties and consult with FirstLight on recommended HSI curves for target species and life stages. Additional modifications of species or guild curves are likely to occur during this consultation, including modifications to the sea lamprey spawning and incubation depth and substrate HSI criteria based on data from the Deerfield River (Yergeau 1983). These changes will be discussed during ongoing consultations on all species.

Freshwater Mussels

FirstLight states that host fish species associated with eastern elliptio and eastern floater mussels are habitat generalists and therefore are poor indicators of fluvial habitat suitability. In reviewing the information provided in Table 3.1.1-2, it appears that at least some of the identified host species are not considered habitat generalists. For example, the white sucker is listed as a host species for both the eastern elliptio and eastern floater, but is considered to be a fluvial-dependent species. In addition, we note that a paper documenting new host fish species for eastern elliptio has been published, indicating a much smaller number of suitable host fishes for elliptio within the Chesapeake Bay watershed (Lellis *et al.* 2013). Of the 38 fish species tested, five were found to be suitable hosts for the elliptio: American eel, lake trout, brook trout, mottled sculpin and slimy sculpin.

While white sucker was not found to be a suitable host species for elliptio in the Lellis study (Lellis *et al.* 2013), it was found to be suitable in an earlier study by Kneeland and Rhymer (2008) and, therefore, it would seem reasonable to utilize the white sucker HSI curves as surrogates if no species-specific habitat suitability indices exist for either the eastern elliptio or eastern floater (similar to the approach that FirstLight has proposed for the yellow lampmussel and triangle floater).

Data Collection

The updated PSP includes a table identifying what the proposed calibration flows/flow ranges will be for each reach and model type. At the last flow study meeting, the Service had noted that for Reach 3, the calibration flow range of 2,500-9,000 cfs appeared to be too high to capture existing conditions, given the approximate extrapolation flow range of 1,430 to 22,500 cfs. Reach 3 begins at the Rock Dam and extends downstream past the Cabot tailrace. Therefore, the upper part of the reach may only receive flows released at the dam (which could be as low as 140 cfs) during periods when Station 1 is not generating, while downstream of Cabot Station would always have flows of at least 1,430 cfs (currently required minimum flow below the project). This concern does not appear to have been addressed in the updated PSP.

Dual Flow Analysis

During a June 20, 2013 conference call regarding the Instream Flow Study conducted by First Light, the Service and other parties requested spatial maps depicting suitable habitat across cells for the 1 D modeled reach. This mapping can be generated from the PHABSIM data. FirstLight expressed concern over the amount of analysis it would take to assess and develop maps for all species/life stages at various flow pairs. It was agreed on that call that, after initial flow study results are reviewed, a subset of species/life stages would be identified to narrow the number of maps to be developed. The updated PSP makes no mention of this issue or the agreement made between FirstLight and other parties. The final plan should include a commitment by FirstLight to the recommended and agreed-to mapping and a description of the proposed post-study consultation process for map development.

Study Report

FirstLight states that raw field data and model output data will be made available upon request. We recommend that both the field data and model output be provided in digital format.

Study Schedule

The study schedule likely needs to be revised due to the postponement of the field visit.

3.3.2 Evaluate Upstream and Downstream Passage of Adult American Shad

Methodology

FirstLight does not provide details on aspects of the study design, such as the number of fish that will be tagged. The rationale FirstLight gives is that these elements will be informed by reviewing existing research and analyzing data from the whole river shad telemetry study conducted by the Service and USGS, which FirstLight proposes to do in Task 1 of the updated PSP.

While the Service agrees that the results of Task 1 would help inform the study design, FirstLight has been given no assurance that USGS will be able to provide the data to FirstLight in a timeframe that fits within the proposed study schedule. Although it would be helpful to have additional site-specific information, it is possible to develop minimum design parameters that can then be refined once Task 1 results become available. Below we provide guidance on those parameters.

Task 2: Develop Study Design

As noted above, the Service recommends that the updated PSP contain a certain level of detail with respect to sample sizes, telemetry equipment specifications, and receiver configurations/locations. While some refinement to these parameters may occur based on results of Task 1, it provides a starting point for those discussions (where none is contained in the updated PSP).

Equipment specifications - The initial PSP filed by TransCanada contained a shad telemetry study plan with a much higher level of detail on the type of equipment that will be used:

Radio receivers will be Lotek SRX_400 and SRX_600 datalogging units. Radio transmitters will be coded VHF transmitters supplied by Lotek Wireless Inc. (Lotek), Newmarket, Ontario, Canada. The radio tags (model number MCFT-3EM) are digitally encoded and will transmit signals on two frequencies (channels), yet to be determined, within the 150- to 151-megahertz band. Each radio tag will contain a unique pulse train to allow for individual fish identification (codes). Each cylindrical radio tag measures 11 mm in diameter, 49 mm in length, weighs 4.3 g in water, and has a 455-mm-long whip antenna. The radio tags will propagate a signal every 2.5 seconds and will have a minimum battery life of approximately 206 days.

PIT readers to be used will be half-duplex units identical to those used for the 2012 USGS study. PIT tags will be 32 mm half-duplex Model RI-TRP-WR2B-30 read/write, Texas Instruments, Austin, TX.

The Service recommends that FirstLight's updated PSP provide a similar level of detail for all equipment (tags, receivers, etc.) that will be used in the study.

Test/Flow Configurations - FirstLight states that a plan and schedule for dam flow releases will be developed and possibly refined based on results of the instream flow study of the bypass reach. The Service agrees with these general parameters, but believes that it is possible (and preferable) to include in the plan a ballpark number of test flows, given that the number of tests has bearing on the number of shad that will need to be tagged to ensure adequate sample sizes for purposes of data analysis. We recommend that two flows below 2,500 cfs be evaluated, in addition to three tests flows between 2,500 and 6,300 cfs. Test flows should be replicated to examine consistency of observations, and to examine confounding variable affects (i.e., timing of run, water temperatures, turbidity). A minimum of three replicate flow conditions for each treatment is recommended.

As a placeholder (pending further consultation and discussion among stakeholders), we provide the following recommended test flows along with their justifications:

Time Period	Test Flow*	Justification
Late April through early June	2,500 cfs	During this period, flows will be driven by needs of SNS. Three test flows spaced apart equally.
	4,400 cfs	
	6,300 cfs	
Early June through early July	1,000 cfs	After the SNS spawning period, bypass flows will likely be driven by instream flow study results for shad with respect to HSI spawning criteria as well as zone of passage.
	1,500 cfs	

* Each test flow should be run for a minimum of three days, with a minimum of three replicates per treatment.

Sample Size - Preliminary data from the USFWS/USGS whole river shad telemetry study results indicate general trends of increasing dropback, especially the farther upriver fish are tagged and the later fish are tagged. Based on this information, the test flow configuration proposed above, and the likely location and number of release sites, the Service recommends that no fewer than 390 shad be double tagged (radio and PIT) for the study, with an equal number of PIT-only tagged fish released. Paired releases of PIT-only tagged fish are a cost effective way to improve potential sample size issues and address many study objectives and/or aid in interpretation of radio-tagged fish data. Proposed capture, handling, tagging, and transport methods may require increasing sample sizes to obtain meaningful and unequivocal results to address defined study objectives. Below is a suggested protocol. The proposed numbers per release will take into account factors that reduce the effective sample size, such as an average dropback rate of 40 percent, and the expectation that not all fish will migrate to the project area, and passage efficiency of existing fishways.

Capture Site	Release Site	Release Date *	# Double Tagged/# PIT Only	Justification
Holyoke Dam	Holyoke Dam	late April (staggered over days)	80/80	Rate of early migrant movement from Holyoke to Turners Falls (TF) and route selection through TF
Holyoke Dam	Holyoke Dam	Early-mid-May (staggered over days)	80/80	Rate of mid-migrant movement from Holyoke to TF and route selection through TF
Holyoke Dam	Holyoke Dam	Late May (staggered over days)	80/80	Rate of mid-migrant movement from Holyoke to TF and route selection through TF
Cabot Ladder	Cabot Forebay	Mid-May (staggered over weeks)	50/50	Rate of movement through TF canal & passage through Gatehouse
Cabot Ladder	Upstream of Gatehouse exit	Mid-May (staggered over weeks)	50/50	Rate of movement through TF headpond and NMPS intake area
Holyoke Dam	Upstream of Gatehouse exit	Mid-May (staggered over weeks)	50/50	Buffer to ensure sufficient # of post-spawned adults for downstream passage assessment

* Release date will depend on the timing of the Connecticut River run in a given study year. If the run is late, these dates would be adjusted accordingly.

Receiver Locations - At the May 21, 2013 study plan meeting, a number of stakeholders identified specific receiver locations. Comparing those comments to the locations identified in

Table 3.3.2-1, it appears that a number of identified sites are not included. Below, we specify those additional sites, as well as provide comments on ones proposed by FirstLight.

- The Cabot Station tailrace receiver is described as a single unit, scanning to the island. This fish ladder entrance and all other ladder entrances should have both a near field and a far field receiver set up. The near field unit will have a restricted detection field (likely three element yagi antenna) and reduced likelihood of issues with noise interference, and will distinguish timing, duration, conditions relative to double-tagged fish movements and the ladder entrance attraction jet. The far field unit will be at a higher sensitivity (likely six element yagi antenna) to cover a large distance and will pick up noise, but also additional data not gathered by the near field unit. The two units complement each other and are part of a sound design to meet study objectives.
- The Station 1 tailrace receiver area shown on Figure 3.3.2-3 is too wide (extending across the entire river channel). The receiver should be sited and configured to pick up shad that are attracted to the Station 1 discharge as well as across the river.
- The “Below Turners Falls Dam” receiver also extends across the river. The equipment should be set up so that it allows determination of which side of the river the fish are coming up (which can then be related to project information such as spill through various gates). As noted above, a second near field receiver will determine whether fish are attracted and approach the entrance jet. Table 3.3.2-1 does not specify exact PIT reader locations. At all of the identified ladders (Cabot, Gatehouse and Spillway), antennas should be located at the fishway exits and entrances.
- A stakeholder had suggested that a receiver be installed at the NMPS upper reservoir. This would help confirm whether shad that are picked up by the NMPS intake receiver are actually entrained by the project or not.
- A stakeholder recommended installing a receiver downstream of Stebbins Island. The most upstream station proposed by FirstLight is the Northfield Mount Herman boathouse. Currently, the upstream extent of the influence of NMPS and Turners Falls project operations is unknown, but could extend as far upstream as the Vernon tailrace. Locating a receiver closer to this upstream extent is reasonable, as fluctuating headpond levels and/or changing hydraulics associated with project operations could alter shad movement and behavior.
- For downstream passage movement of post-spawned shad, as currently configured (Figure 3.3.2-2), it would not be possible to determine whether shad picked up by the Cabot Station Forebay and then the Cabot Tailrace receivers had passed through the units or through the downstream bypass. A PIT antenna on the entrance and exit of the bypass, and a telemetry receiver at the Cabot intake would rectify this problem.

Telemetry stations:

- Red Cliffe Canoe Club – full river width
- Sunderland Route 116 Bridge – full river width (or the Sunderland Waste Water Treatment Plant immediately downstream of the bridge)
- Montague Wastewater – full river width
- Deerfield River Confluence – full river width

- Cabot Station Tailrace – full river width (two receivers for both near field and far field coverage)
- Cabot Station Forebay
 - Radio telemetry antenna at Conte fish passage building
 - Radio telemetry antenna at Cabot forebay – general area
 - PIT antenna and radio telemetry dropper at bypass entrance
- Cabot Fish Ladder
 - PIT antenna and radio telemetry dropper at entrance
 - PIT antenna and radio telemetry dropper at exit
- Radio telemetry antenna to detect fish within the tailrace
- Rawson Island
- North and south channel
- Station #1 Forebay
- Station #1 Tailrace
 - Radio telemetry to identify fish in close proximity to the tailrace
 - Radio telemetry upriver of Station 1 to identify when fish pass the station
- Spillway Ladder
 - PIT antenna and radio telemetry dropper at entrance
 - PIT antenna halfway between entrance and first turn pool
 - PIT antennas at turn pool exits
 - PIT antenna halfway up straight section below counting window
 - PIT antenna and radio telemetry dropper at exit
- Below Turners Falls Dam – full river width to detect fish approaching dam
- Gatehouse Fishway
 - PIT antenna and radio telemetry dropper at new entrance
 - PIT antenna at first vertical slot
 - PIT antenna at last vertical slot
 - PIT antenna and radio telemetry dropper at viewing window
- Upstream end of canal – antenna for fish entering the canal from upstream
- Turners Falls Impoundment
 - NMPS Gill Bank – full river width
 - NMPS Intake
 - Area antenna
 - Dropper antennas at entrance to ensure full depth coverage
 - NMPS Upper reservoir
 - Shearer Farm – full river width
 - Northfield Mount Herman boathouse – full river width
 - Downstream of Stebbins Island – full river width

Video camera locations

- Entrance to the spillway ladder
- Entrance to the Cabot ladder

Task 4: Evaluation of Mortality

The Service has no objection to the use of motion sensor telemetry tags; however, the plan should specify that the tag time interval that will denote a dead shad should be developed in consultation with the Service and other stakeholders. The plan notes that mortality tags will be assessed in the vicinity of areas of entrainment or spill. Fish may be injured and passed downstream of these project structure areas, only becoming readily notable in downstream areas of lower water velocity. Surveys for mortality tags should cover downstream to the Hatfield S-Turn and deep pool areas, which were noted as containing stationary shad tags in the 2011 and 2012 study.

Task 5: Reporting

FirstLight does not provide any details on the types of analyses that will be conducted on the data collected. At a minimum, the Service recommends that the following information be provided in any interim or final reports:

- individual graphical portrayals of movements, identifying passage route selection (upstream and downstream);
- individual tabular depiction of rate of movement from release location up to and through any fish passage facilities;
- analysis of telemetry data in relationship to environmental (water temperature) and operational conditions (as noted in Table 3.3.2-1); and
- summary of mortality data by passage route in tabular format.

All data used to develop the report should be made available to stakeholders (upon request) in digital format, including all telemetry and PIT tag data.

Study Schedule

FirstLight proposes to first review and summarize information from existing shad telemetry reports, and then obtain, compile and analyze the USGS/FWS telemetry data in order to develop a detailed study plan by November of 2013 for stakeholder review and comment. A final study plan would be filed with the Commission by December 2013.

As noted above, the Service recommends that FirstLight develop a more detailed study plan now, which could later be refined based on the results of reviewing and analyzing existing data. The Service has provided guidance on a number of study plan elements herein.

The updated PSP indicates that the telemetry study will occur in 2014, but that a second year of field work may be conducted (depending on 2014 results). It is unclear to the Service what results would necessitate a second year of study. For a telemetry study such as this, evaluation of a single year is not sufficient to understand fish movement and behavior in a complex river environment. Therefore, the Service recommends that the study occur in both 2014 and 2015.

Lastly, at the May 21, 2013 study plan meeting, the Commission had commented that the plan should identify the possible need for a directed mortality study (e.g., balloon tags) if results of the 2014 telemetry study are insufficient to analyze (i.e., motion sensor tags do not function as planned, sample sizes are too small, etc.).

3.3.3 Evaluate Downstream Passage of Juvenile American Shad

Task 1: Evaluation of Timing, Duration and Magnitude of Migration

In response to Service comments provided at the June 4, 2013 study plan meeting, FirstLight has modified the study design to expand the use of hydroacoustics to include the Gatehouse and NMPS intake area in addition to the Cabot forebay. The Service fully supports this modification.

FirstLight proposes to only evaluate the hydroacoustic data during pumping operations. The Service recommends that evaluations start one hour prior to initiation of pumping operations, to assess fish within the zone of pumping influence. Releases of radio-tagged fish should be planned to occur in a range of river discharge conditions (i.e., lower flow conditions would represent least favorable conditions for juveniles, as opposed to higher river discharge flows). Having releases under varied river discharge and a range of pump operations will increase the likelihood of obtaining the most useful information on the extent of any potential project-related impacts to juveniles. FirstLight may wish to increase tagged fish sample sizes to permit examination of operation effects under a reduced pumpback level (1 to 2 units). The Service is most interested in accurately determining operation effects (as currently utilized) in the least favorable scenario, which is 3 to 4 units utilized on pumpback.

Task 2: Evaluate Route of Passage Chose, Delay and Spill Survival

In response to concerns raised by the Service at the June 4, 2013 study plan meeting that it would be difficult to collect wild juvenile shad from the Connecticut River of a size sufficient to implant with telemetry tags, FirstLight now proposes to work with the Service to raise shad in a hatchery environment. We support this proposal and look forward to working with FirstLight on this effort.

The Service recommends providing more details with respect to the tagging, holding and release protocol. For example, will the fish be transported from the hatchery to the release location prior to tagging, or post-tagging? How long will the test fish be held prior to release? We suggest that FirstLight look to the recently conducted study at the Muddy Run Project for guidance on methodology (Normandeau Associates Inc. January 2012. pp. 8-9).

FirstLight proposes to release test fish at least one mile upstream of the Turners Falls Dam. At the June 4, 2013 study plan meeting, the Service recommended having at least two release sites: one upstream of NMPS and one between NMPS and Gatehouse. Below is a suggested release protocol, along with sample sizes:

Location	Release Protocol	Sample Size
Approximately 2 miles upstream of NMPS intake	Release test fish on six days during migration period. On each date, release test fish hourly for six hours. Start time will be based on NMPS operations data.	Minimum four test fish per release date per hour. Total of 144 test fish.
1 mile upstream of Gatehouse entrance (Rod & Gun Club)	Release test fish on four days during migration period. Release all fish together at dusk.	Minimum 20 test fish per release date. Total of 80 test fish (supplemented with unentrained NMPS test fish).

The Muddy Run Project used a total of 145 test fish in its entrainment study (Normandean Associates Inc. 2012). Additional test fish are needed in order to ensure sufficient sample sizes for each possible passage route and different spill conditions at Turners Falls Dam.

The updated PSP should specify whether FirstLight intends to use the same receiver locations as the adult shad telemetry study or not. We recommend that in addition to the locations identified for the adult shad study (as modified by Service comments above), an additional receiver should be installed at the Gatehouse entrance. The adult shad study proposes to use a PIT reader at Gatehouse, but because the juvenile shad will not be PIT tagged, a telemetry receiver should be placed at the entrance to Gatehouse.

Task 3: Turbine Survival

In response to stakeholder comments conveyed at the June 4, 2013 study plan meeting, FirstLight has revised the study plan to confirm that a balloon tag survival study will be conducted to assess turbine mortality at Station 1 and Cabot Station. The Service supports this proposal, but continues to advocate for the need to assess spill mortality. Depending on which gates are being used, spill can discharge at various locations along the dam's apron, including areas of ledge that could result in mortality to outmigrating juvenile shad. While FirstLight indicates that spill mortality can be assessed via Task 2, it is not clear how that would be done, as the juvenile shad telemetry tags would not contain a motion sensor similar to the adult tags.

The Service recommends that at a minimum, spill mortality be evaluated through the four bascule gates and a tainter gate (unless FirstLight can provide certainty that these gates will not be used during the downstream juvenile shad migration period). A minimum of 25 test fish per gate should be tagged and released immediately upstream of each gate to determine spill survival.

At Station 1, FirstLight proposes to evaluate one of the four double runner Francis units, as well as the smaller, faster exciter unit. The Service has no objection to this proposal. In total, three turbines will be evaluated (two at Station 1 and one at Cabot Station). The overall number of test fish proposed for the Turners Falls Project is 150, which would allow 50 test fish per turbine if distributed equally. Fish would be injected into the turbines while at or near full hydraulic

capacity. The Service reiterates concerns it expressed at the June 4, 2013 study plan meeting that if the units typically operate at less than full hydraulic capacity, that condition needs to be evaluated. Likewise, if the units are always operated at peak efficiency, that is the condition that should be evaluated. If the units are operated at varying efficiencies, all three conditions should be evaluated (maximum gate, peak efficiency, and minimum gate).

Task 4: Reporting

This section of the updated PSP lacks sufficient detail regarding the analyses that will be used on each related task (hydroacoustic, radio telemetry and balloon tag). For the telemetry task, the Service recommends that FirstLight provide graphical portrayals of each individual fish's movements and timing through the project area, identifying passage route selection. These movements should be analyzed relative to environmental and operational variables.

For the turbine entrainment task, survival through each turbine/gate setting tested should be calculated based on the number of tagged fish injected into a given turbine or bascule gate that are alive immediately and 48 hours after turbine passage. Final results would be adjusted for survival of control fish. Any injuries of recaptured fish should be reported. Total through-project survival should be calculated based on results of this study, other related studies (i.e., hydroacoustics and telemetry data), as well as historical operations data.

All data used to develop the report should be made available to stakeholders (upon request) in digital format, including all hydroacoustic, telemetry and balloon tag data.

3.3.4 Evaluate Upstream Passage of American Eel

Task 1: Systematic Surveys

In the initial study plan, the Cabot Station log sluice was identified as a survey site, but has been removed in the updated PSP. The reason for this change is unclear. The log sluice outfall passes 200 cfs from June 1 to November 15 and this flow could attract juvenile eels moving upstream. The rip rap along the banks in the vicinity of the log sluice should be surveyed.

Task 4: Reporting

The updated PSP states that a report will be submitted as part of the Initial Study Report in accordance with the Commission's Integrated Licensing Process schedule. However, according to the process schedule, the Initial Study Report is due September 12, 2014 and updated study reports are due September 12, 2015. Given that the eel survey and trap collections may extend into October each year, it is unlikely that FirstLight will be able to file the results in time to make either deadline. In Study Plan 3.3.3, a similar situation exists. For that study plan, FirstLight has acknowledged the disjunct in timing, and proposes to provide stakeholders with a study report supplement to transmit the results of that study (by February of 2015). We recommend that FirstLight include a similar proposal for this study: provide stakeholders with a report

supplement by December 1, 2014 for the eel survey and by December 1, 2015 for the trap collection study.¹

3.3.5 Evaluate Downstream Passage of American Eel

The updated PSP incorporates the use of HI-Z Turb’N tags to assist in quantifying entrainment mortality at the Turners Falls Project. The Service supports this modification to the study design.

Task 1: Evaluate Timing of Downstream Migratory Movements

A general overview of the proposed methodology is given. FirstLight states that the scope and details will be designed and executed in consultation with agencies, if needed. It is unclear to the Service why the scope and details cannot be determined at this time.

FirstLight proposes to evaluate the hydroacoustic data at NMPS only during pumping operations. The Service recommends that evaluation start one hour prior to initiation of pumping operations, to assess fish presence within the zone of pumping influence.

Task 2a: Northfield Mountain Route Selection Study

FirstLight will tag eels with motion sensing radio telemetry tags and monitor their movements during downstream migration, with receivers placed in the immediate vicinity of the NMPS intake. Few details on study methodology are provided. The Service recommends that FirstLight generally follow the protocol outlined in the report “Movement and Behavior of Telemetered Emigrating American Eel in the Vicinity of the Muddy Run Project” (Normandeau Associates Inc. February 2012) with respect to methods and data analysis for the radio telemetry study.

The Service recommends that some of the receiver locations identified in the adult shad telemetry study also be used for the eel movement study (i.e., the Shearer Farm and NMPS Gill Bank sites), in addition to the NMPS intake. In addition, receivers should be placed at the Turners Falls Gatehouse entrance and outlet to the upper reservoir (unless FirstLight is assuming that every eel picked up by an intake receiver constitutes an entrained eel). The receivers at the NMPS intake should be placed in a manner that provides full depth coverage.

FirstLight states that it is still evaluating sample sizes. Dr. Alex Haro at the U.S.G.S. Conte Anadromous Fish Branch of the Leetown Science Center has provided FirstLight with recommendations for minimum sample sizes. At NMPS, Dr. Haro recommends at least 50 eels be tagged. This number is similar to the number of eels radio tagged for the Muddy Run study.² The Service agrees that a minimum of 50 eels should be tagged; the final number may be higher, depending on how many releases will be needed to test all relevant operating conditions. For example, FirstLight has stated that the project rarely pumps with more than three units. However,

¹ Because both the eel survey and trap collection require little analysis, FirstLight should be able to develop a report within 45 days from the date the data collection ends.

² At the Muddy Run Project, additional eels were acoustically tagged—we assume to ensure full-depth coverage over the 60-foot-deep intake. In order to ensure full-depth coverage over the 45-foot-deep NMPS intake, it will be necessary to use dropper antennas.

if FirstLight requests, and is granted by the Commission, an increase in the storage capacity of the upper reservoir, then it is possible that the percentage of time when all four turbines are pumping may increase in the future. Therefore, eel movement and entrainment should be evaluated under both of those conditions.

At Muddy Run, eels were initially released just after dusk. Later in that study, this protocol was amended due to the fact that many eels were passing the project prior to the project entering a pumping mode. A similar adaptive strategy should be used at NMPS. Likewise, the hydroacoustic data that will be collected concurrently should be used to inform release times; if weekly review of the hydroacoustic data indicates eel targets at a certain time (e.g., from 10 p.m. to 1 a.m.), the release protocol should be adjusted accordingly.

Our recommended release protocol is to run tests on eight nights (four nights at three units pumping and four nights at four units pumping) with three releases per night (at dusk, two hours later, and two hours after that) and three test fish per release. This equates to a total of 72 eels.

Task 2b: Turners Falls Dam Route Selection Study

FirstLight proposes to release tagged fish 3 km upstream of the Turners Falls Dam to monitor movements of eels through the lower headpond and power canal. In order to ensure that a sufficient number of eels are exposed to all potential passage routes, the Service recommends that eels also be released immediately downstream of Gatehouse as well as at the proposed location in the headpond.

As noted above, we recommend that FirstLight generally follow the fish collection, holding, tagging and release protocol used at the Muddy Run Project.

With respect to sample size, we offer the following preliminary release protocol:

Location	Release Date/Time	# Eels/release
3 km upstream of Turners Falls Dam	Between Sept 15 and Nov 15, release eels at dusk on day prior to expecting the following flow conditions: <ul style="list-style-type: none">• no spill at dam; and• various spill conditions (discharge gate and flow volume) based on consultation with parties on the instream flow study results and normal range of spill conditions during downstream eel migration periods.	10 per condition, for a total of 30 or more fish (depending on the number of agreed-to spill scenarios)
Immediately downstream of Gatehouse	Between Sept 15 and Nov 15, release eels at dusk on day prior to expecting the following operational conditions: <ul style="list-style-type: none">• only Station 1 operating;• only Cabot operating; and• both stations operating (if this ever occurs).	10 per condition, for a total of 30 fish (supplemented with fish from headpond releases)

As noted to above, we recommend additional radio-telemetry receiver locations to assure that all migration and passage routes are covered. Our recommended locations are similar to those we have identified in our comments on the adult shad telemetry study, Study 3.3.2.:

Telemetry stations:

- Shearer Farm – full river width
- NMPS Intake
 - Area antenna
 - Dropper antennas at entrance to ensure full depth coverage
- NMPS Upper reservoir
- NMPS Gill Bank – full river width
- Turners Falls Impoundment – full river width at boat buoys
- Gatehouse
 - Upstream
 - Downstream/canal
- Turners Falls Dam
 - Across and above bascule gates
 - Across and above tainter gates
- Below the dam – full river width
- Bypass reach at Station #1 – full river width
- Canal
 - Station #1 forebay
 - Cabot station forebay
 - Cabot bypass – multiple droppers, one receiver
- Cabot station tailrace
- Montague Waste Water Treatment Plant – full river width

We also note that Dr. Haro had indicated that it could be difficult to detect tagged fish using the Cabot log sluice. Dr. Haro had suggested that some assurance be provided that the radio method will have a high degree of detection/reliability in this location; otherwise, use of a PIT system to supplement telemetry data and increase confidence was recommended. Likewise, the plan should confirm that receivers will be configured to provide full-depth coverage at all intakes and other deep (>30 feet) locations.

Task 2c: Mobile Tracking

FirstLight plans to manually track tagged eels via boat, vehicle or by foot between release sites to several kilometers downstream of Cabot Station. We recommend including the following additional details in this section of the plan:

- manual tracking will be performed up to 5 km downstream of Cabot Station; and
- manual tracking will occur on a weekly basis, beginning after the first release date and ending in mid-December (or when all viable tagged eels have been detected at the Route 116 Bridge, whichever occurs first).

Task 3: Data Management and Analysis

The report should include a graphical illustration of the movement of each fish. All data used to develop the report should be made available to stakeholders in digital format, upon request.

Task 4: Turbine Survival

In response to stakeholder comments conveyed at the June 4, 2013 study plan meeting, FirstLight has revised the study plan to confirm that a balloon tag survival study will be conducted to assess turbine mortality at Station 1 and Cabot Station. The Service supports this proposal, but continues to advocate for the need to assess spill mortality. Depending on which gates are being used, spill can discharge at various locations along the dam's apron, including areas of ledge that could result in mortality to outmigrating adult eels. While it is possible that spill survival may be able to be inferred with data collected from motion sensor radio telemetered eels, there is no guarantee that radio-tagged eels will use the gates during a spill condition. Evaluation of spill survival is critical to both assess potential impacts of various spill release amounts and locations on eel survival, compare spill survival to turbine survival, and to assess whether spill may be one alternative to addressing downstream eel passage at the project.

The Service recommends that at a minimum, spill mortality be evaluated through the four bascule gates (unless FirstLight can provide certainty that these gates will not be used during the downstream adult eel migration period). A minimum of 25 test fish per gate should be tagged and released immediately upstream of each bascule gate to determine spill survival.

At Station 1, FirstLight proposes to evaluate one of the four double runner Francis units as well as the smaller, faster exciter unit. The Service has no objection to this proposal. In total, three turbines will be evaluated (two at Station 1 and one at Cabot Station). The overall number of test fish proposed for the Turners Falls Project is 150, which would allow 50 test fish per turbine if distributed equally.

According to the updated PSP, eels would be injected into the turbines while at or near full hydraulic capacity. The Service reiterates concerns it expressed at the June 4, 2013 study plan meeting that if the units typically operate at less than full hydraulic capacity, that condition also needs to be evaluated. For example, if the units are always operated at peak efficiency, that is the condition that should be evaluated. If the units are operated at varying efficiencies, each of those conditions must be evaluated (e.g., maximum gate, peak efficiency, and minimum gate), as turbine survival is known to vary depending on turbine unit operations.

FirstLight provides no description of data analysis for this task. Survival through each turbine/gate setting tested should be calculated based on the number of tagged fish injected into a given turbine or bascule gate that are alive immediately following turbine passage and after 48 hours, adjusting for survival of control fish. Any injuries of recaptured fish should be documented and reported. Total through-project survival should be calculated based on results of this study, other related studies (i.e., hydroacoustics and telemetry data), as well as historical operations data.

Study Schedule

The proposed schedule envisions that all tasks will be completed in 2014. Given the number of locations and various operating scenarios to be evaluated, completion of this study in one year appears overly optimistic. Therefore, we believe that this section should specify that an additional study year may be necessary due to circumstances such as: (1) unfavorable environmental conditions; (2) equipment malfunction; (3) inability to secure sufficient test fish; and (4) inadequate replicates of various locations and/or operating scenarios.

Reporting

The updated PSP does not contain a section on reporting. The Service recommends that reporting for this study plan include:

- release numbers, locations and dates;
- fish vitals (length, weight, and morphometric criteria);
- river temperature at NMPS, canal, bypass and below Cabot Station;
- route selection;
- all detections of fish;
- behavior of fish that do not pass the project;
- delay of fish: location and time;
- survival of fish passing each project facility;
- overall project passage effectiveness; and
- graphic description of the movement of each fish.

3.3.6 Impact of Project Operations on Shad Spawning

Study Goals and Objectives

The Route 116 Bridge is in Sunderland, not Holyoke.

In the first version of the study plan, the last bullet in this section proposed that FirstLight would “quantify” spawning activity, while in the updated PSP, the word has been changed to “verify.” The objective is to both verify and quantify spawning activity. Project operation could affect the amount or success of shad spawning while not eliminating spawning entirely, therefore verification of the presence of spawning alone would be insufficient to assess project impacts.

Project Nexus

This section identifies the potential impacts of project operations on shad spawning activity, behavior and success. These include poor fertilization, flushing of eggs to unsuitable habitat due to flow increase, and eggs dropping out into unsuitable habitat due to flow decrease. Since proposed egg collection and monitoring is limited, it is unclear how these impacts will be addressed, given the proposed study methods.

Methodology

It is unclear why FirstLight deleted the paragraph that began with “The field studies will examine...” The Service recommends retaining that paragraph and deleting the new language.

The method section identifies the plan to review existing information and the results of hydraulic modeling to help determine field study locations. We note that the results of the Instream Flow Study will also inform this decision.

Task 1: Development of a Detailed Study Schedule

This section identifies FirstLight’s plan to investigate project discharge changes and natural hydrograph flows to understand the relationship between the magnitude of normal seasonal flows and flow fluctuations due to project operations. While this is a reasonable analysis, we note that impacts to shad spawning would not be affected by magnitude of flow alone, but could be affected by the frequency of changes and rate of flow changes.

Task 2: Examination of Known Spawning Areas Downstream of Turners Falls Dam

FirstLight’s plan states that surveys will concentrate on the five known spawning locations downstream of the Deerfield River confluence. In fact, Kuzmeskus (1977) identifies nine historical spawning sites between the Route 116 Bridge and the Turners Falls Dam. All of these sites should be surveyed, in addition to any sites identified through mobile tracking of adult shad as part of the radio telemetry study (Study Plan 3.3.2). In addition, as survey crews are moving among historical sites, they should monitor for additional (previously undocumented) spawning sites.

In Phase 2 of the updated PSP, FirstLight states that the impacts of flow fluctuation on spawning shad will be investigated at locations identified in Phase 1 “that may become dewatered when water elevations decrease due to operational changes at Cabot Station...” While the Service agrees that those sites should be assessed, the investigation should not be limited to only those sites; there likely are spawning sites that would not become dewatered, but still would be susceptible to large flow/elevation fluctuations and associated changes in depth and velocity which could impact spawning behavior or success. Therefore, the proposed observational and physical habitat data should be collected at all identified spawning sites between Cabot Station and the Route 116 Bridge in Sunderland, and collected under various operational scenarios.

In order to determine if project operation impacts spawning behavior, FirstLight would test several discharge manipulations and compare behavior during the manipulations to “baseline” spawning behavior. It is unclear to the Service when observations would be made relative to the discharge manipulations. For example, if one scenario is to evaluate full discharge and then a minimum flow release, when would observations be made? We recommend that field crews observe and count spawning splashes before the flow changes, during the change, and after the change has occurred, as spawning behavior could be altered during both increases and decreases in flow. In addition, at times of test manipulation, a dedicated field crew should be tasked with

tracking any radio-tagged fish that may be on spawning sites so that their behavior can be evaluated relative to fluctuations in flow.

Task 3: Identification of Spawning Areas Upstream of Turners Falls Dam

The protocol for identifying spawning sites within the Turners Falls impoundment (to the base of Vernon Dam) requires more detail. For instance, surveys for shad downstream of the Turners Falls Dam will occur once 10,000 fish have passed the Holyoke Dam. A similar trigger for initiating surveys upstream of the Turners Falls Dam should be specified. Given that fish pass the Turners Falls Dam later (i.e., under generally warmer water temperatures), and that far fewer fish pass the Turners Dam than the Holyoke Dam, it may be reasonable to set a combination trigger (e.g., after 2,500 shad pass Gatehouse and river temperatures reach 18°C).

FirstLight states that upstream surveys will target areas of suitable habitat, including those containing flowing waters over coarse substrates. These terms are somewhat vague and undefined and may be overly restrictive. For example, at least one previous study documented shad gathering in sections of the Connecticut River characterized by a sandy bottom (Katz 1972), which would not be considered coarse substrate. Given how little we know about shad spawning in the Turners Falls Pool, the Service recommends that surveys occur in all waters of suitable depth (as identified in HSI curves).

Study Schedule

The first bullet in this section likely should read “October 2013 through December 2013” (rather than “December 2014.”

As the Service commented at the June 4, 2013 study plan meeting, given how variable temperature and water flows can be, the timeframe for conducting the field studies should be expanded to include all of May and June (and refined based on passage numbers).

3.3.7 Fish Entrainment and Turbine Passage Mortality Study

Task 2: Quantification of Shad and Eel Entrainment

FirstLight proposes to perform a quantitative assessment of shad entrainment at NMPS based on the tagging and hydroacoustic monitoring that will occur under studies 3.3.2 and 3.3.3. The Service has no objection to using data from those studies to estimate entrainment for adult shad and outmigrating juvenile shad. However, this would leave a data gap with respect to entrainment of younger life stages of shad (i.e., larvae and pre-migrants) that reside in the Turners Falls Pool, potentially within areas of the river susceptible to multiple pump-back events at NMPS.

These concerns were related to FirstLight at the June 4, 2013 study plan meeting. The Service stated that quantification of entrainment of early life stages of shad was needed in order to inform overall impact of NMPS on the shad restoration effort, as well as potential mitigation measures to reduce or offset entrainment mortality at NMPS.

The Service reiterates that entrainment of young-of-year shad at NMPS needs to be quantified. As noted in our March 1, 2013 study request, previous entrainment studies focusing on early life stages of shad (egg, yolk-sac larvae, post yolk-sac larvae, and juveniles) have been conducted at NMPS. Since those early 1990s studies, operations at NMPS have changed (and may change further as a result of this relicensing). Likewise, ongoing passage improvements at the Turners Falls Dam will lead to more adult shad moving through and spawning in the Turners Falls Pool. Therefore, more early life stages will be prone to entrainment. The impact this may have on the shad population and achievement of restoration goals needs to be addressed.

We recommend that a similar methodology to that used in the 1992 NUSCO study (Lawler, Matusky and Skelly Engineers 1993) be used by FirstLight to quantify entrainment of early life stages of shad at the NMPS Project. The sampling should begin July 1 and should continue through October 31.

Task 3: Estimation of Turbine Mortality

FirstLight proposes to use existing literature along with the site-specific design characteristics of the Turners Falls Project turbines to estimate mortality of resident fish entrained at Station 1 and Cabot Station. During the June 4, 2013 study plan meeting, the Service voiced concern over using this methodology, for the following reasons:

- While there is a database of turbine passage survival studies, the actual number of sites with similar design characteristics (e.g., turbine size, type, runner diameter, head, etc.) where similar target species were evaluated is quite small. Using Station 1 as an example, the table below shows the number of similar sites available for comparison in the Electric Power Research Institute database. Once the evaluated species are compared with potential species of interest at Turners Falls, it becomes apparent that any mortality estimates derived from the literature would be based on a very limited data set.
- As mentioned at the June 4, 2013 study plan meeting, a recent report by Kleinschmidt (2007) [that used a methodology at the Holtwood Project (FERC No. 1881) similar to the one that is being proposed in the current updated PSP] found that the average predicted survival values derived from the Advanced Hydro Turbine Model (Franke *et al.* 1997) were higher than actual empirical studies conducted at the Holtwood Project for juvenile Alosids. Where empirical data were taken from other projects, results showed a higher survival for some species/life stages evaluated than from the modeled results (for adult river herring and adult eels). Where empirical studies showed lower survival than modeled results, Kleinschmidt appears to attribute the discrepancies to flaws in the field studies, while results showing higher survival in the field studies are attributed to differences in turbine specifications (rather than to any inherent flaws in the Franke *et al.* model). The Service acknowledges that field studies rarely are conducted under perfect conditions, however it is equally plausible that the Franke *et al.* model requires further refinement that additional empirical studies may help inform.

While the Service does not object to using a desktop methodology to estimate turbine mortality at Station 1 and Cabot Station for resident fishes, we are recommending that the results of the empirical mortality studies that will be conducted on adult and juvenile shad and adult eels be compared to estimates derived using the Franke *et al.* model. This comparison should allow further insight into the appropriateness of using a model versus empirical study to calculate turbine mortality at a project.

Task 4: Reporting

The Service recommends that FirstLight include a table similar to Tables 2.3-1 and 2.3-2 in the Exelon Muddy Run Revised Study Plan 3.3 for eels or shad (FERC # 2355) that summarizes the long-term history of pumping (number of units per hour) at NMPS by month for April through November.

Table summarizing pertinent turbine specifications for projects where survival studies have been conducted, along with information from Turners Falls.

	Designed	Number	Runner		
	Turbine	of	Speed	Head	Runner
Station	Flow (cfs)	Buckets	(rpm)	(ft)	Diameter (in)
Turners Falls Station 1, Unit 3	500	??	200	43.7	42
Turners Falls Station 1, Unit 2	140		257	43.7	33
Alcona, MI	615	16	90	43	100
Alcona, MI	1155 -1660	16	90		100
Bond Falls, MI	450		300	210	
Caldron Falls, WI (Unit 1)			226	80	72
Centralia, WI (Unit 1)	510				
Centralia, WI (Unit 2)	510		90	20	28
Centralia, WI	variable			15.5	
Colton, NY	497	19	360	265	59
Cushman Plant 2, WA	800	17	300	450	83
Cushman Plant 2, WA (1960)	800	17	300		83
E. J. West, NY	2,700	15	113	63	131
Finch Pruyn, NY (Unit 4)				9-16	41
Finch Pruyn, NY (Unit 5)				9-16	41
Five Channels, MI	675	16	150	36	55
Five Channels, MI	1034 -1167	16	150		55
Grand Rapids, WI (U 1,2,4 comb)	645		90		
Grand Rapids, WI (Unit 2)	645		150	28	58
Grand Rapids, WI (Unit 4)	926		180	28	72
Hardy, MI (Unit 2)	510	16	163.6	100.2	83.75

Highley, NY	675	13	257	46	48
Hoist, MI	300		360	142	
Holtwood, PA(U10/single runner)	3,500	16	94.7	62	149.5
Holtwood, PA (U3/double runner)	3,500	17	102.8	62	112
Holtwood, PA	3,500	16	95	55	164
Luray, VA	369	12	164	18	62.75
La central de Beauharnois	7,000	13	75	79	212
Minetto, NY	1,500	16	72	17	139
Peshtigo, WI (Unit 4)	460		100	13	80
Potato Rapids, WI (Unit 1)	500		123	17	84
Potato Rapids, WI (Unit 2)	440		135	17	80
Pricket, MI	326		257	54	53.5
Rogers, MI (units 1 & 2)	383	15	150	39	60
Ruskin, BC	4,000		120	130	149
Sandstone Rapids, WI			150	42	87
Seton Creek, BC	4,500		120	150	114
Shasta, WA	3,200	15	138.5	380	184
Shasta, WA	3,200	15	138.5		184
Stevens Creek, SC	1,000	14	75	28	135
Vernon, VT/NH	1,834	15	74	34	156
White Rapids, WI	1,540	14	100	29	134
White Rapids, WI	900				
Youghiogheny, PA	750			120	

Study Schedule

The meeting for this study plan took place on June 4, 2013, not May 14, 2013.

3.3.8 Computational Fluid Dynamics Modeling in the Vicinity of the Fishway Entrances and Powerhouse Forebays

Study Goals and Objectives

Objective number 5 states that the computational fluid dynamics (CFD) modeling will be coupled with the telemetry study and passage counts to understand conditions preferable for guiding fish to entrances. We note that fish movements are also influenced by other variables, therefore FirstLight should also record and evaluate influences of river temperatures and flows on movements and passage information.

Project Nexus

FirstLight states that existing information indicates that substantial numbers of outmigrating fish use the log sluice/bypass. Given the research that has been done by the Conte Fish Branch at this site, this statement is not accurate with respect to eels and should be clarified accordingly.

Methodology

Task 3 is to construct a three-dimensional model of each target location. The description of the model does not identify grid size to be used in the model. Without some idea of the size of the grid to be used, it is impossible to know if the CFD modeling will be meaningful. For example, a 2-foot grid cell will not provide fine enough resolution to provide data about sweeping velocities at the intake rack or the capture velocities in front of the downstream bypass. The final study plan should define the grid size and provide justification for the proposed grid size.

Task 4 is to execute model runs. Since tailwater conditions greatly affect the functionality of both ladder entrances, FirstLight should run the model for different tailwater conditions based on the normal range of tailwater levels.

3.3.9 Two-Dimensional Modeling of the Northfield Mountain Pumped Storage Project

Study Goals and Objectives

This section states that one goal is to “Assess velocities and flow fields at, and in proximity to, the Project intake/discharge structure...” We note that River2D cannot model vertical walls. River2D is designed to model river beds and cannot model vertical walls based on the experience of our hydraulic engineers and their conversations with Terry Waddle (USGS retired) who was on the River2D development team. Approximating vertical as slightly sloped walls can lead to numerical instabilities within the model. In light of these limitations, we can only speculate that River2D can be used to accurately model flow field in the proximity of the intake/discharge structure; however, if it cannot, is River2D the right software to use? There are other two-dimensional codes like SMS that may be applicable, and should be considered.

Methodology

FirstLight proposes to develop a 2-D model of the NMPS intake/discharge area in order to evaluate potential impacts to fish and bank erosion. In the initial study plan, this assessment was to occur from the NMPS project to 1 km upstream and downstream of the intake/discharge area. At the May 21, 2013 study plan meeting, stakeholders commented that the distance should be expanded from 1 km to 5 km; however, the updated PSP does not incorporate this change.

The proposed River2D model is a steady-state model. Based on some estimates of hydrograph speed and wave celerity, it may take 30 minutes before changes in intake/discharge conditions at the pumps are propagated throughout the extent of the 2-km-long proposed model (or longer with a more extended model we recommended). Given the diurnal nature of both shad movement and pumped storage operations, a transient River2D model seems warranted to assess

NMPS effects on fish and to inform agency management decisions. The existing steady-state Woodlot model (2007) should be able to be adapted to transient set-up and we recommend this be incorporated too.

Regarding Task 3, FirstLight indicates that in the proposed model, the “initial uniform gridded base mesh will be generated on an approximately 50-75 foot spacing” and refined where necessary. This initial grid size may have been appropriate for the original Woodlot model, but this proposed model is focusing in part on the intake/discharge structure which is approximately 75 feet across. That means the entire intake is only one grid cell. The baseline for grid size should be based on getting ten or more cells laterally across the intake/discharge structure and refined moving out. Without this level of resolution, the FirstLight model will not be very accurate or helpful in the proximity of the structure.

At the May 21, 2013 study plan meeting, there were at least two comments made by stakeholders relative to velocities. The first (made by the Service’s Connecticut River Coordinator) concerned velocity measurements at the NMPS intake. Because only mean column velocity will be used in the model, the Service had requested, if it would be possible, to develop separate velocity profiles for the intake. FirstLight’s consultant indicated that it would be possible to provide those data, as an acoustic doppler current profiler (ADCP) unit will be used to collect velocity measurements at the intake while gathering calibration data. This effort should be included in the study plan. These data are important because differential velocities across the intake area relate directly to potential for entrainment based on, among other variables, where a fish tends to reside in the water column (e.g., Alosids tend to be surface oriented, whereas eels tend to be bottom oriented).

The second comment related to deliverables. While the updated PSP states that model run results will include 2-D water depths and velocities, the Commission’s consultant had requested that the study plan include more details regarding how the results would be presented (e.g., vector plots, pseudocolor maps, etc.). It does not appear that FirstLight has addressed this issue.

3.3.10 Assess Operational Impacts on State-listed Odonates

We defer comment on this study to the Massachusetts Division of Fisheries and Wildlife’s Non-Game and Natural Heritage Program.

3.3.11 Fish Assemblage Assessment

Methodology

FirstLight proposes to sample, using three gear types, in the early summer and fall time period. During the June 5, 2013 study plan meeting, the Service had recommended adding in a third time period in the spring. We reiterate this recommendation, as it will provide more comprehensive temporal coverage and increase the probability of detecting those fish species that are more active or fulfilling specific life history requirements under cooler water temperatures (e.g., walleye, white sucker). In order to avoid conflicts with the shortnose sturgeon, the spring sample could focus on the impoundment and bypass reach.

Sampling will be based upon habitat strata, but no definitions for the strata are provided. Using the upstream boundary of Vernon Dam to the Turners Falls Dam, there is the potential to designate many strata on a variety of important criteria. The Service recommends that an overriding criterion should be whether the area is subject to less of an impoundment effect (Stebbins Island to Ashuelot River confluence), is in impounded riverine (much of the main stem), off-channel areas (Bartons Cove, Miller Rod and Gun Club area), and lower reaches of tributaries (e.g., Ashuelot River, Dry Brook, Millers River, Four Mile Brook). These areas will provide different habitat conditions for different species and/or life stages. Large areas, such as “main stem” habitat from possibly the Ashuelot River to the Turners Falls Dam, should be defined by depth zones, reflecting nearshore/shallow, mid-channel shallow, deep water, substrate type (fines/sand/gravel/rock), and submerged aquatic vegetation beds, as these similarly affect species and life stage use.

FirstLight states that at least 18 stations will be sampled. The number of stations should be reflective of the stratification designations and should be based on the diversity of habitat types/criteria noted above, which will influence fish species occurrence. The number of replicate samples required within randomly selected strata should be based on observed species catch rates.

The updated PSP notes collection of 150 fish will satisfy sampling in a transect. However, it is possible that the proposed target number could be reached with one school of spottail shiners or yellow perch, which could lead to a misrepresentation of the fish assemblage at that transect. Sampling cannot be standardized to both distance and sampling on-meter time; rather, sampling time, based on electrofisher “on-time” should be the standard for effort (the 500 seconds identified in the plan appears reasonable). Using distance to standardize is not preferred because the distance sampled will and can vary based on rate of drift/powering, habitat types, quantity of fish and other factors with a 500-second time period. However, FirstLight should report the distance for each transect.

Gill net set time should be reduced from the 24-hour period stated. A several-hour period (3-4 hours) set at dusk into early evening will increase netting effectiveness and reduce the risk of excessive fish mortality. Should catch rates be extremely low, longer sets could then be used. Effort could be reported in catch per net hour (with identification of timing: dusk, dusk-evening, evening).

3.3.12 Evaluate Frequency of Impact of Emergency Gates and Bypass Flume on Shortnose Sturgeon

Methodology

FirstLight states that, should field evaluation of spillway gate and bypass flume scenarios be necessary, data will be collected during the fall to avoid potential impacts to shortnose sturgeon spawning and incubation. However, the fall is when FirstLight proposes to conduct a number of downstream passage studies, and manipulating gate settings during that period could influence

study results. The Service recommends that simulated events occur during the summer period, to avoid interfering with other relicensing studies.³

3.3.13 Impacts of Project Operations on Littoral Zone Habitat

The Service has no objection to the updated PSP, as it appears to incorporate all of the comments raised during the May 22, 2013 study plan meeting.

3.3.14 Aquatic Habitat Mapping of Turners Falls Impoundment

Task 2: Analysis and Report

The Service has no objection to the updated PSP, as it appears to incorporate comments raised during the May 22, 2013 study plan meeting.

3.3.15 Assessment of Adult Sea Lamprey Spawning with Project Areas

FirstLight proposes to survey areas of suitable habitat in the Connecticut River from below Vernon Dam downstream to the Route 116 Bridge in Sunderland, as well as in selected tributaries. At the May 22, 2013 study plan meeting, the Service questioned why only three tributaries had been identified in the initial study plan (the Deerfield, Millers and Ashuelot rivers). In response, the updated PSP contains one additional tributary (the Fall River). The Service recommends that the Green and Sawmill rivers be evaluated to determine if suitable habitat in confluence areas may be affected by project operations, as sea lamprey spawning has been documented in both rivers.

Study Goals and Objectives

The last listed objective of the study is to assess whether the operations of the projects are adversely affecting sea lamprey spawning areas. This objective is too narrow. The study should assess whether the operations of the project are adversely affecting lamprey spawning, not just spawning habitat, since project-induced flow or water level changes could affect spawning behavior without substantial visible sign of direct impact to physical habitat (i.e., dewatering nests, washing nests away, deposition of fine sediment on nest). To this end, the proposed study plan would need to be revised to more closely resemble the study plan proposed by TransCanada for their upstream projects.

Task 1: Field Data Collection

As part of the field data collection, FirstLight proposes to delineate remaining wetted areas of suitable habitat to determine areal loss of habitat. Yergeau's (1983) research found that a minimum velocity over the nests was needed; on the Deerfield River, where most nests were constructed along the river banks, abrupt changes in river discharge resulted in many abandoned redds, even though the nests were still wetted. Therefore, all relevant variables (depth, velocity

³ Under the Study Schedule section of the plan, the summer of 2014 is identified as when the field investigation would take place.

and substrate) should be taken into account when determining the amount of remaining suitable habitat.

Field data collection also includes returning to a subset of 30 identified redds during a period of low water levels that follow a high flow event to assess whether the change in flows affected the habitat or resulted in nest abandonment. Preference for nest selection will be given to “nests most likely impacted by project operations.” The stated protocol and nest selection criteria will not be sufficient to fully assess the impact of project operations.

First, it is not clear what is meant by low flow events following high flow events. Since the operations of both projects can result in multiple flow and water level fluctuations daily, these normal project operations need to be assessed. Also, it is not clear if FirstLight proposes that nests would be re-visited only once or more frequently. Lastly, nest selection would be weighted to nests thought to be most likely impacted, but the actual impacts of the project on nests and spawning behavior are not known.

Since spawning lamprey would be subject to daily but variable fluctuations (varying high flows, low flows and rates of change), it will be important to assess the nests frequently to observe nest condition and nesting behavior over a full range of project operations. The study proposal by TransCanada, in response to a very similar study request, proposes a more robust sampling and observation protocol that will be far more likely to permit an evaluation of the full range of impacts to lamprey spawning habitat and spawning behavior. The TransCanada study proposes observation of nests from the arrival of lamprey at a spawning area (see comments on telemetry below) until water temperature exceeds 22°C, re-visiting a subset of nests on a daily basis. On each visit to a nest, lamprey spawning activity and physical habitat data will be collected, and photographs of nests will be taken under a range of flow conditions. TransCanada proposes to select the subset of nests that will provide as much habitat variability as possible, rather than weighting selections based on assumptions of impacts.

We recommend that FirstLight review and adopt the lamprey redd observation protocols proposed by TransCanada. Implementation of those sampling protocols would assure that sufficient information is gathered on both redds and spawning behavior, over a range of project operations and a range of redd locations and habitats.

Task 2: Data Analysis

Additional analysis of lamprey nest location data should be undertaken to compare redd locations and results of periodic observations to project operations throughout the spawning period.

This section of the updated PSP provides no details on the types of statistical analyses that will be performed on the data collected. We recommend that the narrative under Task 1, where FirstLight states that appropriate statistical techniques such as ANOVA, regression and t-tests will be used to compare variables and determine which factors may affect spawning success, be moved to Task 2.

Task 3: Report

The report should include a map of spawning areas and individual redds that are periodically monitored.

Study Schedule

At the May 22, 2013 study plan meeting, the Service voiced concern over relying solely on habitat-based surveys to evaluate spawning success relative to project operations. TransCanada is conducting a similar study, but is using radio telemetry to track sea lamprey to spawning grounds. We expressed similar concerns to them: relying on just one methodology has disadvantages. In the case of FirstLight's proposal, it is possible that, given the large geographic area, the amount of potential spawning habitat, and the highly variable passage numbers at the Holyoke and Turners Falls projects, surveys may not identify any active nests. Coupling this effort with a modest-scale radio telemetry study, as proposed by TransCanada, would help ensure that data are collected at active nest sites. If a telemetry component is not included in 2014, but an insufficient number of nest sites are observed in 2014, the Service recommends that the study be repeated in 2015, and that the methodology be modified to include a radio telemetry component.

3.3.16 Habitat Modeling for State-Listed Mussel Species Downstream of Cabot

We defer comment on this study to the Massachusetts Division of Fisheries and Wildlife's Non-Game and Natural Heritage Program.

3.3.17 Tributary and Backwater Access and Habitat

Existing Information

At the May 22, 2013 study plan meeting, the Service questioned whether disregarding larger tributaries in this investigation was reasonable. FirstLight states that larger tributaries have sufficient access during all operational phases due to the large catchment size. This reasoning does not account for channel morphology at the confluence, where large sediment bars or other morphological features may inhibit access during certain operational phases regardless of tributary drainage area.

Project Nexus

As stated above, the Service is not convinced that the larger tributaries should be discounted from this investigation. Given that there are only three such systems in the study area, it would not appear to increase the survey effort substantially to add them to the study plan. In fact, the Deerfield River is listed as an investigation area in this section, even though in an earlier section of the updated PSP, FirstLight states it will not be investigated.

Methodology

In response to comments made by stakeholders at the May 22, 2013 study plan meeting, FirstLight has revised its proposed depth criterion from 4 inches to 1 foot. The Service supports this change, as a 4-inch depth would be inadequate for the range of species expected to move upstream into tributaries (e.g., white sucker, trout, sea lamprey, etc.).

Study Schedule

FirstLight states that the survey will be conducted in 2014. The plan does not address a situation like this year, where flows have exceeded the capacity of the Turners Falls Project since the end of May (excluding June 20-27, 2013), which likely would have impacted trying to obtain low flow data. The Service recommends that, should flow conditions in 2014 limit the ability to collect low flow/headpond elevation data, the study should be repeated in 2015.

3.3.18 Turners Falls Canal Drawdown

Study Goals and Objectives

In response to feedback provided by stakeholders at the May 22, 2013 study plan meeting, FirstLight has modified the goals and objectives of this study. The Service believes the updated goals and objectives address the concerns raised at the meeting.

Task 1: Conduct Aquatic Organism Survey of Canal During 2014 Drawdown

Standing Water Surveys

There are no specifically stated methodologies in this section; rather, references are made to an assessment in 2011. During the May 22, 2013 study plan meeting a number of stakeholders expressed dissatisfaction with the qualitative nature of that survey. Assessment techniques for fishes in ponded or flowing water when the drawdown is complete should include backpack electrofishers and seine net gear. Standard approaches to determine relative abundance may include standardized effort among sample areas with fish captured, identified, enumerated and reported in a unit of effort/time, such as fish/minute, using the backpack meter timer.

A standard level of effort, such as a single backpack operator with dip net, with one or two people netting, can be utilized as the habitat conditions permit among the zones (as a standardized level of effort) for a set period of time (e.g., 500 seconds on-meter). This will allow repeated measures and comparisons among areas. Where it is not possible to use backpack shockers effectively, seine nets may be employed. Standardized methods should be developed, such as a single sweep using a bridle/rope.

The plan is not clear as to how frequently the areas of standing water will be monitored. We recommend that at a minimum, those sites be monitored three times (immediately after the drawdown is complete, in the middle of the drawdown period, and immediately prior to refilling the canal).

Dewatered Area Surveys

FirstLight proposes to quantitatively assess the impact of the canal drawdown on sea lamprey ammocetes and freshwater mussels, by deploying up to 10 randomly selected 1-meter-by-1-meter quadrats in zones 2-4. Counts and status (stranded, alive, dead) of lamprey and mussels within each quadrat would be recorded and the data extrapolated to all suitable habitat within each zone.

According to data from the Appendix G survey report, sea lamprey were observed in zones 5 and 6; therefore, those areas should be included in the quadrat survey. Additionally, from the photos presented in Appendix G, it is clear that each zone differs in width and bathymetry. The Service recommends that 10 quadrats be placed randomly in zones 2 and 6, and 20 quadrats be placed in zones 3, 4 and 5. We also recommend stratifying by bank and channel. The final number and placement of quadrats should occur in consultation with the resource agencies and Conte Lab researchers.

The plan should also address how the Station 1 forebay is impacted by the drawdown. We cannot ascertain from the Appendix G report whether that area remains wetted, as the main canal in that zone (7) apparently does. If the forebay area also becomes dewatered, it should be surveyed also.

FirstLight states that the location of sufficiently wetted areas or pools will be recorded, although the method is unclear. The Service recommends that all standing pools of water in zones 2 through 6 be mapped with a GPS unit. This information should then be used to develop graphical representations of the canal in its dewatered state, including identifying those pools where water quality data was recorded. In addition to collecting water quality information from standing pools, water temperature should be monitored in zone 7 for the duration of the drawdown with a continuous data logger(s).

Catches may be reported in units of standardized time of effort and also by unit area (quadrats). Water quality information, fish survey and quadrat data should be summarized in tabular format and included with the graphical canal representation in a report to be provided to stakeholders.

Task 2: Identify and Assess Potential Measures

The plan should identify that another potential measure to be evaluated is the need for annual drawdowns. At the May 22, 2013 study plan meeting, it was conveyed to the stakeholders that the Commission's Part 12 inspection recommends that drawdowns be conducted annually (but does not require it).

In addition to reaching agreement on measures to assess, this task also needs to include development (through consultation with stakeholders) of a study design to assess the effectiveness of any measures that will be tested in the field.

Task 3: Design Selected Measure(s)

Earlier in the updated PSP, FirstLight states that selected measures to reduce adverse effects of the drawdown will be studied in 2015 (first paragraph under the Methodology section); however,

Task 3 does not explicitly state that the selected measure(s) will be studied (only that they will be designed). The plan should specify that selected measure(s) will be designed and studied to determine the effectiveness at minimizing adverse impacts to fish and mussels.

Study Schedule

The seventh bullet should read “Install and Test – September 2015.”

This section also should describe how the proposed schedule fits into the Integrated Licensing Process and procedural deadlines.

3.3.19 Evaluate the Use of an Ultrasound Array at the Cabot Tailrace

General Description of Proposed Study

FirstLight states that this study will be conducted in 2015, pending the results of studies 3.3.1 (instream flow study) and 3.3.2 (adult shad telemetry study); however, the plan is unclear regarding how the results of those studies would inform the need to conduct the ultrasound array study. Absent all of the radio-tagged shad moving up to the dam without delay at Cabot Station under all spill conditions, it will be necessary to conduct the ultrasound array study. The Service is recommending the shad telemetry study occur in 2014 and 2015, which will allow for one full year of studying shad movement without the array and another with the array (for a portion of the migration season).

Task 1: Ultrasound Deployment

The plan does not describe specifics on study design, but states the agencies will be consulted to determine a schedule. We offer the following guidance on minimum design elements:

- ultrasound testing should be initiated once telemetered shad arrive at Cabot Station;
- two test treatments will be evaluated: array on and array off;
- there should be a minimum of six replicates per treatment per flow condition (e.g., non-generation, generation, spill, etc.);
- the first “on” treatment should begin between 10 a.m. and noon daily;
- each “on” treatment should run for at least two hours and each “off” treatment should run for a minimum of three hours (to ensure that sufficient shad are present in the tailrace when the next “on” test begins); and
- a maximum of three days of testing per week for a minimum of two weeks should be conducted (or for the number of weeks necessary to meet the minimum replicate criterion).

For example, if testing were to occur over three days, and it is assumed that shad move during daylight hours (approximately 8 a.m. to 6 p.m.), it would be possible to perform at least four tests per day, for a total of 12 tests (six replicates per treatment). Alternative testing schedules may be considered based on initial results, in consultation with stakeholders. After the first week of trials, a progress report should be provided to stakeholders that describes preliminary results.

Adjustments to the array or study design, if appropriate, and agreed to by FirstLight and interested parties, could be initiated at that time

At the May 21, 2013 study plan meeting, a stakeholder recommended that video be used to supplement the telemetry data. The Service supports this recommendation, as it would allow for observational evaluation of shad (tagged and untagged) behavior in the vicinity of the array during test treatments. Cameras should be deployed both inside the Cabot ladder and outside of the ladder entrance.

FirstLight is proposing to conduct the study in 2015. If the study were to be performed in 2014 and results proved to be insufficient to determine the effectiveness of ultrasound technology in moving fish away from the tailrace and up into the bypass, there would still be an additional study year to either redo or modify the study to employ different monitoring methods, such as hydroacoustics. Therefore, in order to maximize the chances of collecting sufficient data in one study year, the Service recommends adding in hydroacoustics to evaluate how shad respond to the ultrasound array. This would allow for larger sample sizes than telemetry and/or video alone.

Although not specified in the updated PSP, the same telemetry locations described in our comments under Study Plan 3.3.2 should be used in the ultrasound study:

- Deerfield River Confluence – full river width
- Cabot Station Tailrace
 - Radio telemetry antenna coverage of the full tailrace
 - Radio telemetry antenna coverage of the area immediately in front of the fishway entrance
- Below the Cabot Station – full river width
- Rawson Island (both channels)

Environmental and operational data should be recorded during each test period and used in data analysis and interpretation.

Task 2: Reporting

FirstLight does not describe the types of analyses that will be conducted on the data collected. For the telemetry data, FirstLight should use a test that will allow for determination as to whether there is a statistically significant (at $p \leq 0.05$) difference in the number of readings with the array on and off. This will help answer the question of whether ensouffication is a successful avoidance mechanism. In order to determine if the ultrasound array reduces or eliminates delay in the tailrace, FirstLight should analyze the telemetry data to see if there is a relationship between the number of readings for an individual tag and the treatment type (e.g., if there are fewer readings per individual under an “array on” treatment, it may indicate the array reduces delay). The video data should be qualitatively summarized. Hydroacoustic data should be analyzed to determine the relationship between the number of targets in the vicinity of the Cabot tailrace and ultrasound treatment.

3.4.1 Baseline Botanical

Task 2: Field Surveys

Wildlife and Habitat Type Mapping

The Service recommends that all eagle roosting or nesting trees, either previously documented or observed during the surveys, should be recorded, photo-documented and georeferenced.

Invasive Plant Survey

FirstLight states that the intent of the upland invasive species survey is to document significant infested areas. The word “significant” is somewhat ambiguous unless it is being used in the statistical sense, which we do not think is the case for the subject study; therefore, we recommend removing it. The Service has no objection to the proposed methodology.

Task 3: Data Analysis and Reporting

This section of the plan lacks specificity. For the bald eagle information, we recommend that the report provide maps of the project area showing locations of all eagle roosting and nesting trees. A complementary table should be provided listing the location of the trees, whether it is a roosting or nesting site, an assessment of its status (healthy, diseased, etc.) and its level of protection (e.g., within a right-of-way, on protected/conservation land, etc.). Similarly, the invasive plant data should be portrayed on maps as both polygons and point locations, as appropriate. In addition, the invasive data should be provided in tabular format, listing the infestation, species composition and estimated size of infestation.

Study Schedule

The schedule shows report preparation from September to December of 2014. FirstLight should describe how this timeline fits into the Commission’s Integrated Licensing Process and procedural deadlines.

3.5.1 Wetlands, Riparian, and Littoral Habitat Baseline Survey

Task 4: Invasive Plant Survey

In the updated PSP, this section has been expanded to provide more details on the specific invasive species to be included in the survey. As in the upland botanical survey study plan, FirstLight has added in language stating that the intent of the survey is to document significant infested areas. As stated above, the word “significant” is somewhat ambiguous unless it is being used in the statistical sense, which we do not think is the case for the subject study; therefore, we recommend removing it.

While, in general, the Service has no objection to the proposed methodology, it is still unclear to us whether FirstLight intends to survey the entire impoundment and 13-mile stretch of river

below the Turners Falls Dam for wetland and aquatic invasives. In response to this question being raised at the June 5, 2013 study plan meeting, our recollection is that FirstLight indicated that it would be surveying the entire perimeter of the project-influenced area; this does not appear to be reflected in the updated PSP. The Service recommends that FirstLight survey for riparian and aquatic invasives, by boat or on foot, along the entire perimeter of the impoundment and downstream of the dam to the Route 116 Bridge in Sunderland on both sides of the river. The shoreline area to be surveyed should include aquatic, littoral and riparian areas up to the limit of the project-influenced extent of the streambanks.

Task 6: Project Water Level Fluctuation Assessment

To address implications of water level fluctuations on federally listed Puritan tiger beetle habitat, the updated PSP proposes establishment of a cross-section transect to be used in conjunction with hydraulic modeling results. The limited habitat for the Puritan tiger beetle at Rainbow Beach is a shallow sloped area that is sensitive to water level fluctuations. Additional cross-sections and/or fine-scale surveying and mapping of the entire area should be considered so that the areal extent of habitat impacted by various river flow and Holyoke Project pool elevations can be fully assessed.

Study Schedule

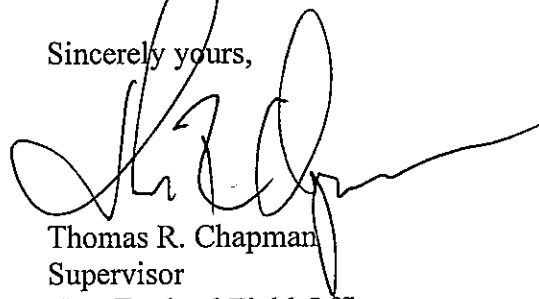
The schedule shows report preparation from September to December of 2014. FirstLight should describe how this timeline fits into the Commission's Integrated Licensing Process and procedural deadlines.

3.8.1 Evaluate the Current and Potential Future Modes of Operation

The Service has no comments on this study plan.

Thank you for the opportunity to comment on the proposed updated PSP. If you have any questions regarding these comments, please contact John Warner of this office at 603/223-2541.

Sincerely yours,



Thomas R. Chapman
Supervisor
New England Field Office

Kimberly D. Bose, Secretary
July 15, 2013

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