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February 24, 2025

Re: FirstLight's 401 Draft Water Quality Certificate, Jan 24, 2025
Northfield Mtn Pumped Storage Project No. 2485-071, Turners Falls Project No. 1889-085

Dear Ms. Stefanik,

Please accept the following comments on the draft 401 Water Quality Certification (WQC) for the Turners Falls Hydroelectric Project (FERC No. 1889-081, "Turners Falls project") and Northfield Mountain Pumped Storage Project (FERC No. 2485-063, "Northfield Mtn").

We are residents of Massachusetts' portion of the Connecticut River Valley and UMass Amherst professors who specialize in water and energy from multiple standpoints. Vogel and Spector lead the UMass Energy Geographies and Politics Project, which consists of professors, student researchers, and alumni who work on electricity policy, markets, politics, sustainability, and environmental justice. Vogel leads a subgroup, the UMass Energy Policy and Rivers group, which brings special expertise on energy markets and policies related to hydropower and rivers, and related river and community impacts, policy, and regulatory processes. Hatch and Vogel led the RiverSmart Communities project, a project looking at how to use the science of fluvial geomorphology and predictions of climate change to help New England communities work with river processes to reduce future flood damage and costs.

All of us have collaborated and consulted closely with a variety of agencies, NGOs, legislators, communities, and frontline activist groups for many years on water, river, and clean energy science, management, and policy in Massachusetts and beyond. Vogel has been a participant-observer in the relicensing of the FirstLight projects since before the official start of the process in 2012, and Spector since 2017. Hatch has been involved with Connecticut River science since 2011.

Sincerely,



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MassDEP Draft Water Quality Certificate for FirstLight's Turners Falls Project and Northfield Mtn, Jan 24, 2025—COMMENTS by Vogel, Spector, Hatch, UMass Amherst

Summary:

The Turners Falls project and Northfield Mountain have strong energy benefits and very negative environmental impacts. While FERC's role is to issue a license that balances the tradeoffs between these, MassDEP's role is to ensure that operations and management under the license do not violate federal or state clean water standards. The current draft does not provide that assurance. It builds overly closely from the Flows and Fish Passage Settlement Agreement (F&FP), failing to provide an independent review and failing to provide protection of water quality. The draft WQC is weakest in the same place as the F&FP: a failure to assess and mitigate the ongoing and future impacts of Northfield Mtn hydropеaking. To ensure that these projects will meet water quality standards now and into the future of a potentially 50-year license, MassDEP must refine a number of its Special Conditions and impose several additional conditions. These include:

1. Additional studies on the water quality impacts of Northfield Mtn operations, restrictions until water quality is assured, and decommissioning funds to avoid a stranded asset with long-term water quality impacts

- (a) Baseline and periodic monitoring, assessment and evaluation of the hydrological impacts of Northfield Mtn hydropеaking (including magnitude, duration, frequency, and seasonality of water level ramping, and resulting changes in velocity); (b) the impacts of these on aquatic life, riparian areas, invasive species, and erosion/sediment as well as other water quality indicators; (c) future modeling of changes in hydropеaking and water quality impacts based on climate change and predicted changes in the electric grid and markets, and (d) the impacts of these on water quality building from the empirical studies of parts a and b; and (e) adaptive management of operations restrictions based on this information so as to protect and enhance water quality.
- Restrictions until such studies are completed on: minimum *and* maximum levels in the Turners Falls Impoundment (TFI), *extended durations or high frequencies of high-volume pumping or generation*, especially during seasons of sensitivity of aquatic life (e.g. fish migration seasons), with carve-outs for urgent grid needs such as scarcity conditions, provided there are also requirements for mitigation for any exceptional impacts at such times.
- Set-aside funds for decommissioning once the project is no longer economical.

Relatedly:

2. Monitoring data, including historical data, must be robust, scientific, regularly produced, and publicly available.

Additionally:

- 3. Endangered Short-Nose Sturgeon must be included** in all fish-related studies and, as appropriate, effectiveness testing related to fish passage
- 4. MassDEP must require public participation opportunities and facilitation and technical support for consultations with federal and state recognized tribes.**

Background on these is below, followed by specific recommendations on the Special Conditions. Additionally, all of these are built on earlier comments we have provided in this process, from which we have provided extended excerpts. These are provided in full as Attachments:

- A. Energy Policy and Rivers group et al re: FirstLight's Flows and Fish Passage Settlement, May 26, 2023
- B. Vogel re: DOER's Mid- and Long-Duration Energy Storage Study, Sept 1, 2023
- C. Energy Policy and Rivers Group et al. re: 401 Water Quality Certificate Applications, June 3, 2024
- D. Vogel comments to FERC re: "Notice of revised procedural schedule for environmental impact statement," December 20, 2024

Detail / Background: Needed additional conditions:

1. Additional studies on the water quality impacts of Northfield Mtn operations, restrictions until water quality is assured, and decommissioning funds to avoid a stranded asset with long-term water quality impacts

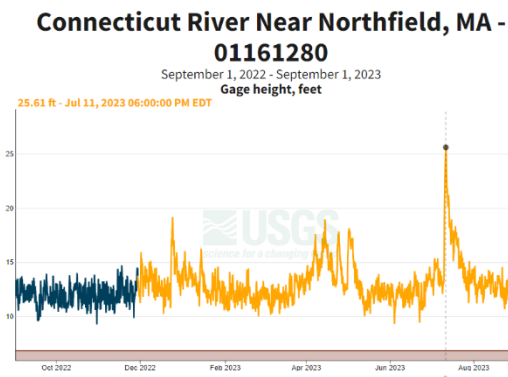
A. Background on rationale for needed added conditions:

- *There is inadequate data on the impacts of Northfield Mtn hydropeaking, but enough to know the impact on aquatic life, erosion, streambank and riparian ecosystems, and other aspects of water quality is enormous.*

In the draft WQC, MassDEP provides considerable discussion of the impact of hydropeaking on the portion of the Connecticut River that now serves as the Turners Falls Impoundment (TFI). But it does not provide extensive data, and seems dubious about some of the impacts. For example, it says “some report that the river flows backwards at times during pumping and generation” (p. 16). In our comments on the DOER storage report (Attachment B) we provided a deeper analysis of this and some of the problems caused by hydropeaking, including reverse flows. We offer an extended excerpt here:

Open-loop pumped storage projects use Massachusetts rivers as their lower “reservoir,” and because of this, they have profound environmental impacts. Every time they “charge” (pump) they suck up large volumes of river water, causing river levels to drop. They have the ability to suck up more water flow than the entire river sometimes provides. When this happens, from the downstream dam (Turners Falls) to the water intake, the river can flow backwards. In contrast, when the project generates energy, the opposite happens: water is poured into the middle of the river, river water levels rise dramatically, and the river from the intake to the upstream dam (Vernon Dam, farther away from the intake) can flow backwards. Under both the current and proposed license, pumping and generation at Northfield can cause water levels to fluctuate up to 9 vertical ft/day. Usual daily fluctuations are more like 4-5 feet... [this] means a far greater horizontal distance, with water sometimes extending up the streambanks, other times not; this width is watered and dewatered repeatedly, day after day. These dramatic fluctuations in river flow, river level, and wetted or dry streambanks threaten higher temperatures and stranding for aquatic organisms in low-water places and times, cause displacement and disorientation during high-flow places and times, and contribute to riverbank and riverbed erosion.

The graph to the right gives some sense of the fluctuations in water level over the last year [2022-3], although this is about 9 river miles upriver from the Northfield intake / outflow, and not all the fluctuations shown here are caused by Northfield. The water level is shown varying from about 9 feet to about 26 feet. The highest levels, on July 11, correspond to this summer's floods. The daily fluctuations, however, are caused by “hydropeaking”—river flows that vary depending on hydropower production. The hydropeaking shown in this graph comes both from Northfield and several upriver projects, particularly Vernon Dam, the dam directly upstream on the Connecticut River.

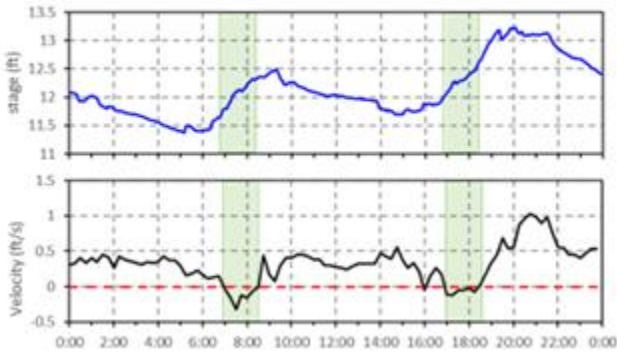


Connecticut River Near Northfield, MA - 01161280



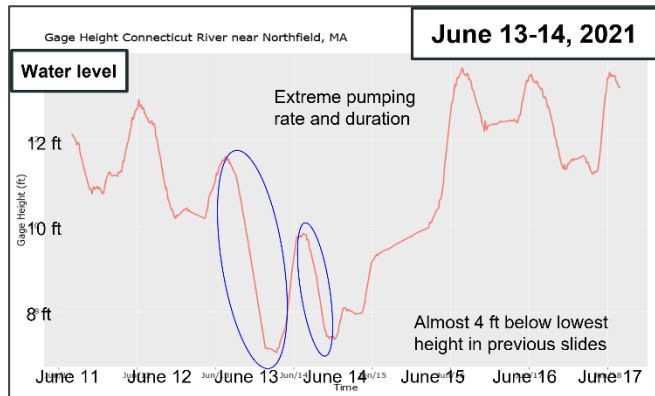
A zoomed-in look at a relatively average few days, such as the last week (Aug 25-Sept 1, 2023, captured Sept 1 at about 9:30 AM), gives some sense of more regular fluctuations. Here the river is going up and down over the course of a few days from 11.5 to 14 feet, so 2.5 vertical feet of variation. At the Northfield intake / outflow location downstream, this [could] be more extreme, likely closer to 5-6 feet in variance.

Nov 3, 2022 - Green bars highlight periods when stage is increasing at Northfield gauge, and velocity is negative.

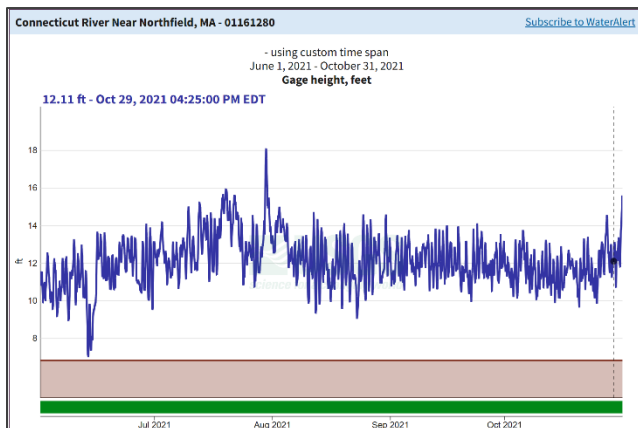


One situation when you can directly see the effect of Northfield, even at the USGS gage 9 miles upriver, is when the velocity actually goes negative at the same time the river level ("stage") goes up. Hydropeaking from the upstream Vernon Dam would cause stage *and* velocity to increase, so this increased stage with *negative* velocity is the effect of Northfield overpowering whatever flow is coming out from Vernon. High generation from Northfield has made the river flow backwards for miles, all the way up to the USGS gage.

In addition to the hydrological impacts documented above, there are others. For example, in June 2021 when the river reached extremely low levels, as documented in the draft WQC, an extended view of the hydrograph at the Northfield USGS gage (see right) shows extreme pumping rate and duration both nights leading up to those low level events



(Slide from: Vogel et al. Hydropower Coffee Hour, July 2021, for CT River Conservancy, <https://www.youtube.com/watch?v=WqeEWZoEpg>).



Additionally, that summer's hydrograph shows that the impoundment was kept abnormally high for much of July and August, with an especially high spike on July 30. Reportedly there were also problems accessing the reservoir during these months because of high levels.

FRCOG's comments and their consultant's report document the problems of erosion caused by extreme saturation from extended high levels, repeated extreme wetting and drying due to extended and repeated ramping, etc.

- *There is likely to be a major increase in hydropeaking and water quality impacts in the TF Impoundment over the first 2-3 decades of the new license. The draft WQC neglected to recognize, much less study, assess, and mitigate, the future impacts on water quality of what will almost certainly be an increase in hydropeaking and its impacts during the terms of the next license. This increase will come because of:*

a) Climate change.

Climate change is predicted to bring much more variability in precipitation in New England in the future, causing more frequent and more extreme droughts and floods. This is going to make river flow much more variable. As a result, a) living things in the river will be subject to greater flow fluctuations than historically—and flow directly affects temperature, dissolved oxygen, turbidity, and other water quality factors, and b) more often than now the flow of the river coming downriver will be low and the impact of Northfield on changing levels and velocity will be greater. Climate change will also bring increased summer temperatures and weather variability that will add stress and variability to energy demand, leading to higher demands for the flexibility of storage.

b) The energy transition.

The transition to an energy grid with more variable energy will likely mean far more operation of Northfield pump storage, at least in the first 2-3 decades of the new license before large amounts of other storage, demand response, other flexible resources, and more 2-way transmission to Canada and other regions come on line. Although the development of offshore wind has been delayed by the Trump administration, the energy transition is still expected to unfold over the timeframe of the next license. As large volumes of offshore wind come on, and the region continues to electrify, there will be more price differential in the ISO-NE energy prices, and Northfield will operate more often.¹ This is already being seen with solar. There are now often several hours of pumping on sunny spring afternoons, as prices go very low or even negative from excess solar output; this means many days now with two pump/generate cycles per day. (See also comments from the Alliance for Climate Transition, copied into the FERC docket.)

Note that after about 20-30 years there may *decreased* hydropeaking, as Northfield's operations may no longer be competitive most of the time with other storage and other providers of flexible resources, and operations may diminish significantly, or the plant could even potentially be shuttered if its revenues are not adequate to maintain the plant.

¹See [E3 study for DOER's Charging Forward report](#). NFM needs a price differential of at least about 35% between high daily prices and low daily prices in order to operate profitably, because it uses about 35% more electricity to pump than it generates. Because the marginal fuel for electric generation on the New England grid is usually natural gas, that price differential is not always available. Currently NFM only generates power about 8% of the hours a year (Energyzd 2020, "Northfield Mountain Pumped Storage: Assessment of Contract Benefits in an Increasingly Renewable Region"). It takes about 50% longer to pump the same water, so that means it pumps about 12% of the hours a year. In other words it operates only about 18% of the hours per year. This could go up dramatically as offshore wind comes on line and provides much more opportunity for price arbitrage.

c) More water storage in the upper reservoir (proposed in license application and supported by the draft WQC).

Allowing permanently larger water storage in the upper reservoir will lengthen potential pumping and generation cycles, making longer operation likely for each cycle, and enabling generation on more days of the week, adding considerably more hydropeaking and flow and level fluctuations. Permanently expanding allowable storage in the upper reservoir will mean that a full cycle of pumping and generation at full capacity will take 24 hours rather than the current 20, meaning the potential for nonstop function of the plant which is not currently possible on a daily basis.² Also, currently NF often strategizes to pump more on the weekends when prices are low and generate more on weekdays, but it can run out of upper reservoir storage by Thursday or Friday. More storage in the upper reservoir is likely to enable generation fluctuations for any day of the week that price differentials are available.

d) Mandated storage procurements in the 2024 Mass climate law.

The recently passed 2024 Massachusetts climate law has mandated storage procurements of 5000 MW by 2030 and requires that existing storage shall be eligible. It is unlikely the state will be able to meet this very ambitious storage procurement target without storage procurements of our large-scale existing storage, Northfield Mtn and Bear Swamp, which together have about 1800 MW of storage, of which almost 1200 MW is Northfield.³ We do not yet know what long-term contracts will do in terms of changing operations at Northfield. This will depend on the specifics of the RFPs that roll out in 2026 and later (the 2025 procurement will not include Northfield). But Northfield may well be required or incentivized to operate even outside the ISO-NE market signals⁴, or to bid below market. Operating outside of ISO market signals means generating even when there is not a 35% differential between high and low daily prices. This means more hydropeaking than would otherwise be expected based on b and c above. (See more on market and out-of-market operation below.)

- *Hydropeaking's impacts are inadequately understood and addressed, with minimal plans to remedy this in the F&FP; these inadequacies are largely adopted directly into the draft WQC.*

As explained in our F&FP comments Attachment A), the F&FP did not adequately account for impacts of Northfield Mtn:

² To pass the full volume currently allowed in the upper reservoir through the NF generators at full capacity--in other words, releasing water through generators at maximum flow for maximum generation, all four generators at once--takes about eight hours. That same water going uphill from the river to the upper reservoir through the pumps at maximum capacity takes about 12 hours. With the proposed increase in storage, those amounts will be approximately 9.5 and 14.5 hours, adding up to 24 hours. (We recognize that normally, the plant does not run at full capacity nor use its maximum storage, to retain some reserves for urgent grid needs and/or more profitable price arbitrage, but under the additional allowed storage the normal operations will likely increase proportionately to this maximum possible.)

³ There is a lot of proposed storage in the ISO-NE interconnection queue, but the largest non-PSH storage that is poised actually to come on line soon is the planned Everett battery storage facility of 750 MW.

⁴ This is how the Massachusetts Clean Peak Std works. It incentivizes operation during certain hours during certain seasons, regardless of ISO market signals and grid needs. (The CPS does not currently do a lot of damage to the ISO markets because there have not been a lot of eligible new MW built since its passage.)

In contrast to large improvements planned at Turners, perhaps the biggest gaping hole in the Flows and Fish Passage Agreement relates to hydropeaking in the Turners Falls impoundment (lower Northfield reservoir, i.e. Connecticut River between Turners Falls and Vernon dams). The daily hydropeaking fluctuations from Northfield, Vernon, and tributaries constitute overarching environmental impacts. High pumping and generation at Northfield can cause water levels to fluctuate up to 9 vertical ft/day, and the river sometimes to flow backwards.

The Flows and Fish Passage Agreement asserts, astonishingly, that “Increasing the upper reservoir storage will have no adverse environmental effects” (Proposed Article B100). FirstLight appears to acknowledge that expanded storage will likely mean expanded operations,⁶ i.e. greater pumping and generation, at the same time again asserting that this will have no effect....

This is patently inadequate. Relicensing studies showed that existing hydropeaking already has a negative impact on fish spawning in the impoundment (FirstLight 2016c). In the statement quoted in the previous paragraph (in Proposed Article B100), FirstLight reveals that we do not have adequate evidence of the impact of hydropeaking on protected, threatened, or endangered species. We have even less information on how current hydropeaking affects habitat and habitat conditions for aquatic species that may not be threatened or endangered, but are resident to the impoundment and contribute important ecosystem services (e.g. native mussels and fishes); and we have still less information on the impact on riparian and floodplain species. Yet the limited fish studies show that there is already significant impact from hydropeaking. Lack of data is inappropriate evidence for this Agreement to say nothing about the range and timing of hydropeaking in the impoundment that may be appropriate to ensure a healthy range and population of native species there.

It also follows from the fish spawning data in the impoundment that increased operations should at the very least be hypothesized to create larger negative impacts on a range of species and habitats. There is inadequate evidence to justify not addressing the potential impacts of increased Northfield hydropeaking that may be enabled by a larger upper reservoir.

In any case, if Northfield is allowed to increase the size of its upper storage reservoir, and/or if its hydropeaking operations significantly increase, the impoundment will be in a condition that is outside the conditions studied within the relicensing studies. There is a... lack of evidence to justify any particular operations plan in these future scenarios.

The draft WQC adds one analysis of hydropeaking to what was provided in the F&FP, and adds a few new provisions on low levels in the TFI. The draft WQC's Appendix B provides two graphs of past and predicted future “exceedance curves.” There is no information on the timeframe of either of these, they address only maximum and minimum levels—nothing on ramping rates or duration, river velocities and fluctuations, seasonality of such fluctuations relative to fish migration or other critical timing, etc.—and there is no provision in the WQC for monitoring to confirm that the asserted predicted no significant effect of adding new storage will not change hydropeaking. For all the reasons listed above, this remains inadequate. We note that FRCOG provided a particularly insightful analysis about the problems and needs for further data and incorporate by reference the details they provided.

The F&FP did have an important provision for monitoring hydropeaking via impoundment levels at the TF dam, mainly for information purposes for recreation, and the draft WQC incorporates these. These are however inadequate to cover the major impacts and information gaps we describe above. Again we incorporate by reference FRCOG's recommendations on this; we also include details in recommendations on Conditions, below.

- *To ensure the project meets water quality standards, the impact of Northfield's hydropeaking impacts must be studied and mitigated; MassDEP must impose additional conditions.*

From our F&FP Comments (Attachment A):

To fully address the impact of Northfield's hydropeaking would require idling or removal of the Northfield Mountain project, or construction of a lower reservoir separate from the river, to create a closed loop system. During the study selection process, the Connecticut River Watershed Council (now the Connecticut River Conservancy) requested a study to look at these options, but FERC rebuffed the need. The Flows and Fish Passage Agreement appears to have no consideration or analysis of a decommissioning, removal, or idling option, even for future scenarios when this project may no longer be a cost-effective resource for the New England electric grid.

There are also ways to address the impact of hydropeaking through mitigation, e.g. reduced flow and level alterations in the impoundment during fish migration or emergence seasons, or a system like that at Cabot that maintains a closer percentage to NRF or allows a reduced amount of variation.... Unavoidable impact could be addressed through off-site mitigation, commensurate with the impact of hydropeaking.

...if Northfield is allowed to increase the size of its upper storage reservoir, and/or if its hydropeaking operations significantly increase, the impoundment will be in a condition that is outside the conditions studied within the relicensing studies. There is a complete lack of evidence to justify any particular operations plan in these future scenarios.

B. Needed added conditions:

More specifically, **the following are needed to ensure Northfield Mtn operations meet Massachusetts water quality standards.**

1) *Studies, data, and adaptive management.*

All of these go beyond the studies and data called for in the WQC:

Baseline and periodic monitoring, assessment and evaluation of

- **(a)** the hydrological impacts of Northfield Mtn hydropeaking (including magnitude, duration, frequency, and seasonality of water level ramping, and resulting changes in velocity);
- **(b)** robust investigation of the impacts of these on aquatic life, riparian areas, invasive species, and erosion/sediment as well as other water quality indicators;

Future modeling of

- **(c)** Changes in hydropeaking and water quality impacts based on climate change and predicted changes in the electric grid and markets, and
- **(d)** The impacts of these on water quality building from the empirical studies of parts a and b;

(e) Adaptive management protocols that can impose operations restrictions based on this information, if necessary to protect and enhance water quality.

2) Operational restrictions

Until these studies can be completed, operational restrictions should ensure limited impact where causation and impacts are poorly understood. Restrictions should be placed on:

- minimum *and* maximum levels in the Turners Falls Impoundment (TFI),
- *extended durations or high frequencies of high-volume pumping or generation*, especially during seasons of sensitivity of aquatic life (e.g. fish migration seasons), with carve-outs for urgent grid needs such as scarcity conditions, provided there are also requirements for mitigation for any exceptional impacts at such times.

Finally, there is a significant chance that as the grid changes, other more economical battery storage, demand response, and long-distance transmission and localized distributed system-based flexibility will come on line. Well within the term of a 50-year license there is a good chance Northfield Mtn will simply no longer be economical to operate. If so, we risk having a stranded asset with no operator and no mitigation, with no funds to decommission the project and terminate the need for further water quality mitigation.

3) Decommissioning funds.

To ensure the project meets water quality standards for the full life of the license, Mass DEP must require set-aside funds for decommissioning once the project is no longer economical. The Connecticut River Conservancy provides extensive discussion of the appropriateness of this in their comments. See also [American Rivers](#) on the practicalities of decommissioning including its high costs, which are often stranded costs with longlasting water quality impacts, with both decommissioning and mitigation costs falling to taxpayers.

5. **Endangered Short-Nose Sturgeon must be included** in all fish-related studies and, as appropriate, effectiveness testing related to fish passage.

2. Monitoring data, including historical data, must be robust, scientific, regularly produced, and publicly available

Closely related to point #1 above, monitoring data must be robust, scientific, regularly produced, and publicly available. Historical data must be made available.

As we explained in our comments on the F&FP:

Given the proposal for a 50 year license, there is tremendous need for ongoing publicly available data, for monitoring and assessments as new measures are implemented or as conditions change, and for adaptive management to alter operations and practices as new information arises. The Flows and Fish Passage Settlement Agreement has very valuable provisions in place for effectiveness testing of a number of measures, and a suite of planned adaptive management measures (AMMs). However, there is a lack of data, monitoring, and planned adaptive management in a host of other areas. There is inadequate evidence to justify these deficiencies. This is especially true for a license that will continue into the next several decades, when climate

change and an energy transition are accelerating, and are likely to fundamentally alter the conditions under which these plants operate within this half-century timeframe....

Public data on Turners Falls impoundment levels at the Turners Falls dam will be a major added beneficial source of data. Among other things this could enable empirical studies that can correlate hydropeaking and impoundment levels with fish, hydrological, geomorphological, ecological, and recreation / use outcomes. However, it appears there is no plan to conduct such studies. As quoted above, the Flows and Fish Passage Agreement asserts, based on a single erosion modeling study, that “Increasing the upper reservoir storage will have no adverse environmental effects” (Proposed Article B100). Based on this conclusion, there appear to be no requirements for monitoring the effects of increased use of the pumped storage station on fish passage; on endangered, threatened and protected species; on macroinvertebrate populations or other indicator biota; or on other environmental parameters—much less a plan for adaptive management in case negative impacts should be found. Yet the few studies performed, including the fish spawning study, already show negative impacts at present. This lack of a data, monitoring, and adaptive management plan in the impoundment is manifestly inadequate.

Similar publicly available hourly data on Northfield pumping and generation will be crucial to assess impacts of Northfield Mountain operations. Yet this does not appear to be contemplated. Additionally, data from Vernon flows, if made public, would be similarly useful. Concerning the Vernon data, it appears that this will mainly be used internally by FirstLight in order to calculate NRF and provide for dampened flex or peaking releases from Vernon. It is not clear whether this Vernon flow data will be made public. Its usefulness for monitoring and adaptive management will be much less if not.

We note that FRCOG provided a particularly helpful list of some of the needs for further data and incorporate by reference the details they provided. More generally

- *The Special Conditions providing for data, monitoring, a website, and quarterly reports must make these publicly available, with searchable historical information that can inform studies of trends and comparison.*

3. Endangered Short-Nose Sturgeon must be included in all fish-related studies and, as appropriate, effectiveness testing related to fish passage

The Draft WQC has extensive discussion of sturgeon and calls for consideration of sturgeon in a number of places. However, almost none of these are included in the WQC’s Special Conditions, which makes the calls for consideration unenforceable. We provided brief comments to FERC on the needs for a full Section 7 consultation since the emergence of new eDNA data showing the presence of sturgeon in the TFI and even above Vernon Dam (Attachment D). The primary points we made in that letter apply also to the need to consider this highly sensitive use under the WQC:

1. There needs to be public input, especially of the states and the tribes—and that includes both downriver and upriver states and tribes, whose sturgeon populations will be impacted for decades by the operations of FirstLight’s projects and the Conditions Mass DEP sets.
2. Analysis across relevant geography and time.
3. Needs for data, monitoring, assessment, and potential adaptive management during the license term.

We ask you to read Attachment D to understand our full conception and rationale.

4. MassDEP must require public participation opportunities and facilitation and technical support for consultations with federal and state recognized tribes

MassDEP is an agency within the Executive Office of Energy and Environmental Affairs. As such it is required to follow the EEA Environmental Justice Strategy, which calls for consultation with federal and state recognized tribes, and for state agencies to actively support participation. This needs to be written into the Conditions of the WQC.

Changes needed in the WQC Conditions based on the above:

Special Condition 10 (and 11).

Maximum and minimum levels: The range should be 179 to 184. See specific suggestions in comments from FRCOG. Exceptions are excessive and should be limited to times specifically listed in the Condition, or when the grid has scarcity or near-scarcity events. Exceptional impacts at these times must be monitored and mitigated.

Velocity fluctuations must be monitored below the Northfield intake and also at the USGS Northfield gage, and their impacts assessed. Until impacts can be demonstrated to have minimal impact, Northfield Mtn shall not be operated so as

- Not to cause negative velocity in either location during upstream or downstream fish migration seasons.
- Additional restrictions should be added for rate and duration of pumping and releases
- This restriction may be excepted at times specifically listed in the Condition, and during grid scarcity or near-scarcity events. Exceptional impacts at these times must be monitored and mitigated.

These tighter restrictions must be maintained until demonstrated through careful and robust analysis that there is no significant impact on sensitive aquatic life, erosion, and other factors (see 1B, above).

Special Condition 12.

The flow notification website and quarterly reports must be explicitly required to be available to the public, and to provide historical data and searching capabilities. Delays of historic data release could be allowed to protect proprietary information on operations.

Special Condition 13.

Use of extra storage in the upper reservoir should be permitted only during grid scarcity and near-scarcity events or in anticipation of ISO-identified extended weather stress such as extended cold winter weather.

See F&FP discussion of upper reservoir storage.

Special Conditions 14-17.

Sturgeon need to be added explicitly to these conditions.

Fish passage in and through the TFI must be addressed. We suggest FirstLight be required to propose fish passage improvements or mitigation as part of their hydropeaking impact study, and implement them by year 7, and undertake adaptive management as needed at year 12.

Special Condition 26.

The water quality plan must also include biological indicators including:

- fish spawning, rearing, and migratory success in and through the TFI
- endangered, threatened and protected species;
- macroinvertebrate populations or other indicator biota

This water quality plan must also be linked to the data and monitoring of the impoundment (Special Condition 12) to provide for robust study of the impacts of hydropeaking (see 1B p. 8.)

Special Condition 27.

The invasive species management plan must study and mitigate for the impact of hydropeaking. Additionally, this should be linked to the data and monitoring of the impoundment (Special Condition 12) to provide for robust study of the impacts of hydropeaking (see 1B p. 8.)

Special Condition 28.

The riparian management plan must study and mitigate for the impact of hydropeaking. Additionally, this should be linked to the data and monitoring of the impoundment (Special Condition 12) to provide for robust study of the impacts of hydropeaking (see 1B p. 8.)

Special Condition 29.

The sediment management plan should be linked to the data and monitoring of the impoundment (Special Condition 12) to provide for robust study of the impacts of hydropeaking (see 1B p. 8.)

Additionally, this plan should consider natural fluvial-geomorphic processes and their impairment and the impact on habitat maintenance and dynamic creation.

Finally, see FRCOG's comments on this and other studies on the crucial need for modern scientific methods and data. These are essential. Among other things it is also essential that the USGS gage at the Route 10 bridge is funded for the duration of the license.

Special Condition 31.

Climate change's impacts on fish will go well beyond potential changes in the seasonality of migration. This should be a robust study that includes such considerations as low flows and elevated temperatures, as well as wider biotic community changes.

Special Condition 35.

MassDEP must require the licensee to contribute to a decommissioning fund so that Northfield Mtn does not become in the future more nimble grid an expensive stranded asset whose impacts and decommissioning fall fully onto the Commonwealth's taxpayers.

Special Condition 36.

MassDEP must require the licensee provide periodic outreach materials and notifications to federally and state recognized tribes, as well as to the states of Vermont, New Hampshire, and Connecticut; and contribute to a fund to facilitate and provide support for consultation with tribes.