Commonwealth of Massachusetts

Division of Fisheries & Wildlife

MassWildlife

Wayne F. MacCallum, *Director*

August 29, 2013

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

COMMENTS
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Project No. 1889
Revised Proposed Study Plans (RSP)

Dear Secretary Bose,

The Massachusetts Division of Fisheries and Wildlife (Division) is the agency responsible for the protection and management of the fish and wildlife resources of the Commonwealth. The Division is also responsible for the regulatory protection of imperiled species and their habitats as codified under the Massachusetts Endangered Species Act (M.G.L. c.131A). The Massachusetts Endangered Species Act (MESA) was enacted in December 1990. Implementing regulations (321 CMR 10.00) were promulgated in 1992 and recently revised and implemented as of November 2010. The MESA provides a framework for review of projects or activities that occur within mapped areas of the state, called *Priority Habitat*, and published in the Natural Heritage Atlas. As such, we monitor operations at hydroelectric projects within the Commonwealth, as well as comment on proposed hydroelectric facilities. The Division has the following comments in response to the August 14 filing of FirstLight Hydro Generating Company's "Revised Proposed Study Plan for the Turners Falls Hydroelectric Project (P-1889) and Northfield Mountain Pumped Storage Project (P-2485)".

General comments:

In general, FirstLight has attempted to incorporate the comments and suggestions received from stakeholders on the April 15, 2013 Proposed Study Plan (PSP) and June 28, 2013 Updated Proposed Study Plan (UPSP). A few issues remain.

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3.3.2 Hydraulic Study of Turners Falls Dam Impoundment, Bypass Reach and below Cabot Station

The fourth paragraph on page 3-79 suggests that the topography of river banks and floodplains is needed when simulating flows and that FirstLight will rely on ten meter digital elevation models for necessary upland information. Further, FirstLight suggests that depth, velocity, and WSEL data will be collected from transects as part of Study No. 3.3.1, which have yet to be determined.

As stated in its previous comments on the UPSP, the RSP should reference collection of transects associated with state-listed macro-invertebrate and plant species. As further described within the Division's comments on Study No. 3.5.1, the RSP should confirm that transects will be established in a subset of occupied and unoccupied patches of tiger beetle and state-listed plant habitat to refine, and for use in conjunction with, hydraulic modeling results. Fine-scale variability in elevation, slope, substrate, and flow dynamics have the potential to significantly impact habitat suitability for these species, and multiple transects are likely needed to fully understand the extent and quality of habitats at these sites. Similarly, field assessments should involve collecting elevation, slope, substrate, flood depth, flood duration, and velocity measurements sufficient to permit assessment of how the quality and extent of suitable habitat changes over a range of flows. The Division would strongly encourage FirstLight to consult with the Division prior to initiation of field work in order to seek concurrence that transect selection and data collection are sufficient to enable fine-scale analyses.

3.3.1 Conduct Instream Flow Habitat Assessments in Bypass Reach and below Cabot Station

Figure 3.3.1-5 shows seven shad spawning locations. Study Plan No. 3.3.6 states that there are fifteen previously identified shad spawning locations. All locations should be plotted.

Table 3.3.1-2 target species: Sea Lamprey spawning and incubation should be added to Reach 1 and 2. Substrate may be lacking but fish will be there when more water is added to the bypass reach.

Because shad spawning sites are important, transects in the IFIM study should be located at each spawning location in reaches 4 and 5. If the shad spawning survey finds additional spawning locations, transects should also be placed at each new location.

HIS Criteria: The Division believes that good progress is being made to identify which HIS curves for which species/life history stages will be used to determine habitat availability and flow recommendations and the addition of curves which

represent fish guilds rather than individual species shows some merit and should be followed up.

RARE SPECIES:

The RSP has been revised relative to the UPSP in accordance with the Divisions' request to include IFIM and habitat persistence modeling for freshwater mussels in Reach 5 (from Rte. 116 Bridge in Sunderland to Dinosaur Footprints Reservation). The Division reaffirms its request that the proposed study include modeling of persistent habitat for all state-listed freshwater mussel species in all reaches, from the bypass reach through Reach 5. Tasks 2-6 should be amended so as to detail FirstLight's plan to apply appropriate data collection, modeling, and analysis methodologies for state-listed mussel species in all reaches. If 1-D modeling approaches do not provide data sufficient for spatial analysis and estimation of habitat persistence, FirstLight should consider alternative approaches that are capable of providing this critical data**.**

The Division further reaffirms that persistent habitat modeling should be conducted in all reaches for all three state-listed mussel species, as previously requested, regardless of current occupancy. These species include: Dwarf wedgemussel (*Alasmidonta heterodon*), yellow lampmussel (*Lampsilis cariosa*), and eastern pondmussel (*Ligumia nasuta*).

1. Note that in responses to the Division's comments on UPSP 3.3.1, FirstLight incorrectly listed eastern lampmussel (*Lampsilis radiata*) as a target species and omitted eastern pondmussel (*Ligumia nasuta*). *L. radiata* is a common species and was not included by the Division in its requests for habitat persistence modeling. *L. nasuta* is state-listed as a "Species of Special Concern" in Massachusetts protected under the MESA, and should replace *L. radiata* for inclusion in habitat persistence modeling.

2. In its comments on the UPSP, the Division clearly requested quantitative habitat data collection, construction of data-driven HSIs, and persistent habitat modeling for all three state-listed mussel species in lieu of the initially proposed modeling of potential host fish habitat. This request was made because use of host fish habitat as a surrogate for mussel habitat persistence is NOT an acceptable approach for analysis of potential Project effects and conservation of mussel populations more broadly. In response to our comments on the UPSP, FirstLight has chosen to only model habitat persistence for *Lampsilis cariosa*; however, the RSP appears to ignore the need for data-driven assessment of the effects of current and future Project operations on two of the three rare species (one state-listed and one federally- and state-listed) with the potential to occur in the Connecticut River, both now and under potentially modified flow regimes. Previous Division requests for data-driven modeling of suitable habitat availability and persistence of all state-listed mussels currently or historically occurring in the Connecticut River should not be viewed as a "research project" – as suggested by the RSP in response to the Division's comments on the UPSP –

but as a critical mechanism for determining the effects of current and proposed Project operations on species protected under the MESA and U.S. Endangered Species Act and enabling informed, data-driven flow recommendations.

a. As outlined further in the Division's comments to Study No. 3.3.16, the Division also believes that the proposed construction of Category I HSI criteria using a DELPHI workgroup, if utilized, should be an iterative process in which additional data is collected following panel recommendations to ground-truth expert opinion. Additionally, the Division and other key stakeholders should have a central role in the selection and review of DELPHI workgroup participants.

3. In the RSP, FirstLight has chosen to eliminate use of host fish habitat modeling approaches for state- and federally-listed mussel species. Although the Division does not support the use of host fish habitat as a proxy for persistent mussel habitat modeling, persistence of suitable host fish habitat and passage across barriers is required for sustained mussel populations above and below the Turners Falls Dam. The Division has requested assessment of host fish relationships (see the Division's comments to Study No. 3.3.11 for additional explanation) and the use of these relationships to guide fish passage design at Turners Falls. The Division reaffirms that habitat persistence should be modeled, and passage evaluated, for key host fish species of state- and federally-listed mussels.

   Modeling of individual host fish habitat, as part of the overall modeling effort, would yield critical information regarding the presence and availability of host fish habitat in the Connecticut River and whether host fish habitat availability is a limiting factor to mussel distribution. As outlined in the Division's comments on UPSP Study No. 3.3.11, the Division believes that the RSP should be amended to include one of the following two options:

   a. **Preferred Host Fish Modeling Option:** Develop HSI curves for *confirmed* host fish, to be used to model host fish habitat persistence and mussel dispersal across barriers. The identification of suitable host fish relationship for *Lampsilis cariosa* and *Ligumia nasuta* are needed and can be determined through a laboratory host trial described further under the Division's comments on Study No. 3.3.11. Such studies are not necessary for *Alasmidonta heterodon*, as Tesselated Darter can be has been well established as a confirmed host fish in laboratory and field studies (Michaelson & Neves 1995); this relationship should be included in Table 3.3.1-2. For the other two species, once a suitable host fish is identified, the IFIM model for the host fish may be used to focus on host habitat and passage and determine if these represent limiting factors in the persistence of the mussel species.

The Division notes that although *potential* host fish species have been identified in some cases, *actual* host fish species remain poorly understood. For example, Table 3.3.11-1 acknowledges that glochidial host fish for Eastern Pondmussel is unknown. Congeners of this species metamorphose on a number of fish species that are primarily inland freshwater species (i.e. bass, sunfish, perches, etc. [Corey et al. 2006]), suggesting that the proposed use of American shad as a host/habitat proxy may not be appropriate.

The Division is concerned about the proposed omission of glochidial assessments (see Study No. 3.3.11) because, without a more concrete understanding of which fish species are actually utilized as hosts within the Connecticut River, and which species are particularly important in enabling mussels to complete this key stage of their life cycle, fish passage and habitat persistence would have to be assessed and ensured for all potential host fish species. Further, the design of any potential fish passage devices would be dramatically more difficult without an understanding of specific fish swimming speeds, necessary approach velocities, attraction flows, etc.

Furthermore, instream habitat alterations may affect host fish presence in reaches both above and below the dam. Any associated loss in host abundance would also manifest a decline in mussel populations. The intent of this element of the Division's study request is to target which host fish species are most critical in the Connecticut River, and therefore, guide analysis and future re-design of current fish passage structures at Turner's Falls to ensure passage of these critical host fishes. It is, in effect, complimentary to Study Plan No.'s 3.3.1, 3.3.2, 3.3.3, 3.3.4, and 3.3.5, all of which seek to assess habitat persistence, and upstream and downstream passage for migratory fish species, except that the species of concern for mussels requires identification to ensure adequate design. Further, the design of any potential fish passage devices would be dramatically more difficult without understanding of specific fish swimming speeds, necessary approach velocities, attraction flows, etc. Design of any passage devices under such circumstances would be difficult, at best.

b. **Alternative Host Fish Modeling Option:** Develop HSI curves for all potential hosts as surrogates for confirmed host fish. Should FirstLight wish to assume that all potential host fish species are equally important for purposes of the re-licensing process, model habitat persistence of all potential host species in reaches affected by flow alteration, and agree to enable passage of all potential host species as part of re-licensing discussions, the Division would willingly cede this request with our above concerns about the inefficiencies and engineering challenges this presents.

If a host fish is determined to be present, persists, has adequate migration across barriers in the absence of a viable mussel population, then the Division would conclude that host fish availability is not a limiting factor in mussel distributions in the Connecticut River, and that other factors are limiting mussel persistence.

General Description of Proposed Study

The RSP and the UPSP acknowledge the Division's request for a habitat-based field study "such as" IFIM & PHABSIM conducted in the bypass reach and below Cabot Station in order to quantify the relationship between Project operations and aquatic habitat persistence. The RSP proposes to utilize an approach similar to that outlined in Maloney et al. (2012), but only proposes the use of 1-D modeling in lieu of the 2-D modeling employed by Maloney. FirstLight acknowledges that the proposed 1-D modeling in PHABSIM may be ineffective at modeling persistent habitat of freshwater mussels (see Task 6b responses), but does not offer a resolution or alternative modeling approach. The Division agrees with FirstLight's assessment that 1-D modeling in PHABSIM may be ineffective. While the Division does not object to FirstLight utilizing the proposed modeling approach, we restate our request for FirstLight to pursue an alternative modeling approach with documented effectiveness (see Maloney et al. (2012) or Parasiewicz et al. (2012)) a priori, or otherwise be prepared to do so should the proposed 1-D modeling in PHABSIM prove inadequate to analyze the persistence of all parameters needed for suitable habitat persistence.

Resource Management Goals of Agencies/Tribes with Jurisdiction over Resource (18 CFR § 5.11(d)(2))

The Division requests that the first two bullets be amended to specifically include the protection and enhancement of freshwater mussel species.

Existing Information

Freshwater Mussels:
On page 3-95 and 3-96, the RSP proposes to use data collected from mussel surveys conducted in 2012 (reaches 1-3 & canal) and those planned or currently being conducted to assess freshwater mussel presence and habitat in reaches 4 & 5, with additional data collected derived in association with the FERC license of the Holyoke Dam. We are supportive of FirstLight's efforts to maximize efficiency; as provided in our comments on the UPSP, however, the Division reiterates that data collection pursuant to the FERC license of the Holyoke Dam will not be sufficient to meet the requirements set forth in the Division's Study Request for the Turners Falls Dam without modification. This concern was not addressed within the RSP. The Division also asked for changes to data collection methodologies (see comments on Study No. 3.3.16), which similarly remain unresolved.

Further, the Division reaffirms its assertion (see comments on Study No. 3.3.16) that habitat persistence modeling should be conducted for all state-listed mussel species, regardless of whether a species is currently or historically documented to occur in the proposed study reaches. The goal of the IFIM and habitat persistence modeling is to determine the location of suitable, persistent adult mussel habitat within Reaches 1-5 of the Connecticut River, regardless of current occupancy, and assess how these habitats are affected by current and potential Project operations. Suitable habitat, although currently unoccupied, might otherwise support viable populations of state-listed mussel species under modified flow regimes or fish passage structures

Methodology

Task 1(Consult with Agencies and Interested Stakeholders to Determine Study Area, Study Reaches, and Habitat Suitability Index Curves)

Study Area:
In the fourth paragraph on page 3-98, the RSP proposes to model habitat suitability of host fish species and state-listed mussel species that are documented to occur. The Division notes that modeling habitat persistence for host fish species as a proxy for mussel habitat is inadequate unless documented primary host fish are used (see comments on host fish below). Further, the Division holds that habitat persistence should be modeled for adult stages of all state-listed mussel species in all reaches, regardless of current documented occurrence. If a state-listed species is not found in the study reach, HSIs should be constructed using habitat data from occurrences outside of the study reach to determine the effects, if any, of current and potential Project operations on state-listed mussel habitat persistence.

Study Reaches and Transect Location:
In the last paragraph of page 3-100, the RSP describes Reach 5 as the section of the river between the Rte. 116 Bridge extending to Dinosaur Footprints Reservation. Hydraulic modeling in this area proposes to follow the 1-D HEC-RAS model developed for Study No. 3.2.2, with HSI criteria for state-listed mussels found there developed through a DELPHI workshop group. The Division notes two primary concerns with this approach:

1. The DELPHI workgroup has not been fully explained in Study No. 3.3.16 or in the RSPs responses to the Division's comments on UPSP 3.3.1. The Division reaffirms (see comments on Study No. 3.3.16) that opinion from a workshop panel is not an adequate substitute for empirical data on habitat suitability for freshwater mussels, and will likely result in habitat suitability indices that are too broad to adequately inform habitat suitability. If constructed, the panel (DELPHI workshop group) should be conducted in an iterative format, in which subsequent data is collected in order to ground-truth panel opinion. Further, it is imperative that the

Division and other stakeholders are given priority and final approval in the selection of panel members.

2. The Division reaffirms its position that data-driven habitat suitability indices should be developed for all state-listed mussel species. If necessary, data should be collected in occupied habitats outside of the study reach in order to generate the data necessary to inform the creation of suitable habitat thresholds.

The RSP proposes that transect selection and fieldwork for reaches 4 and 5 will occur after the delineation of occupied mussel patches in these reaches. FirstLight has proposed to incorporate representative habitat in transect locations for shad (p.3-101) and mussels (p. 3-107). As provided in its original comments on the UPSP, the Division believes that transects should be placed in occupied mussel habitat, unoccupied but potentially suitable habitat, and unsuitable habitat. Habitat suitability must be quantified in all three habitat types in order to enable development of accurate, data-driven HSI curves. Further comments on quantitative habitat assessment are found in Division comments to Study No. 3.3.16.

Freshwater mussels:
The RSP proposes the use of a host-fish as a proxy to model non-listed mussel species persistence in reaches 1-3, and the use of habitat suitability criteria derived from a proposed expert panel in reaches 4-5. The Division reaffirms that habitat persistence should be modeled for all state-listed mussel species in all reaches, based on data-driven habitat suitability indices, regardless of documented occupancy in recent qualitative mussel surveys. Further comments on appropriate techniques for development of mussel HSIs are found in Division comments to Study No. 3.3.16.

The Division also notes that it has not requested habitat persistence modeling for non-listed mussel species. The USFWS has requested the use of white sucker as the host surrogate for eastern elliptio (*Elliptio complanata*), the eastern floater (*Pyganadon cataracta*), and the triangle floater (*Alasmidonta undulata*), as well as the use of American shad lifestages as the host surrogate for alewife floater (*Anadonta implicata*). The Division reaffirms its position that the use of habitat persistence modeling of host-fish in lieu of modeling habitat requirements for mussels is not preferred and should not be undertaken for any state-listed mussel species without further empirical evidence of host-mussel relationship determined through approved research methods. The Division also notes that because non-listed mussel species are likely more common and abundant throughout all reaches, data may be readily available for creation of non-listed mussel species HSI criteria without the need to use host fish as surrogates. As affirmed in Study No. 3.3.16 and herein, however, such data is lacking for state-listed mussels and the use of non-listed species' HSI criteria is not represent a viable substitute for state-listed species.

Table 3.3.1-2: Target species and life stages presently proposed for the IFIM study reaches

1. The Division requests that state-listed mussels be added to reaches 1-3, and that modeling should be conducted on mussel habitat persistence from data-driven HSI criteria. State-listed mussels should be modeled throughout all reaches, regardless of current occupancy.
2. The Division requests that, in instances where host fish are proposed as a modeling proxy, the table should be revised to read "non-listed freshwater mussels" in reaches 1-3.

Table3.3.1-3: Mussel species potentially found in the study area and their preferred habitat and host fish.

1. Dwarf wedgemussel should be added to the table.
2. "Host Fish" should be changed to "Possible Host Fish."

Task 2 (Method for Assessing State and Federally Listed Mussels)

Task 2a: Screening Level Mussel Assessment

As stated previously, the proposed study excludes reaches 1-3 for modeling habitat persistence of state-listed mussels. The Division requests these reaches also be modeled for persistent habitat of state-listed species and reaffirms its comments regarding the need for data-driven HSI development.

The description of study design is confusing, as currently written, and needs further clarification. In the first paragraph of this section (p. 3-105), the RSP proposes to create thresholds for habitat parameters that bracket a range of values observed in occupied habitat; if habitat parameters fall outside of these thresholds (upper and lower bounds), then habitat is deemed unsuitable. At the end of the paragraph just prior to Table 3.3.1-4, FirstLight states:

1. "If threshold levels are not exceeded in any transects, then no further assessment of documented state and federally listed mussel beds is proposed" – which is to say that if the habitat parameters fall within suitable habitat, then no modeling of habitat persistence will occur.

2. Conversely, "If threshold levels are exceeded, then a more detailed assessment is proposed…" – or if environmental parameters are outside of the bounds of suitable habitat, then modeling will continue according to Task 2b.

As stated, the proposed study will only model habitat persistence of unsuitable habitat, and will not assess the persistence of suitable mussel habitat. The Division notes that this is contrary to the goal of modeling habitat persistence and ensuring the persistence of state-listed mussels in the Connecticut River. Footnote 54 at the bottom of page 3-105 does not effectively clarify this decision-matrix. The Division requests clarification on the intent of this section, and that

the RSP be revised to affirm that the goal of the study is to model suitable habitat for state-listed mussel species across the entire range of potential flows.

Task 2b: Detailed One-Dimensional HEC-RAS Modeling
In the first paragraph on page 3-106, FirstLight states that habitat criteria may include "depth, velocity, shear stress, relative shear stress, Froude number or other hydraulic metrics", which will be combined with the hydraulic model to conduct a persistent habitat analysis using 1-D model outputs. The Division reaffirms two concerns:

1. The RSP has not included the modeling of temperature changes at varying flows, as requested by the Division, nor changes in temperature during the rising limb of the hydrograph associated with a peaking event. The Division also reaffirms its position that water temperature is a particularly important factor in determining mussel habitat suitability, and that temperature data should be collected and modeled as part of the proposed study plan, similar to approach used by Castelli et al. (2012). Of particular concern is the relevance of temperatures throughout the study area during low flows and the rate of temperature change caused by peaking, since thermal thresholds are very likely affected by acclimation temperature (Galbraith et al. 2012, Pandolfo et al. 2010). In addition to physiological stress, temperature is known to regulate the lure display behavior of freshwater mussels (Gascho-Landis et al. 2013). Two of the state-listed species in this study (yellow lampmussel and eastern pondmussel) attract host fish using this strategy, strongly suggesting that abrupt changes in temperature are likely to interfere with critical host-mussel interactions. Thermal modeling needs to be included in modeling persistent habitat, and should reflect the rate of temperature change in occupied and potential, unoccupied habitat during peaking operations.

2. The RSP references Maloney et al. (2012) as a similar study, but only proposes the use of 1-D modeling. The RSP also states that 1-D modeling is likely not adequate for modeling dual flow or spatial habitat persistence. The Division reaffirms its position that modeling approaches have been published in current literature (including the approach outlined in Maloney et al. (2012)) that are suitable to accomplish the goals of this study and model habitat persistence of listed freshwater mussels under current and potential hydrologic regimes. If proposed methodologies are unable to accomplish study objectives, than the RSP should be revised to utilize appropriate methodologies.

Task 3 (Field data collection)

The Division reaffirms its request for a full velocity profile at transects in all reaches, and that temperature measurements similarly be taken at transects in all reaches. Temperature measurements should be taken sufficient to model changes

in temperature throughout a peaking operation, such that thermal parameters are included in the modeling of habitat persistence.

On page 3-109, the RSP proposes that only six transects will be used throughout reach 5. The Division reaffirms that the RSP should be amended to include replicate transects in occupied mussel habitat, unoccupied potential mussel habitat, and unsuitable mussel habitat.

Task 5 (Hydraulic modeling reach 5)
The RSP acknowledges that further hydrologic scenarios may need to be modeled if the current scenarios do not provide enough resolution for habitat analysis. Modeled scenarios should address rates of change in physical environmental variables (i.e., rates of change in velocity and temperature) during the course of a typical peaking cycle.

Task 6b (Persistent potential habitat modeling)
The Division requested that persistent habitat modeling be conducted for all reaches. The Division concurs that FirstLight's proposed approach may not be optimal for spatial modeling and representation of habitat persistence for freshwater mussels, and therefore reaffirms that a suitable modeling approach be used to analyze habitat persistence for all three proposed state-listed mussel species and yield spatial representation of suitable habitat persistence.

3.3.2 Upstream and Downstream Passage of American Shad

Location of telemetry antennas and receivers and description of receivers and antenna arrays is generally acceptable but there appears to be no capability to detect multiple frequencies with the Lotek receivers. All receivers should be able to detect all frequencies and codes **simultaneously**. Between fish tagged for FirstLight and TransCanada there will likely be over 500 tagged fish on multiple channels. Cycling through frequencies and antennas is likely to miss fish with the probability of missed detections increasing with the number of fish tagged

The RSP does not include:

- Description of fish transport methods – tank, salt, 0^2, etc.
- Location and number of video cameras in the spillway is not detailed
- The number of replicates for each of the three day test flows is not described. Each of the three bypass flows during the sturgeon spawning period should be done for three days each (4 replicates = 36 days) alternating between flows after each three day period. After sturgeon spawning, the two lower flows should alternate for four days each until the end of the passage season.
- Where and how frequently water temperatures will be taken should be described, given that temperature is one of the variables that is proposed to be analyzed in relation to fish passage. Temperature should be recorded at least every two hours.

Manual tracking should occur twice a week. From the Holyoke dam to Cabot station is over thirty miles of river. From the Turners Falls dam to the Vernon dam is nearly twenty miles.

Task 3: Evaluation of Mortality

Mortality of tagged fish should be assessed at all telemetry locations and during mobile tracking and not just at the tailraces of Cabot Station and Station #1, the spillway and deep holes.

Task 5: Reporting

The report details are very superficial.

The report should include:

- Release numbers, locations and dates
- Fish vitals (length and sex)
- River temperature at Northfield, canal, bypass, and below Cabot Station
- Details of all manual tracking detections
- Movement times for all fish radio telemetry and PIT antenna – station to station
- Graphic description of movements of all fish

Turners Falls

- Upstream passage efficiency (proportion of fish passing upstream of the dam) for:
  - Fish detected at the Montague Waste Water Treatment Plant (MWWTP)
    - Fish in the tailrace at Cabot Station
    - Fish detected at the base of the Turners Falls dam
- Fishway attraction effectiveness – proportion of fish entering each of the three fishways that pass the fishway
- Behavior of fish that do not pass the project
- Number of forays fish made into each fishway
  - Successful and unsuccessful
- Number of forays upstream from MWWTP
- Number of forays into the bypass reach at each flow
- Analysis of how project operations affect upstream movement and entry into fishways

Downstream:

- Approach route and route of passage
- Analysis of delay at each barrier (gatehouse, station #1, Cabot Station, and dam)
- Proportion of fish that use:
  - Bypass, Cabot Station, Station #1, or pass over the dam in spill

    - Survival of fish using each route
- Overall successful project passage

Northfield Mountain:

- Number of fish within the Northfield zone of influence
- Number of fish entrained
- Delay at the Northfield project
- Description of movement patterns in the vicinity of Northfield Mountain
- Number of fish detected at stations upstream of Northfield

Study Schedule

The RSPrecommends that a second year of study be conditioned based on the results of the 2014 study. How the results of those studies would determine the need for a second year of study is not described. A specific set of criteria should be listed that FirstLight feels would justify not doing a second year of study.

The study should be done in 2014 and 2015. Evaluation of a single year of river conditions is not sufficient to understand fish movement and behavior in a complex river environment. Environmental conditions vary year to year in any river and a one year study cannot capture this variation.

3.3.3 Downstream Passage of American Shad

Task 2: Evaluate Route of Passage

All receivers should be able to detect all frequencies and codes **simultaneously**. Both FirstLight and TransCanada will be tagging juvenile shad during the fall. Information at FirstLight projects can be augmented by collecting data from fish tagged by TransCanada. Cycling through frequencies and antennas is likely to miss fish with the probability of missed detections increasing with the number of fish tagged.

Task 4: Reporting

The report should:

- Report the volume of spill at each gate throughout the testing period.
- Spill data for the period of out migration should be summarized for the full period of digital records so that an analysis of spill potential can be included in an overall project passage analysis.
- Delay at any location should be reported.
- A daily record of Northfield operations during the study period.
- A long term history of pumping (number of units per hour) should be provided by month for April through November should be provided in tabular form similar to Tables 2.3-1 and 2.3-2 in the Exelon Muddy Run RSP 3.3 for eels or shad (FERC # 2355).

3.3.4 Upstream Passage of American Eel

Task 1: Systematic Surveys

The entrance to the spillway ladder and the lower pools of the fishway should be surveyed.

Task 2: Trap Collections

Stakeholders should be consulted in determining additional trap locations beyond the three listed.

Surveys of eel concentrations should be done in 2015 as conditions in the field may change, the number of eels present will likely change, and the conditions that stimulate eels to move upstream are episodic. By surveying a second year the likelihood of surveying when eels are migrating is increased.

Eel ramps should be covered with plywood to prevent avian predation.

Traps should be check the day after periods of rain or other events that would precipitate eel movement to prevent overcrowding and mortality.

3.3.5 Downstream Passage of American Eel

Number of eels required:

The proposed studies will require a minimum of 282 silver eels for 2014 studies (72 for Northfield, 60 for route selection, and 150 for Turbine/Dam passage survival studies). While it is desirable to use as many eels as possible for maximum sample size/data resolution, this number may be unattainable if eels are to be collected only at the Cabot and Holyoke bypass samplers (and TransCanada may need lots of eels as well). Using eels from locations outside the CT River basin may not be possible due to fish importation/disease issues. Therefore, a second year of telemetry studies may be required if the sample size targets are not met in the first year.

Receivers:

All receivers should be able to detect all frequencies and codes simultaneously. Both FirstLight and TransCanada will be tagging American eels during the fall. Information at FirstLight projects can be augmented by collecting data from fish tagged by TransCanada. Cycling through frequencies and antennas is likely to miss fish with the probability of missed detections increasing with the number of fish tagged.

Hydroacoustics:

No complete assurance that acoustic targets can be definitively identified as eels, as opposed to other fish/objects with similar target strength, except via concurrent bypass sampling. Can the hydroacoustics consultant provide any additional assurance that targets can be confidently identified as eels?

Task 5: Reporting

The report should include:

- Release numbers, locations and dates
- Fish vitals (length, weight, and morphometric criteria)
- River temperature (collected every hour) at Northfield, canal, bypass and below Cabot Station
- Route selection
- Analysis of how project operations affect downstream movement and 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
- A daily record of Northfield operations during the study period
- A long term history of pumping (number of units per hour) should be provided by month for April through November should be provided in tabular form similar to Tables 2.3-1 and 2.3-2 in the Exelon Muddy Run RSP 3.3 for eels or shad (FERC # 2355).

3.3.6 Impact of Project Operations on Shad Spawning, Spawning Habitat and Egg Deposition

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

Phase I surveys should be done three times a week to ensure that all areas are identified.

Spawning could be altered during both increases and **decreases** in flow. Both should be observed.

Egg netting below spawning sites should be done before and after flow changes. The RSPhas only one ten minute tow. The number of eggs collected before and after fluctuation changes can be compared.
Temperature should be recorded continuously at the upper and lower most spawning sites selected for manipulation evaluation.

Task 3: Examination of Identified Spawning Areas Upstream of Turners Falls Dam

While the HIS curves for shad spawning may be helpful to identify shad spawning areas, the full river upstream of the Turners Falls dam should be surveyed by boat at least twice a week. Radio tagged shad can be used to locate potential shad spawning sites.

Task 5: Data Analysis and Reporting

In addition to a map of all spawning locations, detailed maps of Phase II locations should be provided. Additional information should include:

- The number, dates and times of observations in Phase I
- A description of flow manipulations including change in flow and stage, the time for the effect to be realized (start and end times), and whether the flow was increased or decreased.
- # of splashes before, during and after flow manipulation
- #'s of eggs collected before and after flow manipulation
- Behavior of fish during manipulations
- River temperature during study period
- Discharge in 15 minute increments during the period of the study
- Comparison of 2014 fluctuations to prior years fluctuations

3.3.7 Fish Entrainment and Turbine Mortality

The Division is not convinced that no field data collection is necessary. How will realistic numbers for American shad egg and larva entrainment at NMPS be developed?

How will "developing a qualitative scale of entrainment risk" translate to an estimate of impacts on fish populations?

3.3.8 CFD of Fishway Entrances and Powerhouse Forebays

A CFD model of the Station No. 1 discharge into the bypass reach could determine potential impacts to fish migrating upstream through the bypass reach. Why was this not proposed?

3.3.10 Assess Operational Impacts on Emergence of State-listed Odonates in the Connecticut River

General Description of Proposed Study

In its comments on the UPSP, the Division expressed concern about the proposed omission of surveys for state-listed odonates within the Upper Reservoir. However, the Division was not aware that water level elevations in the Upper Reservoir currently fluctuate 10-40 feet a day, depending on power demand, as detailed within the RSP. The Division concurs that water level fluctuations of this magnitude are likely to preclude the presence of state-listed odonates in the Upper Reservoir and that surveys are *not* warranted at this time.

Methodology

As outlined in its comments on the UPSP, it is critical that data collection be sufficient to enable robust statistical analyses of survey results for each species across a variety of habitat conditions. Based on the RSP – which is limited to four qualitative and four quantitative sites - the Division remains concerned that natural heterogeneity/variation will make detection of trends impossible within a robust statistical analysis (including multivariate methods) without sufficiently large sample sizes. The Division reiterates its previous recommendation that the RSP be amended to explicitly state that additional data will be collected (either within the same season or during the next study season) should initial data collection be found to be insufficient. Judgment of sufficiency should be based upon power analyses or similar statistical methods to determine if data collection is sufficient to robustly explain heterogeneity/ variation, and should be confirmed through consultation with the Division. The Division believes that it may be more efficient to develop pre-approved, maximum data collection thresholds to guide the study process and ensure sufficient data collection, and reiterates its willingness to work with FirstLight to develop such thresholds. FirstLight should be aware that conclusions based solely on non-parametric statistical methods will undermine the utility and analysis power of the study.

See General Notes 1, 2 and 3, below.

Task 3 (Qualitative Surveys for Larvae and Exuvia)

1. In its comments on the UPSP, the Division suggested that specific regions have seen relatively less study compared with others (including Barton's Cove, Reach 3 (as defined in Study No. 3.3.1), and the reach between the Railroad Bridge and Third Island in Deerfield/Montague) and should be targeted for qualitative surveys. The RSP has been revised to reflect this recommendation, and the Division appreciates FirstLight's concurrence with this request.

2. In its comments on the UPSP, the Division suggested that the RSP should provide information regarding the effort (amount of time to be spent per unit of area) proposed for survey of each study reach. The RSP has been revised to reflect this recommendation and suggests a minimum of eight (8) person-hours of collection per site, with emphasis on habitats preferred by target

state-listed odonates. The Division concurs that this level of survey intensity is appropriate for the type of qualitative surveys proposed.

3. In its comments on the UPSP, the Division suggested that surveys should be timed so as to capture the emergence periods of all target odonate species. In the fourth paragraph of page 3-243, the RSP suggests that surveys will focus on larval stages and that this approach will eliminate the need to time surveys for specific emergence periods. The Division concurs with this assertion, but would highlight that identification of rare odonate larvae – and in particular, larvae of the Tule Bluet (*Enallagma carunculatum*), state-listed as "Special Concern" – requires extensive experience identifying state-listed odonate species. The resume of the selected biologist, with information demonstrating this experience, should be submitted for Division review and approval in advance of field work.

4. In addition to the data parameters proposed on page 3-244 for collected tenerals or exuvia, the exact time of observation should also be collected. This data would supplement and improve the usefulness of data collected under Task 4 survey activities, with minimal additional cost.

Task 4 (Quantitative Surveys for Emergence/Eclosure Behavior)

1. In its comments on the UPSP, the Division expressed concern that the proposed study would be unlikely to provide sufficient spatial coverage of different habitat conditions (from substrate and vegetative community type to water depth and velocity) nor a sufficient number of data observations for each species (or species group) to enable robust data analysis. In response to the Division's concerns, the RSP was revised to suggest that "*a minimum* of six transects will be established within each [of four] study reach, for *a minimum* of 24 transects," and that more transects may be added depending on habitat variability, habitat preference, and variability in collection density and species composition among transects. Further, the RSP was revised such that the width of transects was increased from 1 meter to 2 meters.

   The Division is concerned that if data is collected pursuant to the RSP as currently proposed, with 2-meter wide transects surveyed at two-week intervals, field work will very likely yield sample sizes that are insufficient to enable robust statistical analysis and detection of potential Project impacts. In general, surveys should result in thorough coverage of suitable emergence habitats from the water's edge upslope to the top of the cut bank, or to and including the first line of trees; surveys beyond these features are unlikely to produce data useful to analyzing potential Project impacts and are therefore not warranted. The Division would again suggest modifying the study design such that transects run parallel to the river (from the water's edge to the top of the cut bank or to/including the first line of trees) and are of sufficient length and width to enable more thorough spatial coverage of emergence habitats and improve emergence detection more broadly.

Additionally, it is important to remember that odonates tend to emerge in mass events, and that fluctuating water levels will likely wash away many if not most exuvia during between-survey periods (see #2, below, for additional comments on the importance of water level stabilization). The Division believes that surveys should occur weekly (rather than every two weeks, as proposed) in order to increase emergence detection and reduce the likelihood that evidence of mass emergence events will be masked by normal water level fluctuations.

More broadly, although the RSP references the potential to delineate and collect data within additional transects, it does not articulate thresholds at which additional transects would be added to the study plan or where those transects would be located. The Division is concerned that, without delineating clear, minimum data collection thresholds by habitat type and species, the study will not create a framework or decision-matrix to ensure and guide the addition of new transects to the study plan. Further, it will not ensure sufficient spatial coverage of different habitat conditions nor a sufficient number of data observations for each species (or species group).

The Division reiterates its previous recommendation that the RSP be amended to explicitly state that additional data will be collected (either within the same season or during the next study season) should initial data collection be found to be insufficient. As stated above, judgment of sufficiency should be based upon power analyses or similar statistical methods to determine if data collection is sufficient to robustly explain heterogeneity/ variation, and should be confirmed through consultation with the Division. The Division strongly advises FirstLight to work with the Division to develop pre-approved, minimum data collection thresholds to guide this process and ensure sufficient data collection. FirstLight should be aware that conclusions based solely on non-parametric statistical methods will undermine the utility and analysis power of the study, and may not be accepted by the Division. The Division also reiterates that the study proposal should ensure sufficient observations are collected within each emergence habitat type. As provided in its comments on the UPSP, the Division would again suggest stratifying sampling within known emergence habitats (e.g., gradually sloping mud banks, natural vegetation, rip rap, etc.).

2. In its comments on the UPSP, the Division suggested clarifying the parameters (including both appropriate weather conditions and flows) under which surveys will occur. The Division appreciates that the RSP provided a more explicit articulation of these parameters, in accordance with many of the Division's suggestions. On the first paragraph on page 3-245, however, the RSP states that "if possible, surveys will be coordinated with upstream hydropower operations to occur during a period of stable water levels." The RSP further states that this will "increase the likelihood of collecting data on species that emerge very near the water line and might otherwise be washed away by daily flow fluctuations."

The Division believes that water level stabilization is potentially the most important factor with the potential to significantly confound survey results. While it acknowledges that water releases from upstream hydroelectric projects make it difficult to fully stabilize water levels, the Division is concerned that the RSP does not propose to stabilize water levels to the greatest extent possible by modifying Project operations. Flow manipulation is being proposed for other studies (see Study No. 3.3.1), and the Division believes that flow manipulations are equally warranted here. Without stabilization of water levels (e.g., no or significantly reduced peaking during a sufficient time window prior to field work), collected data will be *highly* biased toward individuals and species that travel far / fast enough to be observed and measured; individuals that do not will have been washed away by water level peaks and therefore escape observation. As referenced above, the RSP effectively reaffirms this assertion, and the Division strongly believes that the majority of state-listed odonates emerge and eclose within areas that are most susceptible to the Project's typical peaking operations. Without ensuring sufficient water level stabilization prior to surveys, the Division believes that resulting data will not be sufficient to enable an unbiased analysis of Project impacts nor allow it to develop data-driven flow recommendations that will protect and/or enhance state-listed odonate populations.

For similar reasons, the RSP was revised to ensure that surveys will occur no sooner than 48 hours after a significant rain event. As noted in its comments on the UPSP, the Division reiterates that the RSP should be revised to specify a clear threshold regarding what constitutes a "significant rain event." That threshold should be of such a magnitude as to provide a reasonable level of assurance that rain events below the threshold will not significantly bias survey results.

3. In its comments on the UPSP, the Division requested the collection of data sufficient to determine how long emergence takes for state-listed odonate species. The Division also expressed concern that the lack of a robust plan to assess emergence time would undermine the utility and analysis power of the study.

   The time it takes a teneral to complete the emergence process is a critical piece of information which, in conjunction with a better understanding of the rate and magnitude of water level fluctuations (to be provided by Study No. 3.2.2), is necessary to enable assessment of whether and to what extent water level fluctuations affect the ability of tenerals to complete the emergence process. It will also enable assessment of which species or species groups, which tend to exhibit unique habitat preferences and *may* exhibit different emergence rates/distances, are most affected by water level fluctuations. As stated in the Division's original study request, emergence from larval wetlands is considered one of the most perilous stages of the odonate life cycle and it is likely that large, rapid changes in water elevation – where the

magnitude and rate of water level increase exceeds the capacity of tenerals to successfully complete the emergence process - may cause adverse effects to the life cycle of state-listed odonates, and particularly, the emergence of tenerals. This, in turn, may impact the abundance, composition, and distribution of state-listed odonate populations in the Connecticut River more broadly. Indeed, the Division strongly believes that the majority of state-listed odonates emerge and eclose within areas that are highly susceptible to Project peaking operations, and that current operations likely have a significant and measurable effect on odonate populations.

The Division applauds the revisions contained within the RSP, which creates a general study framework to assess how far tenerals travel **and** how long the emergence process takes. The Division acknowledges that acquiring a large number of observations for a range of species sufficient to enable robust and representative data may be difficult. As outlined above, however, understanding the time it takes a teneral to complete the emergence process is necessary to enabling an unbiased analysis of Project impacts and development of data-driven flow recommendations that will protect and/or enhance state-listed odonate populations.

For this reason, the Division reiterates the importance of delineating pre-approved minimum data collection thresholds in advance of field work in order to ensure sufficient data collection for each species or species group. The Division would reaffirm its willingness to work with FirstLight to develop achievable thresholds, and preliminarily, would suggest that a minimum of ten observations per species or species group (for a total of fifty (50) observations), as appropriate, may, pending appropriate power analyses or similar methods, represent a sufficient sample size. The Division notes that *Gomphus fraternus*, *Gomphus vastus*, and *Gomphus ventricosus* are likely to be sufficiently similar that they may be considered a single species group.

4. In addition to the data parameters proposed on page 3-245 for collected tenerals or exuvia, the exact time of observation should also be collected and correlated to records of relative water levels in that stretch of river since the previous survey.

3.3.11 Fish Assemblage Assessment

In the RSP, FirstLight has chosen to not host fish habitat modeling for state- and federally-listed mussel species. Although the Division does not support the use of host fish habitat as a proxy for persistent mussel habitat modeling, persistence of suitable host fish habitat and passage across barriers is required for sustained mussel populations above and below the Turners Falls Dam. The Division has requested assessment of host fish relationships and the use of these relationships to guide fish passage design at Turners Falls. As stated on page 3-249 of the RSP, FirstLight is not proposing to evaluate larvae on host fish because the host

relationships for listed species in the Connecticut River are "well understood," with references to Table 3.3.11 provided.

The Division concurs that the host relationship for *Alasmidonta heterodon* is well understood and documented. Some hosts for *Lampsilis cariosa* have been identified, and key hosts *likely* include, but may not be limited to, white perch, striped bass, yellow perch, and/or black basses. However, FirstLight recognizes that hosts of *Ligumia nasuta* are "Unknown". Furthermore, the statement that this species is "reported to parasitize" centrarchids and banded killifish is misinformation. Nedeau (2008) clearly states that closely related mussel species have been known to metamorphose on centrarchids and killifish, but the host of *Ligumia nasuta* remains unknown and untested.

The Division remains concerned regarding the proposed omission of glochidial assessments. Without a concrete understanding of which fish species are actually utilized as hosts within the Connecticut River, fish passage and habitat persistence would have to be assessed and ensured for all potential fish host species. Further, the design of any potential fish passage devices would be more difficult to engineer without a firm understanding of target fish swimming speeds, necessary approach velocities, attraction flows, etc. for key species. **Should FirstLight elect not to conduct a targeted assessment of key host fish species or genera, and thereby effectively assume that all potential host fish species are equally important for purposes of the re-licensing process, the RSP should be revised to include a thorough evaluation of upstream and downstream passage for all potential host fish species.**

However, the Division reaffirms that a targeted assessment of key species or genera of host fish species is necessary and feasible for *Lampsilis cariosa* and *Ligumia nasuta*. Either field based approaches that include genetic or morphometric identification of encysted glochidia on field collected fish, or the use of a quantitative laboratory host fish trials, may be used. The Division requests the use of a tiered approach to assess host suitability and identification of primary hosts for both species (e.g. > 40% metamorphosis success using established host fish protocols [Johnson et al. 2012 and Fritts et al. 2012]) in the laboratory. Using a tiered approach to assess host suitability, the study would progresses to the next tier if no suitable primary host is found.
Tier 1:

- One species of black bass (*Micropterus salmoides* or *M. dolemieu*)
- Striped bass (*Morone saxatilis*)
- One species of shad/herring (*Alosa*)

Tier 2 (if no suitable hosts found above):

- One species of sunfish (*Lepomis*)
- One species of chub (*Semotilus corporalis* or *S. atromaculatus*)
- One species of sucker (*Catostomus*)
- Yellow perch (*Perca flavescens*)

- One catfish species (Bullhead – *Ameiurus*, or Channel catfish – *Ictalurus punctatus*)

Tier 3 (if no suitable host found above):

- As needed and in consultation with the Division.

3.3.15 Sea Lamprey Spawning

Study Goals and Objectives

The goals and objectives listed in the RSP do not address the first goal and objective in the NOAA study request which was to "…determine whether the operations of the Projects are affecting the success of this activity [spawning] to occur."

Task 1: Field Data Collection

FirstLight proposed to radio tag and release twenty lamprey at the Rt. 116 Bridge and twenty above the Turners Falls dam. In 2008, 56.8% of the lamprey passed at Holyoke passed the Gatehouse fishway. If a similar percent passed in 2014 only ten lamprey would be available to locate spawning areas below Turners Falls. An unknown percent of these fish will ascend tributaries beyond the zone of impact of the project. In order to better assure that some tagged lamprey reach spawning grounds that are with the zone of influence, fifty fish should be tagged for release below Turners Falls. The recommended addition of twenty tagged lampreys to be released above Turners Falls is appropriate.

It is unclear how lamprey redds will be located as the telemetry locations for the adult shad study are not specific to lamprey spawning areas. Manual tracking will be needed to locate fish not at fixed telemetry locations.

Capping of redds in a large river with fluctuating flows has a low likelihood of success and may bias the impact of project operations by mitigating the effect of fluctuating flows. As such, it should be a component of a more complete evaluation of spawning success.

Tracking of tagged fish should not be the only means to locate spawning sites. All likely spawning locations should be observed determine if lampreys are using them or not. Knowledge of the range and number of spawning locations can be used to analyze the overall impact of project operations. Mapping of all spawning locations from the Rt. 116 bridge to the Turners Falls dam is needed for the classification of suitable and unsuitable habitat, redd construction or none in suitable habitat, and active spawning locations that is described in the Report section of the study plan.

In addition to capping redds, redds in several zones of impact (closer to and farther away from Cabot station) should be evaluated for the presence of eggs. This can be done in a minimally invasive way by capturing eggs in a net below a redd while moving rocks in the redd until a few eggs are captured. If no eggs are located the redd is not viable.

During alterations in flow (up and down) caused by project operations, observations of redds with lamprey should be made to determine if redd abandonment occurs as a result of project operations. Redd abandonment would be an obvious effect of project operations.

Task 2: Data Analysis

The proposed methodology for evaluating redd success is inadequate. The definition of success in this plan is limited to the presence or absence of larvae in redds which are capped.

Spawning success cannot be documented merely by the presence of redds or of the condition of redds prior to and after peaking events. Rather, it should be documented with an evaluation of eggs in redds.

Redds in areas that are highly impacted by peaking flows should be compared to redds in low impact areas to determine if eggs are present in redds. Similar or a significant difference in the frequency of redds with eggs in the high and low impact areas would be an indicator of spawning success.

Similarly the number of incidence of redd abandonment can be compared between high and low impact areas.

Task 3: Report

The report should also include:

- Locations of all telemetry detections
- Discharge and stage during all observations of redds during fluctuations
- Continuous river temperature
- A statistical analysis of before and after events
- Maps of all suitable spawning locations
- Maps of all redds located during the study

3.3.16. Habitat Assessment, Surveys, and Modeling of Suitable Habitat for State-listed Mussel Species in the Connecticut River below Cabot Station

General Description of Proposed Study

The RSP proposes to limit the survey area to the 13-mile reach between Cabot Station and the Route 116 Bridge in Sunderland, and that additional freshwater

mussel studies associated with the FERC license of the Holyoke Dam (including portions of the Connecticut River south of Dry Brook in Sunderland) will provide information on the distribution and habitat of state-listed mussel species in Reach 5. We are supportive of FirstLight's efforts to maximize efficiency; as provided in our comments on the UPSP, however, the Division again notes that data collection pursuant to the FERC license of the Holyoke Dam will not be sufficient to meet the requirements set forth in the Division's Study Request without modification. FirstLight should ensure that the RSP is amended to confirm that mussel data collection associated with the FERC license of the Holyoke Dam will be collected pursuant to the requirements set forth for by the Division as detailed in our comments on the UPSP or ensure that independent data collection will meet data collection needs. This was not addressed in the RSP.

In the second paragraph on page 3-302, the RSP states that development of binary HSI curves will rely on data collected during the proposed field study, species-specific data from other studies in the Northeast, and expert review. The Division has two concerns with this approach:

1. FirstLight has proposed a "binary" HSI curve to delineate between either "suitable" or "unsuitable" habitat. FirstLight is proposing to survey suitable habitat pursuant to NHESP's "Endangered Species Habitat Assessment Guidelines: Freshwater Mussels" (version May 2013). These guidelines are effective at producing qualitative assessments of habitat, but may not produce quantitative habitat measurements needed for HSI construction. In order to establish an accurate HSI curve, habitat will need to be assessed **quantitatively** in unsuitable habitats, suitable habitats that contain mussels, and suitable habitats where mussels are absent. Further, efforts to measure habitat parameters should incorporate a structured, randomized approach to include occupied, unoccupied and unsuitable habitat. Further, the Division feels that the environmental parameters proposed for measurement in the RSP will be insufficient to determine quantitative differences between suitable and unsuitable habitats (see further discussion under Methodology, below).

2. FirstLight proposes the use of an expert panel to supplement areas of data insufficiency. Expert review panels may be a valid approach to assess the data needs for this project, but should only be incorporated in an iterative approach in which subsequent data is collected in order to ground-truth expert opinion (see further discussion under Task 3, below).

Existing Information

1. In the first paragraph of page 3-304, the RSP has recognized and addressed the Division's previous comments regarding its concerns of sheer stress and flow velocity affecting mussel habitat. However, the Division remains concerned regarding the extent of environmental variables proposed for

collection. In particular, the Division believes that in order to properly represent and model mussel habitat, FirstLight must collect a full velocity profile, rates of change in velocity-related metrics that are likely to occur under a peaking event (i.e., change from no release to peak release), and temperature changes during these periods.

2. On page 3-227 of the UPSP and page 3-303 of the RSP, FirstLight recognizes three state-listed species of freshwater mussel (*Lampsilis cariosa, Ligumia nasuta, Alasmidonta heterodon*). However, Study No. 3.3.1 only proposes HSI curves for *Lampsilis cariosa,* as this is the only species that has been found in more recent surveys of the Connecticut River (see page 3-95 – 3-97). The Division reaffirms its request that HSI curves be created for all three state-listed species regardless of survey results, for the following reasons:

    a. Past studies have only been conducted in a qualitative manner and have not incorporated repeated visits to enable detection probability, as previously recommended by the Vermont Agency for Natural Resources in a letter dated March 1, 2013 (listed on letter page 185 in Appendix A), and in the Division's comments on Task 3 of the UPSP. Without quantitative assessment of detection probability, the Division has no way to ascertain whether a documented absence of mussels is a false-absence, due to poor detection probability, or a true absence of the species from the surveyed segment of the Connecticut River. References previously recommended by the Division and VANR include Meador et al. 2011 and Peterson et al. 2011.

    b. The purpose of HSI curves and IFIM modeling are to determine if suitable habitat exists and will persist within the Connecticut River under current or alternative Project flows. Even in the absence of a species record, IFIM modeling should still be conducted in order to determine if habitat availability is the (or a) limiting factor to the occurrence of that particular state-listed mussel species. Thus, construction of HSI curves for all three state-listed mussels based on data-driven habitat parameters – using data collection from elsewhere in the Connecticut River or the Northeast more broadly, where species are known to persist - is still critical to impact analyses and development of data-driven flow recommendations if statistically suitable mussel densities do not occur within a study reach. . The use of an expert panel is not a suitable substitute to data-driven HSI curve development, unless the panel is used in an iterative process that includes ground-truthing of estimated HSI parameters through additional fieldwork. An iterative process including an expert panel and ground-truthing could be a very useful way of narrowing the actual field data collection required for development of HSI parameters.

Methodology

Task 2 (Mussel Survey and Habitat Assessment)

The RSP has been modified relative to the UPSP such that it does not include the identification of a 2-Phase Mussel Survey and Habitat Assessment. The RSP proposes a semi-quantitative (i.e. timed searches) mussel survey in habitat that is determined suitable following a qualitative habitat assessment. The Division asserts that this is a further deviation from a quantitatively-structured study design that is needed to assess the persistence of mussel habitat and mussel populations in the Connecticut River. Again, failure to use quantitative methods - as outlined in the RSP - will fail to produce sufficiently focused and accurate variables for the development of HSI curves and modeling of habitat suitability and persistence.

1. On page 3-304, the RSP proposes a comprehensive habitat assessment throughout the affected project area following the Division's "Endangered Species Habitat Assessment Guidelines: Freshwater Mussels" (version May 2013). The RSP proposes to follow the qualitative habitat assessment with semi-quantitative mussel surveys in areas of suitable habitat, after consultation with the Division. The Division notes that **quantitative habitat measurements will still be needed for HSI curve creation in areas of both suitable and unsuitable habitat**, and also requests the use of repeated sampling efforts incorporating mark-and-recapture techniques. Such techniques will allow for more accurate population estimates as well as an understanding of detection probability, which will better inform habitat suitability in occupied as well as unoccupied but otherwise suitable habitats (see Meador et al. 2011 and Peterson et al. 2011).

2. The RSP proposes a Catch Per Unit Effort method to assess species abundance. The Division notes that the RSP did not provide a proposed time/unit area searched for preliminary habitat assessments or mussel surveys, and that it is important to standardize effort across occupied and unoccupied habitat and ensure sufficient effort and high detection probability.

3. In responses to the Division's comments on the UPSP, FirstLight chose not to include tagging because this methodology was perceived as a method only needed for long term monitoring (which is not proposed). The Division would like to reaffirm its request that all state-listed mussels, and the first 50 individuals from non-listed species, be tagged with an individual identifier (e.g. Hallprint shellfish tag). This is essential to a repeated visit, mark-and-recapture assessment of population size and detection probability. Previous requests by the Division for repeated visits and employment of mark-and-recapture techniques have not been addressed in the RSP. The Division proposes that a robust design is used, where a mussel survey is repeated using the same methods within a specified timeframe, in which the

population is assumed to be closed to immigration and emigration (i.e. 24-48 hours after initial survey). Mark-recapture information can be used to determine detection probabilities, thus adding quantitative rigor to a timed-search approach (see Meador et al. 2011).

4. The RSP suggests that key instream habitat parameters (i.e. water depth, flow velocity, substrate, nose velocities, etc., as detailed on page 3-305) will be collected as part of mussel surveys. The Division reaffirms that these instream habitat parameters should be collected pursuant to the applicable standards outlined within the final, FERC-approved Study No. 3.3.1, and that the RSP explicitly detail (either in situ or by reference to Study No. 3.3.1) the procedures that will govern data collection. The Division further reaffirms its request for collection of a full velocity profile. Complete profiles should be conducted in transects perpendicular to the flow of the river channel, including (but not limited to) a minimum of one transect within the mussel population, one transect immediately upstream of the population, and one transect immediately downstream of the population.

   Collection of flow velocities at or near the substrate surface, and at varying flows, is particularly critical to informing further analyses of how various flow regimes affect mussel behavior and persistence of potential habitat (e.g., relative sheer stress, etc.). Therefore, the Division would recommend that the RSP be revised to explicitly specify (either in situ or by reference to Study No. 3.3.1) that velocity measurements will be collected at near-substrate depths within all potentially suitable habitats, and that IFIM models incorporate changes in temperature, velocity, depth, shear stress, and habitat persistence for all lifestages in the mussel lifecycle. These requests were not addressed in Study No. 3.3.16 or 3.3.1 of the RSP.

5. The Division reaffirms that water temperatures should be recorded as part of the freshwater mussel habitat assessment, mussel surveys, and IFIM (Study No. 3.3.1) transects. The Division notes that water temperature is a particularly important factor determining mussel habitat suitability, and that the RSP should be revised to ensure that temperature data is collected and modeled (see Castelli et al., 2012). Of particular concern is the relevance of temperature during low flows and the rate of temperature change during peaking, as thermal thresholds are likely affected by acclimation temperature (Galbraith et al. 2012, Pandolfo et al. 2010). As a minor addition to fieldwork associated with Study No. 3.3.1, we recommend point temperatures be taken at all test flows within a representative subset of transects within suitable mussel habitats. The Division requests that temperature profiles be conducted throughout a peaking operation in order to assess the rate of temperature change occurring during a typical peaking cycle. Temperature data should be collected during seasons where peak operations will have the greatest effect on temperature change. These requests were not addressed in Study No. 3.3.16 or 3.3.1 of the RSP.

6. The RSP has removed the proposal of additional IFIM transects in occupied mussel habitat, which are now detailed in Study No. 3.3.1. The Division will address further concerns related to HSI parameters and IFIM modeling directly in its response to Study No. 3.3.1.

Task 3 (Develop Binary HSI Criteria for State-Listed Mussel Species Documented in the Project Area)

The RSP proposes to develop quantitative, binary HSI curves for all state-listed freshwater mussels documented to occur in the Connecticut River between Cabot Station to Dinosaur Footprints Reservation. FirstLight proposes to accomplish this using a combination of data collected from: 1) current, proposed, and previously conducted mussel surveys and habitat assessments; 2) sources of data in peer-reviewed and gray literature; and 3) the use of an expert panel, where data is insufficient. Then, FirstLight proposes to summarize and create HSI curves from these sources. The Divisions comments regarding this proposal are provided below.

1. Data collected from current and previous research on the state-listed species and literature sources will be helpful in developing HSI curves *provided* there is enough published data available in the peer-reviewed and gray literature. It is the apparent lack of sufficient data in the literature that led the Division to request that onsite data collection be utilized to develop data-driven HSI curves for all three state-listed species.

2. Given our concerns about FirstLight's current study proposal, as detailed above, the Division is similarly concerned that the currently proposed data collection approach is unlikely to provide sufficient accuracy to delineate between suitable and unsuitable habitats and address the need for data-driven HSI curves. The Division therefore recommends that habitat parameters be collected at sites where state-listed mussel species are known to occur outside of the 35-mile reach between Cabot Station to Dinosaur Footprints in order to supplement the within-Project data collection.

3. The RSP again proposes that binary HSI key criteria only include water depth, flow velocity, substrate, shear stress, relative shear stress, and Froude number for each species, with a written rationale for the criteria. With the latter three variables all being derived/calculated from flow velocity, the Division again reaffirms its request for collection of a full velocity profiles. The Division also reaffirms that temperature and the rate of change in temperature during the peaking process is a critical concern to freshwater mussel habitat suitability and reproduction. Recommendations to include these metrics in HSI criteria and assessment of habitat have not been addressed by FirstLight.

   It is the Division's belief that literature-review and opinion alone - absent field-collected data relevant to this project - a panel may create habitat thresholds that are too broad, and thus overestimate available mussel habitat

in the Connecticut River. However, an expert panel could be utilized in an iterative process where additional data is collected following panel recommendations to ground-truth expert opinion. Further, if an expert panel is constructed, the Division should have a key role in review and selection of panel members and have (at minimum) an equal responsibility for panel member selection as FirstLight and FERC.

3.3.18 Impacts of the Turners Falls Canal Drawdown on Fish Migration and Aquatic Organisms

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

All live fish collected by electrofishing or seining should be moved to a suitable tank with continuously flowing water as soon as possible after collection until they can be returned to the river.

The location of quadrates should be mapped with GPS.

Habitat types in each zone should be mapped with GPS so that the expansion of sub-samples can be accurately completed.

Dissolved oxygen should be measured in zone 7 after the canal is initially drained, mid-way through the drawdown, and at the end of the last day of the drawdown.

Depending on where the Keith Drainage Tunnel is located (no location description is provided) temperature and dissolved oxygen should also be measured downstream of the tunnel as well as at the upper and lower end of zone 7.

As the pools change over time, additional surveys of the size, water temperature and dissolved oxygen in pools in zones 1 to 6 should be made at least two times in addition to the initial survey. One survey should be the last day prior to refilling.

A task for Reporting is not included. A report should be completed.

It should include but not be limited to:

- Temperature, DO and turbidity data from all samples
- Map and area of habitats within each zone
- Map and area of all pools during each of the three monitoring periods
- Map of quadrate locations
- Description of survey methods during the initial evaluation
- List and number of fish species stranded
- Results of electrofishing and seining.
- Counts of mussels and ammocoetes in each quadrate

- Expansion of sub-sample quadrates to total mussels and ammocoetes in each zone
- Summary of Task 2 consultation
- Plans for mitigation that will be tested in 2015

3.5.1. Wetlands, Riparian, and Littoral Habitat

Study Goals and Objectives

In the third paragraph on page 3-342, the RSP was revised to delete the reference to "known or potential" habitat for state-listed plant and invertebrate species. This appears to be consistent with the absence of any proposal to collect data within potential but currently unoccupied habitat that might otherwise support viable populations of state-listed species under modified flow regimes. As further articulated within the additional comments below (see Task 3, #3 & 4; Task 6, #1 & 2), the Division is concerned that the absence of fine-scale analyses within potentially suitable but currently unoccupied patches of habitat will make it difficult (or impossible) to assess how habitat suitability for each taxonomic group changes across a range of flow regimes, or to develop appropriate, data-driven flow recommendations that will protect and/or enhance known populations as well as enable persistent use of potential habitats. Assessing impacts to and potential enhancement of potential but currently unoccupied habitat is critical to protecting the long-term viability of state-listed species in the Connecticut River. The Division also notes that fine-scale analyses will yield baseline information by which future monitoring of both occupied and unoccupied sites for both state-listed plants and tiger beetles can be compared and the effects of modified flow regimes assessed.

Methodology

See General Notes 1, 2 and 3, below.

Task 3 (Sensitive Plant Survey)

1. In the first paragraph of page 3-349, the RSP suggests that the Proponent will "consult with the MDFW for concurrence to establish survey intensity (time per unit area)." The Division supports this approach; however, the RSP should be revised to clarify that these consultations will occur prior to initiation of field surveys.
2. In the first paragraph of page 3-349, the RSP suggests that the Proponent will "locate all high probability areas that have suitable habitat and a high likelihood for sensitive plant associates," and that these areas will be surveyed using a timed- per unit area approach. The RSP should articulate the criteria to be used in identifying areas with a high likelihood for sensitive plant associates. The Division would again highlight that mud flats, sand bars, and high energy shore and cobble islands represent the key habitats

with a high likelihood of state-listed plant associates, and that these areas should be specifically targeted for surveys. Additionally, the Division notes that field work associated with this portion of the study should be conducted in accordance with the "Endangered Species Habitat Assessment and Survey Guidelines: Plants" document found on our website, and in particular, should generate maps of all potentially suitable habitats and identify those sites which were specifically targeted for in-depth survey.

3. In the second paragraph of page 3-349, the RSP was revised to specify that data related to plant health and vigor, including spatial mapping of vigor as it varies across spatial / elevation gradients, will be collected. The Division supports this approach. However, the Division notes that surveys should also collect information regarding the spatial extent of the population, the number of individuals (or estimates thereof), substrate, and the spatial extent of potentially suitable habitat (even if unoccupied). Data related to the size and spatial extent of a particular population will be critical to inform the fine-scale analyses of habitat suitability and hydrologic modeling outlined more completely below (see #4), which is in turn necessary to enable analysis of how germination, growth, and dispersal of state-listed plans may be affected by Project operations.

   The primary goals of the study, as stated in the third paragraph of page 3-341, "are [to] quantify the impacts of water level fluctuations and the current and proposed flow regimes on state-listed rare plant species." As articulated in the Division's previous comments on the Updated Proposed Study Plan (UPSP) – and with similar approaches articulated within the Division's comments on state-listed tiger beetles (see Task 6) and mussels – quantification of Project impacts should include the following actions:

   a. Delineate all suitable habitat for state-listed plants (particularly species inhabiting mud flats, sand bars, and high energy shore and cobble island habitat types), both occupied and unoccupied;
   b. Determine habitat suitability preferences for state-listed plants by comparing flow parameters within and between occupied and unoccupied patches of suitable habitat; and
   c. Assess how quality, quantity, and location of habitat changes over a range of water elevations and inundation frequency/duration/timing/magnitude.

   However, the second paragraph of page 3-349 states that data will only be collected at sites where state-listed plants are located. More broadly, the RSP does not articulate how the Proponent proposes to assess Project impacts on both occupied and unoccupied (but potentially suitable) habitats. Although assessing impacts to known habitats is a crucial component of any study plan, assessing impacts to potential habitat – which might otherwise support viable populations under modified flow regimes – is similarly critical to supporting the long-term viability of these species in the Connecticut River.

In the absence of data collection sufficient to enable fine-scale hydrological modeling of water elevations and the timing, duration, magnitude and frequency of flooding in these key habitats, the Division is concerned that the RSP, as currently proposed, will not enable effective and accurate assessment of how habitat suitability for each plant species or species group (demonstrating similar micro-habitat requirements) changes across a range of flow regimes.

Comparison of flow conditions across a range of sites is crucial to understanding how the quality, quantity, and location of habitat varies between occupied and unoccupied patches of potentially suitable habitat. As requested, field assessments of both existing and potential habitats should involve collecting flood depth, timing, duration, and extent – as well as frequency and changes to substrate characteristics – sufficient to permit assessment of how the quality and extent of both suitable habitat changes over a range of flows. This approach would enable delineation of habitat suitability parameters for each species or species group (demonstrating similar micro-habitat requirements), which are currently not well understood, as well as appropriate flow recommendations that will protect and/or enhance both known populations and potential habitats.

The Division notes that the data collection (see above and #4, below) would not be necessary in all suitable habitats. Instead, cross-sections should be established in a subset of habitats – including i) occupied, high quality habitats, ii) occupied, low quality habitats, and iii) unoccupied (but otherwise suitable) habitats – in order to enable **carefully targeted, fine-scale analyses of flood depth, timing, duration, and extent across a range of flow regimes**. As previously suggested, analyses should target plant communities inhabiting mud flats, sandbars, and high energy shore and cobble island habitats, which collectively support the greatest concentration of state-listed plants species with a potentially high degree of susceptibility to existing and potential Project operations.

4. In the third paragraph of page 3-349, the RSP states that hydraulic modeling will provide data to determine the contribution of water level fluctuations associated with Project operations, and that this modeling will "enable analysis of how the germination, growth, and dispersal of listed plants may be affected by the timing, duration, extent, and frequency of Project-related water level fluctuations."

   The Division conceptually supports this approach. As outlined in #3 above, however, the RSP does not provide a framework through which the effects of Project operations on the life cycle (including germination, growth, or dispersal) of state-listed plants will be *quantified*. As suggested in its comments on the UPSP, the Division believes that cross-sections (see similar comments in Task 6, #2 below for state-listed tiger beetles) should be established in both occupied and unoccupied patches of suitable habitat in

order to enable fine-scale analysis of habitat persistence across a range of flow conditions. Fine-scale analysis is necessary to enable accurate hydrologic modeling and facilitate analysis of how germination, growth, or dispersal may be affected by the timing, duration, extent, and frequency of flooding. The Division notes that – because fine-scale variability in elevation, slope, substrate, and flow dynamics have the potential to significantly impact habitat suitability – multiple cross-sections are likely needed to fully understand the extent and quality of habitats at these sites. The Division would strongly encourage the Proponent to consult with the Division prior to initiation of field work in order to seek concurrence that data collection and survey methodology are sufficient to enable fine-scale analyses.

Task 6 (Project Water Level Fluctuation Assessment)

1. As outlined in the fourth paragraph of page 3-341, the Division requested (both in its original Study Request and its comments on the UPSP) integration of modeled river flows and water levels with a habitat assessment for state-listed tiger beetle species. Similarly, the Division requested that the model should, as stated in the fourth paragraph, "specifically assess the influence of existing and proposed Project operations on water levels for both known populations and potential habitats for the Cobblestone Tiger Beetle (*Cicindela marginipennis*) and the Puritan Tiger Beetle (*Cicindela puritana*)." In the first paragraph of page 3-353, the RSP states that a "hydraulic model will be developed as part of Study No. 3.2.2" and that this information will be used to address how hydraulically connected habitats and vegetation are affected, and how operations have or may affect known populations and potential habitats for state-listed invertebrate species." However, the RSP does not currently include a habitat assessment to identify *potential habitat* for state-listed tiger beetles as part of its plan to assess the potential impacts of Project operations on potential habitats; instead, the RSP appears to limit all analyses to known, occupied sites (of which only one site / population of each species is currently known).

   As stated in the Division's comments on the UPSP, the Connecticut River harbors the only known population of each species in Massachusetts. The Puritan Tiger Beetle itself is among the most imperiled species in the United States. Assessing impacts to known habitats is a crucial component of any study plan, as it is widely believed that the daily peaking mode of current Project operations negatively affects these known populations.

   However, assessing impacts to potential habitat – which might otherwise support viable populations under modified flow regimes – is similarly critical to protecting the long-term viability of each species in the Connecticut River. If Project operations negatively affect known populations, it is likely that Project operations also reduce the quality and extent of suitable habitat – and therefore, the ability of the species to colonize and persist – at currently unoccupied sites. The Division is aware of other, currently unoccupied sites

which might support viable populations under modified flow regimes, and is very concerned that the Proponent's plan to exclude these sites from assessment and further analysis will undermine the ability of the study to assess the full impacts of Project operations on these species and their habitats in the Connecticut River (as further outlined in #2, below). Therefore, and as previously requested in the Division's comments on the UPSP, the RSP should be modified to include plans for a habitat assessment for state-listed tiger beetle species sufficient to identify potentially suitable habitats within the TFD Impoundment and downstream of the TFD to Rainbow Beach. Additionally, the Division notes that field work associated with this portion of the study should be conducted in accordance with the "Endangered Species Habitat Assessment and Survey Guidelines: Wildlife" document found on our website, and in particular, should generate maps of all potentially suitable habitat.

2. As currently proposed, the RSP suggests that a cross-section(s) will be established in "known areas of cobblestone tiger beetle and Puritan tiger beetle habitat for use in conjunction with model results," so as to provide information on water level changes at a variety of test flow conditions. The RSP states that cross-section information will include depth and substrate measurements.

   The Division supports use of cross-sections at known, occupied sites, as well as the RSP's suggestion of further consultation regarding whether additional fine scale surveying at occupied locations is necessary. However, and as more fully articulated in #1 above, cross-sections should also be placed in a subset of unoccupied but potentially suitable habitats at narrow between cross-section distances such that data collection can occur at a sufficiently fine scale. This will enable data collection to support analysis of variability in elevation, slope, substrate, and flow characteristics and how these micro-habitat features vary within and between occupied and unoccupied patches of potentially suitable habitat at a biologically relevant scale for the state-listed beetles. This approach would enable delineation of habitat suitability parameters for each species, which are currently not well understood, as well as appropriate flow recommendations that will protect and/or enhance both known populations and potential habitats.

   As outlined in its comments on the original Study Plan, the Division believes that fine scale variability in flood depth, frequency, timing, duration, extent, flow direction, and flow velocity have the potential to significantly impact habitat suitability for state-listed tiger beetles. Multiple cross-sections placed closely together at a subset of sites will be needed to capture small but significant variability in conditions experienced by the beetles. As previously requested, field assessments should involve collecting elevation, slope, substrate, flood depth, flood duration, and velocity measurements sufficient

to permit assessment of how the quality and extent of suitable habitat changes over a range of flows. The measurements should be taken over a range of test flows, between the existing minimum flow and maximum project generation flows, and synthesized to quantify habitat suitability for each species under each test flow. Limiting data collection to depth and substrate data, as proposed, will not address the real-fluid conditions experienced by the beetles during a range of flows nor provide a biologically relevant scale for analysis.

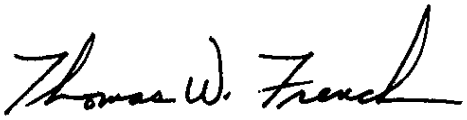
Variability in water velocity is directly tied to bed load, relative sheer stress, scour, and the balance between sedimentation and erosion. These factors can significantly affect habitat suitability for state-listed tiger beetles. The Division strongly suspects, based on over a decade of population monitoring, that water velocities in beetle habitat in excess of their tolerance, together with increased frequency of summer flooding events and other related factors, are primary factors in the decline of tiger beetle populations in the Connecticut River (Davis 2002-2012, unpublished). An understanding of how flow dynamics – and therefore the persistence of suitable habitat – changes at relatively fine scales across a range of flow regimes is a crucial component of the assessment of potential Project impacts.

Therefore, the Division notes that data collection should include a full velocity profile, with increased measurement spacing in at- and near-substrate ranges. Data would then support analysis and modeling in order to determine the iteration between velocity changes across a range of flows and habitat suitability and persistence for beetle adults and larvae. The Division would recommend that the RSP explicitly specify that, while collecting other relevant data during field assessment of delineated cross-sections within both known and potentially suitable habitats (see above), velocity measurements will also be collected. To encompass fine scale changes in habitat suitability, the Division recommends additional data collection transects of littoral habitat within occupied and unoccupied habitat to include wetted width, and substrate and velocity measurements at sub-meter intervals measured from the margin of the wetted width. Multiple transects should be collected within each delineated habitat in order to ensure adequate spatial coverage and statistical representation. Data should be collected at temporal intervals that represent the variety of localized changes in flow with changes in water surface elevation and rates of change throughout the rising limb of the hydrograph as it is affected through a typical peaking operation.

The Division notes that although the hydraulic model developed as part of Study No. 3.2.2 will provide an important tool for understanding Project impacts, the Division is concerned that this model alone may not enable biologically relevant analysis of all key parameters, both in terms of the scale of data collection and the selection of field-collected variables. In the third

paragraph on page 3-76, the RSP states that the hydraulic model will "provide WSEL (depth) and mean channel velocity information to help inform other environmental, geologic and recreation studies as listed above", within which this study was listed. Modeled water surface elevations would enable analysis of flood depth and duration across the range of potential Project flows, two key parameters affecting habitat suitability that may be assessed through collection of elevation, slope, substrate, flood depth and duration measurements across a range of test flows. However, neither parameter would enable analysis of localized flow velocity and dynamics within near-bank habitats. Mean channel velocity itself (which the hydraulic model will provide) is unlikely to provide a sufficient indicator of the velocities and flow dynamics in affected habitats and, especially, near-substrate depths. In the absence of a more explicit description of model application to near-shore and near-substrate flow velocities, the Division is concerned that application of the hydraulic model alone is unlikely to provide data of sufficient relevance to understand how this important factor changes across a varying flow regime. We believe that the approach outlined in Study No. 3.3.1, which models changes in depth, velocity, and other factors across a range of flows, is more appropriate at these key sites in order to fully understand how variable flow dynamics affect habitat suitability and therefore inform appropriate flow recommendations.

Thank you for this opportunity to comment.

Sincerely,  Caleb Slater, Ph.D. Anadromous Fish Project Leader	Sincerely,  Thomas W. French, Ph.D. Assistant Director for the Natural Heritage & Endangered Species Program

GENERAL NOTE #1: All page references, above, provide reference to the 'Track Changes' version of the RSP.

GENERAL NOTE #2: The Division shall be notified, in the form of a Rare Animal or Plant Observation Form, of any state-listed species observed during field surveys associated with any study herein. FirstLight can take advantage of the Division's new data submittal tool, the Vernal Pool & Rare Species Information System (VPRS):

http://www.mass.gov/dfwele/dfw/nhesp/species_info/vprs_home.htm

VPRS is an online mapping and data submittal application that provides users with a way to submit rare species observation reports and vernal pool certification forms to the NHESP electronically. Additionally, the system provides the ability to bulk upload data from a spreadsheet, making data submission more efficient for large-scale survey efforts. The Division would encourage FirstLight to contact our office for further details in advance of field surveys and data collection so as to ensure that data can be submitted in as efficient and cost-effective format as possible.

GENERAL NOTE #3: Field identification of many state-listed species requires considerable expertise and field experience. Therefore, all study plans requiring field surveys and identification of state-listed species should be amended to include the following requirements:

a. Field surveys should be conducted by a qualified biologist in appropriate quality habitats throughout the project area (or a portion thereof, as appropriate), using methodologies consistent with the "NHESP's Endangered Species Habitat Assessment & Survey Guidelines" guidelines.
b. The Division requires pre-approval of the biologist prior to conducting surveys. We can provide contact information for pre-approved biologists on a species or taxa specific basis, or we can review the qualifications of other proposed biologists (in which case a copy of the biologist's resume and qualifications should be sent to the Division for prior review).
c. The selected biologists shall submit written survey protocols for Division approval prior to initiation of field work. Survey protocols shall list the specific taxonomic characteristics for definitive identification as well as the characteristics of similar or easily confused species. Please ensure that the biologist contacts our office to discuss these species and their photo-documentation requirements.
d. Collection or handling of state-listed species requires the selected biologist submit a Scientific Collection Permit Application for Division review and approval prior to initiation of field work.

GENERAL NOTE #4: Many rare species are sensitive to unauthorized collection. External reports or other external materials or products developed using these data shall not reveal site locations without written consent by the Division. A copy of any external reports, manuscripts, or other products related to state-listed species shall be provided to the Division upon completion.

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