Northfield Mountain Station
99 Millers Falls Road
Northfield, MA 01360
Ph.: (413) 659-4489
Fax: (413) 659-4459
Email: Douglas.Bennett@firstlightpower.com

Douglas Bennett
Director MA Hydro Operations
Northfield Mountain/Turners Falls Project

June 13, 2019

VIA ELECTRONIC FILING

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

Re: FirstLight Hydro Generating Company, Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485). Re: Response to Comments

Dear Secretary Bose:

FirstLight Hydro Generating Company (FirstLight) owns and operates the Turners Falls Hydroelectric Project and Northfield Mountain Pumped Storage Project. FirstLight is in the process of relicensing the facilities with the Federal Energy Regulatory Commission (FERC). On August 10, 2018, FERC issued its Revised Process Plan and Schedule requiring FirstLight to file reports for the following studies by March 15, 2019

- Study No. 3.3.9: Two-Dimensional Modeling of the Northfield Mountain Pumped Storage Project Intake/Tailrace Channel and Connecticut River Upstream and Downstream of the Intake/Tailrace.
- Study No. 3.3.19: 2018 Ultrasound Array Study
- Study No. 3.7.1 Phase 1A, 1B and Phase II Archaeological Surveys

Per the process plan and schedule, FirstLight held its study report meeting on March 29, 2019 and filed its meeting minutes on April 15, 2019. Stakeholders had until May 14, 2019 to file comments on the above reports. Comment letters were received from Karl Meyer (letter dated April 15, 2019) and the Connecticut River Conservancy (CRC) (letter dated April 30, 2019). Mr. Meyer's letter did not include comments on the three bulleted studies above; rather he was making recommendations for the 2019 Ultrasound Array Study.

CRC had comments on Study Nos. 3.3.9 and 3.3.19. No comments were filed on Study No. 3.7.1. Included in Attachment A is a response to CRC's questions and comments.

Relative to Study 3.3.19, the original ultrasound array study was conducted in 2016. This study was one of the studies approved by FERC. On February 23, 2018, FirstLight filed a letter with FERC indicating that it was going to conduct another ultrasound array study in 2018 based on lessons learned from the 2016 study. FirstLight indicated it would circulate a draft study plan with stakeholders and seek input before filing a final study plan with FERC. In its February 23rd letter, FirstLight indicated it would file the study plan for FERC's information; FirstLight was not seeking a Determination on the proposed study and FERC did not issue a Determination letter. In short, FirstLight voluntarily conducted the 2018 Ultrasound Array Study. In this response to comments on the 2018 Ultrasound Array Study, FirstLight addressed the majority of comments received from CRC. However, some of the comments, particularly those pertaining to Appendix G cannot be addressed without additional effort. FirstLight is in the process of conducting additional, voluntary follow up work in 2019 and these comments will be addressed as the 2019 fallback data is compared with the previous year's information.

If you have any questions regarding the above, please do not hesitate to contact me. Thank you for your assistance in this matter.

Sincerely,

Douglas P Bennett

Douglas Bennett
Director of MA Hydro Operations

Attachment A: Response to CRC Comments

Attachment A: Response to CRC Comments

Commenter	Comment	Response
Study No. 3.3.9. Two-Dimensional Modeling of the Northfield Mountain Pumped Storage Project Intake/Tailrace Channel and Connecticut River Upstream and Downstream of the Intake/Tailrace.		
CRC-1	CRC recommends that the velocity figures from Appendix B showing all pumping scenarios at realistic impoundment elevation (181.5 ft) be zoomed in on the tailrace area (Map 3 for these scenarios) and in the vicinity of the barrier net study to better understand velocities in that area.	On June 3, 2019, FirstLight filed the following study: *Northfield Mountain Generating Station (FERC No. 2485), CFD Modeling for Fish Exclusion Net Forces*". The CFD modeling was conducted to show more detailed velocities in the area of the proposed barrier net. The results from this analysis address these CRC data requests.
Study No. 3.3.19: 2018 Ultrasound Array Study		
CRC-1	General Comments: Tables 4.3.3-1, 4.3.3-2, E1-1, E1-2, E1-3, and E.2-1 have more fish moving to other locations than at initial location. It is unclear how more fish can move to subsequent locations than were at the original location.	These tables enumerate all movements originally made from, back into, and to other locations, from the initial location. Movement was complex with multiple fish making multiple trips back into and out of the initial model location. Let's examine Table 4.3.3-1, which enumerated movement from Cabot tailrace in 2015. Initially, 66 fish were captured in the tailrace (n = 66). Of those 66 fish, 23 made movements toward Cabot Ladder a total of 87 times. That averaged out to 3 Tailrace-to-Cabot Ladder movements per fish, with 1 fish making 13 movements. Of those 23 fish that made movements towards Cabot Ladder, 22 of them made 86 subsequent trips back out to the tailrace. Of the 66 fish originally recaptured in the tailrace, 23 of them were recaptured in the Cabot Ladder, 30 of them in the Bypass Reach, and 20 of them back downstream. At any time, fish can move back into the original location. In other words, there was a lot of back and forth movement, these tables enumerate all movement, and they develop statistics on the expected number of trips per fish.
CRC-2	4.3.3 Cabot Tailrace Movement Page 4-8 says that in 2018, fish had to travel through two ensonified reaches. What were the two reaches?	The first reach is movement from the farfield through the acoustic barrier and into the nearfield. The second reach is from the nearfield, through the acoustic barrier at the entrance of the ladder and into the ladder.
CRC-3	4.3.3 Cabot Tailrace Movement On page 4-8, the third paragraph states that total movements and the percent of fish moving into the Cabot ladder were greater in 2018 than 2015. But in next paragraph it says "Overall, a higher proportion of movements from the tailrace were directed toward the [Cabot] ladder in 2015." These statements seem contradictory.	In 2015, 35% of the fish made 87 movements towards Cabot Ladder. They averaged about 3 trips per fish. In 2018, 47% of the fish made 117 movements, and averaged about 2 trips per fish. Of all the movements made from the tailrace in 2015, roughly 40 – 50% of them were towards the ladder, while in 2018 of all the movements made from the tailrace, 30 – 40% were towards the ladder. In 2018, there was almost double the number of fish in the tailrace. In 2018 fish made fewer trips on average towards the ladder, and the proportion of all movements from the tailrace towards the ladder was lower. In 2015, less fish overall were in the tailrace, but on average they made more movements towards the ladder, and overall, the proportion of movements from the tailrace to the ladder was higher than in 2018.
CRC-4	4.3.3 Cabot Tailrace Movement On page 4-9, the model that best describes movement from tailrace into the Cabot ladder incorporated the ultrasound array. Does this mean that once fish are inside the 'fence,' they were more inclined to enter the ladder than pass through the fence again? Or does it refer to fish outside the 'fence'? This is confusing as the upstream end of the fence is at the entrance to the ladder.	The hazard ratio of the model was less than 1. With the ultrasound array on, fish are less likely to move towards the ladder. However, we found that the effect of the ultrasound array was dependent upon time. For every hour a fish was exposed to the ultrasound, it was less effective.
CRC-5	4.3.3 Cabot Tailrace Movement On page 4-9, it is not clear how the ultrasound array affected movement from the Cabot ladder to the tailrace?	Data from 2018 were combined with movement data from 2015 to compare conditions with and without ultrasound. The model found that 2018 fish were 3.13 times more likely to move from the ladder into the tailrace. However, the test of proportionality was significant. In other words, the effect of the ultrasound at moving fish from the ladder into the tailrace decreases with time. For every hour, fish were almost half as likely to move back into the tailrace.
CRC-6	4.3.3 Cabot Tailrace Movement On page 4-9, explain how the 'cumulative average discharge' is calculated. Explain how the single factor models were used to get the best model.	The cumulative average discharge was calculated for the time a fish was present before moving to a new location. For example, a fish can be present in the tailrace for 15 minutes or 15 hours before moving to the bypass reach. To calculate the cumulative average bypass flow while present, we queried the bypass flows between the time a fish entered and exited the tailrace and calculated the statistical average. After testing single factor models, more complex models were created using the most significant variables, by combining these with other significant variables, we can make ever more complex models. More complex models were built in an iterative test fashion in R. Not all permutations were tested.
CRC-7	Section 5 Discussion Page 5-2 describes issues keeping transducers activated and aligned. Was this a problem with higher generation? How has this been accounted for in the analysis?	FirstLight kept records of when the transducers went offline. These times were accounted for in a column that indicated the operational status of the array. The array was known to be down on from 5/15/2018 10:00 to 5/18/2018 at 23:45 and from 6/4/2018 at 0:00 to 6/5/2018 at 23:45. On the outage from 5/15 to 5/18, the average Cabot Generation was 4,804 cfs, while during the outage from 6/4 to 6/5 the average Cabot Generation was 1,010 cfs.

<table>
<tr><th>Commenter</th><th>Comment</th><th>Response</th></tr>
<tr><td>CRC-8</td><td><u>Section 5 Discussion</u>
Page 5-3 states that 1- hour volatility (best model) moved fish from the tailrace into the bypass. It says, “However, fish are 13% less likely to move into the bypass reach for every 1,000 cfs increase over the baseline.” Does that mean that, with an increase, fish stay in the tailrace or are more inclined to move downstream?</td><td>The tailrace to bypass movement model incorporated additive effects of two variables, instantaneous discharge at Cabot and short-term volatility (1 hour). We are always comparing the movement of a fish at one level of flow (or other variable) to the baseline condition. The baseline Cabot discharge was 0 cfs and the baseline short term volatility was also 0 cfs. For every 1,000 cfs above baseline, fish are 13% less likely to move. Fish are more likely to move to the bypass when flow is volatile in the short term and discharge is low as compared to baseline.</td></tr>
<tr><td>CRC-9</td><td><u>Section 5 Discussion</u>
On page 5-3, what does, “Once fish move into the bypass reach, movement analysis suggests that fish prefer flows in the 3,000 to 6,000 cfs range” mean? Only flows at the end of the season were less than 3,000 cfs.</td><td>FirstLight assessed movement under a series of binned flow ranges (1,000, 2,000 and 3,000 cfs bin). Of those three models, the only model that was significant incorporated 3,000 cfs bins. When we viewed the histogram that counted movement to the spillway in 3,000 cfs bins, the bin that had the highest count was 3 to 6,000 cfs.</td></tr>
<tr><td>CRC-10</td><td><u>Section 5 Discussion</u>
Rawson Island Complex - - Is there an analysis of passage success at different bypass flows for 2018?</td><td>There is, but no model was significant. Please see table E.2-4. Note the only model that was significant looked at movement in quarter day intervals. Fish that moved between 6 am and noon had the highest hazard ratio.</td></tr>
<tr><td>CRC-11</td><td><u>Appendix E. Bypass Movement Analysis</u>
On page E-3, the report says, “The Nelson-Aalen cumulative incidence plot (Figure E.1-1) shows around 35% of the movements from the Conte discharge were directed towards the spillway within 200 hours of arriving in the bypass reach.” What defines ‘toward the spillway’?</td><td>Being recaptured in the spillway after being recaptured at Conte Discharge.</td></tr>
<tr><td>CRC-12</td><td><u>Appendix E. Bypass Movement Analysis</u>
Figure E.1- 1 shows that the upper confidence bound is less than 30%. How is this reconciled?</td><td>The 35% was based off of visual interpretation of the line, and is the reason for using approximation qualifiers (i.e. “around”). Examination of aggregate counts show 70 fish out of 280 arriving at the spillway, which is 25%.</td></tr>
<tr><td>CRC-13</td><td><u>Appendix E. Bypass Movement Analysis</u>
On page E- 3, the model showed that the majority of fish moved to the spillway when flows were greater than 4,000 cfs. How does the count of transitions in Figure E.1- 2 compare to the amount of time those flows were provided?</td><td>The table below shows the proportion of fish to arrive at Spillway from Conte under each bypass flow bin (1,000 cfs increments), and the proportion of bypass flow observations within each bin. Note that 32% of the Bypass flow observations in 2015, 2016 and 2018 were between 0 and 1,000 cfs. However only 1% of the fish arrived at this flow bin. The flow bin with the largest number of successful fish was 4 to 5,000 cfs with 43% of the fish arriving at the Spillway. This flow bin was provided 14% of the time.

We have not queried out only those time stamps where fish were known to be in the bypass reach. Therefore, the % of bypass discharge observations account for times when no fish were present (either before they arrived or after the last fish had moved) and these proportions should be considered approximate

<table>
<tr><th>Flow Bin</th><th>% of Passage Count</th><th>% of Bypass Discharge Observations within each Flow Bin</th></tr>
<tr><td>0 - 1,000</td><td>0.01</td><td>0.32</td></tr>
<tr><td>1,000 - 2,000</td><td>0.03</td><td>0.07</td></tr>
<tr><td>2,000 – 3,000</td><td>0.13</td><td>0.19</td></tr>
<tr><td>3,000 – 4,000</td><td>0.06</td><td>0.09</td></tr>
<tr><td>4,000 - 5,000</td><td>0.43</td><td>0.14</td></tr>
<tr><td>5,000 – 6,000</td><td>0.06</td><td>0.01</td></tr>
<tr><td>6,000 – 7,000</td><td>0.29</td><td>0.09</td></tr>
<tr><td>> 7,000</td><td>0</td><td>0.009</td></tr>
</table></td></tr>
<tr><td>CRC-14</td><td><u>Appendix E. Bypass Movement Analysis</u>
On page E-3, it states, “As the cumulative average flow while present increases by 1,000 cfs over the baseline, fish are nearly 7 times more likely to migrate to the spillway.” What is the ‘cumulative average flow’? Is it flow at the tailrace/Smead Island area? Is this similar to saying that more fish move to the bypass when flows are greater in the bypass?</td><td>The cumulative average flow is the cumulative average flow experienced by a fish while it is moving from one state to another. Please see answer to CRC-6.</td></tr>
<tr><td>CRC-15</td><td><u>Appendix E. Bypass Movement Analysis</u>
On page E-3, it says, “The hazard rate associated with a higher than average discharge and another day later in the season (HR = 0.99) suggests that fish are less likely to migrate to the spillway. In other words, there are diminishing returns with higher flow later in the season.” What is a higher than average discharge and where? This is a bit confusing as only in 2015were bypass flows greater than about 3,000 cfs.</td><td>The interaction effect associated with cumulative average discharge and day of year was significant. Later in the season, when discharge is greater as compared to baseline, fish are less likely to move. This effect is small in comparison the hazard ratio associated with the primary effect of cumulative average flow while present. For every 1,000 cfs increase over baseline, fish are 6.92 times more likely to move.</td></tr>
</table>

Commenter	Comment	Response
CRC-16	<u>Appendix E. Bypass Movement Analysis</u> On page E-5, Table E.1-5 shows that model 17 has an AIC that is second lowest. Model 8 has the lowest AIC (Akaikes Information Criteria). Why isn't 8 a better model?	Answering this question would require an additional level of effort, which FL does not believe is warranted to inform the study results at this time. Please note that FL conducted the 2018 ultrasound array follow up study on a voluntary basis, as the study was not required by FERC. FL is in the process of conducting additional, voluntary follow up work in 2019 and these comments will be addressed as the 2019 fallback data is compared with previous year's information.
CRC-17	<u>Appendix E. Bypass Movement Analysis</u> Section E2 2018 Detailed Bypass Movement. In the first paragraph of this section it states that 36 fish were at Station 1 and 33 were at the dam but later it states that 36 fish were captured at Station 1 and 29 continued upstream. Why is there a difference?	5 fish made 6 movements undetected from Conte Discharge to the Spillway. From Station Number 1, 29 fish made 41 movements. There were 33 unique fish detected at the spillway, these fish either came from Station Number 1, or were undetected at Station Number 1 and originated from Conte. Once at the Spillway, 23 fish made 34 movements back to Station Number 1, meaning there was quite a bit of back and forth movement. A fish could have moved to the spillway past Station Number 1 undetected, dropped back to Station Number 1, and then make a subsequent trip back to the Spillway. These tables count back and forth movement.
CRC-18	<u>Appendix G Assessment of Fallback Fish</u> The fall back analysis seems to have a year problem. Page 1 in the first paragraph, it says fish from 2016 were not used, but the sixth paragraph in G.2 refers to fish releases in 2015 and 2016. Table G.2-6 and Figure G.2-1 are labeled 2015 and 2016. This seems contradictory.	FL is in the process of conducting additional, voluntary follow up work in 2019 and these comments will be addressed as the 2019 fallback data is compared with previous years information.
CRC-19	<u>Appendix G Assessment of Fallback Fish</u> The role of discharge is not clear. Figure G.2-1 paragraph says, "While not as strong an association, the count of fallback fish appeared to peak around 17,000 cfs" and the Discussion says fat metering and Montague discharge were the most significant factors influencing fallback in 2015 and 2016. Table G.2-5 says that the best model incorporated water temp, de-scaling and percent body fat.	
CRC-20	<u>Appendix G Assessment of Fallback Fish</u> The report states that the best model for fallback is model 1, fat content assessed. But the AIC for best model 4, descaling, in Table G.2-6 is significantly different from other lower that any of the other three. Why is the model with the lowest AIC not the best?	