

**Before the Federal Energy Regulatory Commission**

**Amended Final Application for New License for Major  
Water Power Project – Existing Dam**

Turners Falls Hydroelectric Project (FERC Project Number 1889)  
Northfield Mountain Project (FERC Number 2485)



**EXECUTIVE SUMMARY**

**DECEMBER 2020**

## EXECUTIVE SUMMARY

### 1. Introduction

FirstLight Power (FirstLight) is a leading clean power producer and energy storage company in New England with a portfolio that includes 1.4 gigawatts (GW) of pumped-hydro storage, battery storage, hydroelectric generation, and solar generation. FirstLight submits this Executive Summary in support of its Amended Final License Application (AFLA) to the Federal Energy Regulatory Commission (FERC) for the Turners Falls Hydroelectric Project (Turners Falls Project, FERC No. 1889), and the Northfield Mountain Pumped Storage Project (Northfield Mountain Project FERC No. 2485).

The 67.709 megawatt (MW) Turners Falls Project ([Figure ES-1](#)) and 1,166.80 MW Northfield Mountain Project ([Figure ES-2](#)) are located on the Connecticut River in the Commonwealth of Massachusetts (MA) and the states of New Hampshire and Vermont. The Turners Falls Project is composed of the 62.016 MW Cabot Station and the 5.693 MW Station No. 1.

Cabot Station is the fourth largest conventional hydroelectric station in New England and the largest in MA. Cabot Station is operated to meet peak demand, as well as to provide voltage control, and reserve capacity while producing an average of 332,351<sup>1</sup> megawatt hours (MWh) per year of renewable carbon-free energy. To put this quantity in context, this is enough renewable energy to completely power approximately 37,000<sup>2</sup> Massachusetts homes each year. Station No. 1 is operated primarily when flows in the Connecticut River are either below the hydraulic capacity of a single Cabot Station unit or above the maximum hydraulic capacity of Cabot Station. The hydraulic capacity of Cabot Station and Station No.1 are approximately 13,728 cfs and 2,210 cfs, respectively (total of 15,938 cfs).

The Northfield Mountain Project is the region's largest energy storage project. Built initially to store excess nuclear energy during nighttime hours, Northfield is now the perfect complement to the continuing transformation of New England's electric supply towards intermittent renewables such as solar and offshore wind to meet regional carbon and greenhouse gas emission targets. Northfield's ability to store 8,729 MWh<sup>3</sup> of energy, its large MW capacity, and its ability to ramp up electric production rapidly make it the most valuable tool the Independent System Operator-New England (ISO-NE) has to continuously maintain New England's load and supply balance both now and into the future with the continued penetration of renewable energy. For example, on the recent summer peak day of July 27, 2020, Northfield generated approximately 5,500 MWh of energy, displacing substantial additional generation by fossil fuel-fired peaking units that would have been needed, if not for Northfield. And looking forward, Northfield is an emissions-free source of energy storage that supports MA's goal of decarbonizing the energy grid to meet its climate target of net zero emissions by 2050.<sup>4</sup> The energy grid cannot be fully "green", and maintain reliability, without on demand large-scale zero-emissions energy storage like the Northfield Mountain Project.

The Turners Falls and Northfield Mountain Projects are also important contributors to the local economy. In 2019, FirstLight paid over \$15,049,000 in local property taxes. The towns of Erving, Montague, Gill and Northfield each receive significant tax revenue from FirstLight. Relative to the total town property

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<sup>1</sup> Average generation for the period 2011-2019.

<sup>2</sup> Assumes 750 kWh per month consumption per home.

<sup>3</sup> Note that FirstLight is proposing to expand the operating limits of the Upper Reservoir from the licensed 1000.5 to 938 feet to 1004.5 to 920 feet. With these expanded operating limits there would be 10,779 MWh of stored energy.

<sup>4</sup> On April 22, 2020 the Commonwealth of Massachusetts set a goal of reducing carbon emissions by 100% below 1990 levels by 2050 pursuant to authority under the Global Warming Solutions Act of 2008.

taxes in 2019, FirstLight paid approximately 85%, 23%, 11% and 19% of the Erving, Montague, Gill and Northfield total tax base<sup>5</sup>, respectively. In addition, FirstLight is one of the top employers in Franklin County, contributing to the overall health of the economy and local rates of employment in Western MA.

The submission of this AFLA is an important milestone in relicensing these two facilities. The AFLA proposes important environmental and recreational improvements to the Projects while also allowing the Projects to continue to serve their essential roles in powering the regional electricity grid, accelerating carbon and air pollution reductions, and supporting their host communities.

This AFLA culminates an 11-year process in which FirstLight has conducted an extensive public scoping process and completed over 40 scientific studies and numerous supplemental information filings, which included state of science hydraulic, erosion causation, and fish passage analyses. The completion of these extensive scientific studies advances the state of knowledge of the environmental, recreational, and cultural resources at the Projects' sites and in the Connecticut River watershed. These studies will benefit this license application review by federal and state resource protection agencies and other stakeholders, and they serve as the foundation for this comprehensive licensing proposal.

## **2. FirstLight's Proposal**

FirstLight's proposal includes significant new Protection, Mitigation and Enhancement (PM&E) measures relative to operations (flows and water elevations), fish passage, and recreation that will deliver extensive new environmental benefits to the Connecticut River ecosystem. FirstLight's operational proposal is summarized in [Table ES-1](#). [Table ES-1](#) includes the specific PM&E measures proposed as well as a description of the benefits of the proposal and the estimated costs over the proposed 50-year license term. All costs discussed herein are based on nominal dollars<sup>6</sup> over a 50-year new license term. The operational proposal includes maintaining considerably higher seasonal flows in the Connecticut River between the Turners Falls Dam and the Cabot Station tailrace (the Turners Falls Project bypass) and for Cabot Station, the proposal includes higher seasonal minimum flows, maximum seasonal flow restrictions and seasonal up- and down-ramping restrictions. Details of the operational proposal are included in [Table ES-2a](#) (proposed operations in license Years 1-3) and [Table ES-2b](#) (proposed operations starting in Year 4-50). In addition, FirstLight's proposal includes several PM&E measures for upstream and downstream fish passage and recreation as outlined in [Table ES-1](#).

Together, FirstLight's proposed PM&E package represents a comprehensive suite of environmental and recreation enhancements totaling over \$238,339,000<sup>7</sup> in new capital investment, periodic costs and operations and maintenance (O&M) costs and energy revenue losses over a 50-year new license term. Of these costs, \$193,158,000 and \$45,182,000 will be spent at the Turners Falls Project and Northfield Mountain Project, respectively. In addition, the provision of increased flows to the Turners Falls Project bypass and the other operational changes described in [Table ES-2a](#) and [Table ES-2b](#) will result in an average annual energy loss of 33,512<sup>8</sup> MWh/year which is equivalent to 11.3% of the energy currently produced by the Turners Falls Project.

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<sup>5</sup> The bulk of the Northfield Mountain Project taxes are paid to the towns of Northfield and Erving (~\$10,515,000 total) and the bulk of the Turners Falls Project taxes are paid to the towns of Montague and Gill (~\$4,507,000 total).

<sup>6</sup> Note that the nominal dollars shown in this Executive Summary differ from those shown in the Turners Falls and Northfield Mountain Project Exhibit Ds. As required by the FERC, the cost information in the Exhibit Ds are based on 2019 dollars and have not been adjusted for inflation over a 50-year license term.

<sup>7</sup> Note that the total nominal costs does not include the cost associated with dredging the Upper Reservoir intake channel to reduce sediment discharges to the Connecticut River. The nominal cost of the dredge over a 50-year license term is \$102,631,000.

<sup>8</sup> This is enough energy to fully power 3,700 homes for a year.

FirstLight also proposes to increase the allowed usable storage of the Northfield Mountain Project's Upper Reservoir from the current 1000.5 to 938 feet to 1004.5 to 920 feet which will provide regional reliability benefits by incrementally expanding Northfield's ability to store large quantities of energy and enhancing its ability to deliver long-duration and flexible capacity when it is most needed. Northfield Mountain is ISO-NE's best tool in continually maintaining the load and generation balance throughout New England. When large generation sources, including the region's nuclear generators and transmission lines with neighboring systems, shut down unexpectedly, Northfield Mountain is able to fill the generation void without the need to start an equivalent amount of oil and natural gas fueled generators, supporting system reliability while reducing the carbon footprint of the region. In recognition of these reliability benefits, FERC has approved temporary amendments in the past to operate between 1004.5 and 920 feet when needed to support system needs.<sup>9</sup>

While on many days, the additional storage capability would likely not change the extent of pumped storage generation which is limited by system energy economics, on some other days, the system relies very heavily on pumped storage capability. As an example, on May 29, 2020, following forced outages at a nuclear facility and the Phase II HVDC line from Quebec, Northfield quickly replaced the lost generation and supplied that load support through the day's peak hours depleting much of its stored energy. Had the requested additional storage flexibility existed on that day, Northfield could have provided further support without recharge and thus reduced the extent to which ISO-NE had to commit additional fossil-fired resources to maintain reliability in the late evening hours of May 29 and early morning hours of May 30.<sup>10</sup> As shown by this recent example, the additional storage that is being requested will further enhance this capability and provide a reliability and environmental benefit for New England without altering the Project's impact on the local environment.

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<sup>9</sup> FERC has previously approved temporary license amendments in 2001, 2005, 2006, 2014, 2015, 2017, in each instance to address "projected shortages in energy" (2001 and 2005), "projected energy shortages" (2006), "address reliability challenges" (2014), "address winter reliability" (2015), and "in anticipation of potential reliability challenges" (2017).

<sup>10</sup> ISO-NE August 24, 2020 presentation entitled "ISO New England Information Session: Recent Operational Contingencies and Pricing" at slide 28.

**Table ES-1. FirstLight’s Proposed Protection, Mitigation & Enhancement Measures**

PM&E Measure	<sup>1</sup> Total Cost	Benefits
<b>Operational Proposal</b>		
Seasonally varying Turners Falls Project bypass flows	The proposed operational regime described herein results in a net loss of 33,512 MWh/yr of power from the Turners Falls Project compared to baseline conditions. This equates to a revenue loss of approximately \$107,168,000 over a 50-year license term.	<ul style="list-style-type: none"> <li>• Spawning habitat for the federally endangered Shortnose Sturgeon (SNS) will increase by 3-fold between the Turners Fall Dam and Rawson Island and by 2.6-fold between Rawson Island and the Montague Bridge compared to existing conditions.</li> <li>• Spawning habitat for American Shad will increase by more than 3-fold in the reach between Turners Falls Dam and Rawson Island and by 2-fold between Rawson Island and Cabot Station compared to existing conditions.</li> <li>• SNS rearing habitat (egg/larvae) is also substantially increased compared to existing conditions.</li> <li>• Establishing increased bypass flows allows migratory fish to follow the natural route of the Connecticut River to the Spillway Lift.</li> </ul>
Seasonally varying minimum flows below Cabot Station		<ul style="list-style-type: none"> <li>• Baseloading a Cabot Station unit provides a substantial increase in American Shad spawning habitat of 76.5 – 81.5% compared to existing conditions.</li> <li>• Baseloading a Cabot Station unit would also maintain 30% more habitat for SNS larvae, a critical life stage that drifts below Cabot Station from spawning locations near and above Cabot Station.</li> </ul>
Seasonally varying maximum flow release restrictions at Cabot Station		<ul style="list-style-type: none"> <li>• Proposed Cabot Station maximum flow restrictions will reduce potential impact on the federally endangered Puritan Tiger Beetle (PTB) located downstream at Rainbow Beach.</li> </ul>
Seasonally varying up- and down-ramping restrictions at Cabot Station		<ul style="list-style-type: none"> <li>• Proposed Cabot Station up- and down-ramping restrictions will protect SNS in spawning areas close to Cabot Station.</li> <li>• Proposed Cabot Station up-ramping restrictions are designed to protect state-endangered dragonflies during the eclosure process.</li> </ul>
Seasonal Turners Falls Impoundment (TFI) rate of rise restrictions		<ul style="list-style-type: none"> <li>• The rate of rise in the TFI, as measured at the Turners Falls Dam, are designed to protect dragonflies during the eclosure process.</li> </ul>
Whitewater Releases at Turners Falls Dam		<ul style="list-style-type: none"> <li>• Supplements natural spillage events and provides a predictable schedule, assuming flows are provided from upstream sources, for boating use of the Turners Falls Project bypass.</li> </ul>
<b>Fish Passage</b>		
Spillway Lift	\$46,203,000	<ul style="list-style-type: none"> <li>• This proposal allows Shad to follow the natural route of the Connecticut River where they can utilize additional spawning habitat and follow their natural route of passage to Great Falls. Further, this proposal avoids the inefficiencies of the Cabot Station and gatehouse ladders and addresses the migratory delay in the power canal.</li> </ul>
Ultrasound Array in Cabot Station Tailrace	\$11,620,000	<ul style="list-style-type: none"> <li>• The ultrasound array will divert American Shad away from the Cabot tailrace to continue migration up the bypass reach.</li> </ul>

<b>PM&amp;E Measure</b>	<b><sup>1</sup>Total Cost</b>	<b>Benefits</b>
Eelway near Spillway	\$1,681,000	<ul style="list-style-type: none"> <li>The eelway will provide formalized upstream passage where none existed previously. Temporary eel ramp studies showed that the vast majority of eels use the Turners Falls Dam spillway area for upstream passage.</li> </ul>
Barrier net in the Northfield Tailrace/Intake	\$42,453,000	<ul style="list-style-type: none"> <li>Installation of the barrier net eliminates entrainment and mortality of downstream migrating juvenile American Shad and adult American Eel.</li> </ul>
Plunge Pool below Bascule Gate No. 1	\$12,467,000	<ul style="list-style-type: none"> <li>The plunge pool provides for a safe passage route for juvenile and adult American Shad and adult American eel at the Turners Falls Dam during their downstream migration.</li> </ul>
Station No. 1 Rack Structure	\$6,124,000	<ul style="list-style-type: none"> <li>The rack structure precludes juvenile and adult American Shad and adult American Eel from being entrained at Station No. 1.</li> </ul>
<b>Recreation Measures</b>		
Formal Access Trail and Put-In just below Turners Falls Dam	\$1,304,000	<ul style="list-style-type: none"> <li>Provides a put-in just below the Turners Falls Dam for kayakers, canoeists and other boaters wishing to run the bypass reach.</li> </ul>
Formal Access Trail and Stairs for Take-out at Poplar Street	\$1,573,000	<ul style="list-style-type: none"> <li>Provides an upgraded take-out and/or put-in for kayakers, canoeists and other boaters.</li> </ul>
Relocation of the Boat Tour Dock at Riverview	\$1,191,000	<ul style="list-style-type: none"> <li>The relocation is necessary as the proposed barrier net encloses the existing boat dock.</li> </ul>
Create a New Access Trail with Stairs for a Put-In at Riverview	\$873,000	<ul style="list-style-type: none"> <li>Provides another access location for those wishing to launch car-top boats.</li> </ul>
Formal Access Trail and Put-In at Cabot Camp	\$665,000	<ul style="list-style-type: none"> <li>Provides a formal access location for anglers.</li> </ul>
<b>Project Modifications needed to implement FirstLight's Operational Proposal</b>		
Upgrades to Station No. 1 to pass a portion of the proposed bypass flow	\$3,526,000	<ul style="list-style-type: none"> <li>Allows for variable operation of Station No. 1 so that FirstLight can better follow inflow conditions and adhere to the split in Turners Falls Project bypass flows between spillage and Station No. 1 generation (details of the "flow split" are included in <a href="#">Table ES-2a</a>).</li> </ul>
Heating of Bascule Gate No. 1 to pass proposed winter bypass flows	\$1,492,000	<ul style="list-style-type: none"> <li>Allows for Bascule Gate operation to provide winter minimum flows to the Turners Falls Project bypass.</li> </ul>
<b>Total over 50 year license term, including energy revenue loss and all PM&amp;E measures</b>	<b>\$238,339,000<sup>11</sup></b>	
<sup>1</sup> Total cost includes energy revenue loss, capital cost, periodic costs, and operation and maintenance costs over a 50-year duration.		

<sup>11</sup> The total nominal cost over a 50-year license term, including the sediment dredge of the Upper Reservoir, is \$340,970,000.

### **3. General Environmental Setting**

The Turners Falls and Northfield Mountain Projects are located on the Connecticut River at river mile 122 and 127, respectively. They are located between Great River Hydro's (GRH) Vernon Project upstream and Holyoke Gas and Electric's (HG&E) Holyoke Project downstream.

The Vernon Project is one of three GRH projects also undergoing relicensing in parallel to the Turners Falls and Northfield Mountain Projects. The other two projects are the Bellows Falls and Wilder Projects which are located immediately upstream of the Vernon Project. All three GRH facilities are used to meet peak demand and, thus, control the inflows to the Turners Falls and Northfield Mountain Projects. Upstream of the Wilder Project is the Fifteen Mile Falls Project including the Moore, Comerford and McIndoes Developments which are also owned by GRH and were licensed in April 2002. These developments have significant storage capacity, are peaking facilities, and through their operations influence flows to the Wilder Project and eventually to the Turners Falls and Northfield Mountain Projects. As discussed below, both the provision of appropriate flows from the Vernon Project and adequate advance reporting of flow management by GRH will be key to the success of FirstLight's proposed PM&E operational measures.

### **4. Proposed Protection, Mitigation, and Enhancement Measures**

FirstLight's proposed PM&E measures address the following resources: a.) fish passage, b.) fish and wildlife habitat, c.) recreation, and d.) cultural/historic. FirstLight's operating proposal is included as [Table ES-2a](#) and [Table ES-2b](#).

#### **Fish Passage and Restoration**

FirstLight supports the state and federal fisheries agencies in their efforts to restore populations of American Shad and American Eel to the Connecticut River Basin. For American Shad this has been an ongoing effort for 40+ years while efforts for American Eel are more recent (20+ years). Accordingly, FirstLight is proposing extensive improvements in both upstream and downstream fish passage to aid in these efforts.

The Turners Falls Project is near the natural upstream extent of the migration route of American Shad seeking spawning locations in the Connecticut River and its tributaries. The Great Falls, upon which the Turners Falls Dam sits, was historically a formidable barrier to upstream migration for shad that swam upstream 122 miles from the mouth of the Connecticut River without feeding. Within the context of this historic use, FirstLight's fish passage proposal for American Shad has focused on a.) safe, timely, and effective upstream passage of adult shad at Turners Falls Dam, b.) safe, timely, and effective downstream passage of adult and juvenile shad at the Turners Falls Project, and c.) habitat restoration in the bypass reach and the Connecticut River downstream of Cabot Station. In addition, FirstLight has also focused on the safe passage of shad and adult American Eel at the Northfield Mountain Project tailrace/intake.

The existing Turners Falls Project has upstream fish passage ladders located at a.) Cabot Station which moves shad from the Cabot Station tailrace into the power canal, b.) the gatehouse which moves shad from the power canal to the TFI, and c.) the Spillway which moves shad from the base of the Turners Falls Dam to the TFI via part of the gatehouse ladder. When these ladders were built, the primary target species was Atlantic Salmon. After a 45-year attempt to restore extirpated Atlantic Salmon to the Connecticut River, the number of returns remained low and the program was discontinued in 2012. The existing ladders are now used exclusively for shad but despite years of effort by the agencies, FirstLight, and predecessor companies, the ladders, which were designed to pass Atlantic Salmon, do not work as well in passing American Shad. This is because of the differences in swimming abilities between salmon (strong swimmers) and shad (weaker swimmers). In addition, fish passing through the Cabot ladder to the power

canal can experience excessive delay or may be unable to traverse the 2.1-mile-long power canal which has a variety of hydraulic challenges for a migrating fish.

Given the challenges with the existing upstream passage system for shad, FirstLight is proposing an alternative approach. Specifically, FirstLight is proposing to move all upstream fish passage to the Turners Falls Dam with the construction of a state-of-the-art Spillway Lift. With much higher proposed bypass flows, this alternative follows the natural route through the bypass, avoids the inefficiencies of the Cabot Station ladder and addresses the risk of excessive delay or failure in the power canal. The proposed fish passage configuration will have its own challenges including moving fish past false attraction at the Cabot Station tailrace. FirstLight proposes mitigating for false attraction at Cabot Station by installing an ultrasound array system designed to repulse shad from the tailrace and direct them up the bypass to the Spillway Lift. Initial testing of this system revealed that the ultrasound array encouraged timely passage of shad beyond Cabot Station and into the bypass reach. FirstLight proposes to close the Cabot ladder to prevent shad from entering the power canal once the ultrasound array and Spillway Lift are operational.

In addition to the improved upstream passage of American Shad, FirstLight is proposing to install an upstream passage facility for American Eel. FirstLight conducted eel ramp siting studies as part of its licensing study efforts and based on these studies is proposing that a new eel ramp be constructed in the vicinity of the new Spillway Lift.

Having passed upstream of the Turners Falls and Northfield Mountain Projects, post-spawned shad and their progeny (juveniles) as well as adult silver phase eels will also have to pass downstream to complete their life cycle. FirstLight is proposing to install a barrier net across the Northfield Mountain Project intake/tailrace from August 1 to November 15 of each year to preclude entrainment of adult migrating American Eels and juvenile shad.<sup>12</sup>

Downstream shad and eel migrants encountering the Turners Falls Project have two passage routes under FirstLight's proposal. These routes include spilling via Bascule Gate No. 1 located immediately adjacent to the Turners Falls gatehouse where flows on the order of 1,000 to 1,510 cfs will be passed or via the power canal. The 1,000 to 1,510 cfs spillage is equivalent to 6.3-9.5% of the combined hydraulic capacity of Station No. 1 and Cabot Station and above the 5% attraction flow recommended for downstream passage attraction flow by the United States Fish and Wildlife Service (USFWS). Migrants passing over the crest of Bascule Gate No. 1 will land in a newly constructed plunge pool that is deep enough to provide a safe landing zone for downstream migrating fish.

Although spillage from the Bascule Gate No. 1 should reduce the number of fish migrating down the power canal, any fish that do will be precluded from entering Station No. 1 by the installation of a new barrier rack with ¾-inch clear opening placed across the entrance to the branch canal. This rack will reduce fish mortality at Station No. 1 caused by the high revolutions per minute (rpm) of these smaller units.

Finally, fish migrating down the power canal to Cabot Station are already protected by an existing 31-foot high rack structure. The top 11 feet of the upper racks have clear bar spacing of 0.94 inches (15/16-inch), and the bottom 7 feet of the upper racks have clear bar spacing of 5 inches. The entire 13 feet of the lower racks have clear bar spacing of 5 inches. Cabot Station is already outfitted with a downstream fish passage facility with a state of the science uniform flow acceleration weir and an attraction flow varying between 110 and 253 cfs depending on the power canal elevation.

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<sup>12</sup> Based on the studies, entrainment of adult shad did not occur at the Northfield Mountain Project intake during upstream or downstream migratory efforts.



The downstream passage facilities at Cabot Station have been the subject of considerable discussion between FirstLight and the fishery agencies during relicensing. This discussion has focused on turbine mortality for juvenile and adult American Shad as well as silver phase adult eels. Studies have shown good survival for juvenile shad and silver phase adult eels (95% 1-hour survival for juvenile shad/no 48-hour survival available; and 96% 48-hour survival for adult silver phase eel passing through the turbines). Immediate survival of post-spawned adult shad either passing through Cabot Station or the bypass sluices was high (100%). Survival for adult shad was 89.2% (48-hour) for fish passing the log sluice/uniform acceleration weir and 65% (48 hour) survival for adult shad passing through the turbines. Any downstream fish passage structure at Cabot Station would have its own challenges relative to inducing fish movement and assuring survival. Given the high survival rates, FirstLight's proposed plunge pool below Bascule Gate No. 1 and the significant cost of a new rack, bypass system and receiving pool (estimated at approximately \$10,000,000<sup>13</sup>), FirstLight is not proposing any additional measures for downstream passage at Cabot Station.

### **Fish and Wildlife Habitat**

Habitat issues associated with the Projects include aquatic habitat in the bypass reach of the Connecticut River between Turners Falls Dam and Cabot Station, aquatic and terrestrial habitat in the Connecticut River downstream of Cabot Station and aquatic habitat in the TFI.

FirstLight is proposing substantial increases in minimum streamflows for fish habitat and fish passage in the Connecticut River. As illustrated in [Table ES-3](#) and [Table ES-4](#), FirstLight's minimum flow proposal for the 2.5-mile long bypass and the reach downstream of Cabot Station will increase potential American Shad spawning habitat from 8.5 million square feet to 16 million square feet. Based on information provided in the Connecticut River Atlantic Salmon Commission (CRASC) American Shad Management Plan, this increase in habitat could result in increased production of shad, with more than 14,000 additional shad returning to the basin as adults.

#### *Bypass Reach*

FirstLight is proposing to greatly enhance fish habitat in the bypass reach for various species and life stages of fish and provide significantly higher bypass flows in the spring to provide a route of passage for migratory fish to the proposed Spillway Lift. FirstLight is proposing spring flows of 6,500 cfs (April 1 – May 31), 4,500 cfs (June 1 – June 15), and 3,500 cfs (June 16-June 30) in this reach which will substantially increase American Shad and SNS spawning habitat compared to the current license minimum flow requirements. Spawning is a critical life stage for these species and increasing spawning habitat is expected to result in population increases. [Table ES-3](#) compares the habitat during the spring under existing (baseline) conditions and FirstLight's proposal for the reach upstream of Rawson Island. [Table ES-4](#) shows similar information for the reach between Rawson Island and the Montague Bridge below Cabot Station. As these tables show, spawning habitat for SNS increases more than 3-fold between Turners Falls Dam and Rawson Island and more than 2.6-fold between Rawson Island and the Montague Bridge when comparing proposed minimum flows to existing minimum flows. Rearing habitat (egg/larvae) for SNS is also substantially improved by the proposed minimum flows. PM&E measures for SNS also include up- and down-ramping of no more than 2,300 cfs/hr (approximately one of the six Cabot generating units) from April 1 – May 31, 24 hours/day, so as not to potentially affect SNS at spawning areas close to Cabot Station. Also, spawning habitat for American Shad, a key management species, increases by more than 3-fold in the reach between Turners Falls Dam and Rawson Island and 2-fold between Rawson Island and Cabot Station.

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<sup>13</sup> This estimate reflects a one-time capital cost and does not include periodic or annual O&M.

### *Downstream of Cabot Station*

Downstream of Cabot Station, habitat availability is a function of continuous minimum flows, seasonal up- and down-ramping rates, and the timing of Cabot Station maximum generation as well as discharges from the Deerfield River. Also, in the reach below Cabot Station are both aquatic and terrestrial state and federally listed species that can be influenced by Cabot Station discharges and HG&E's Holyoke Dam impoundment level management.

In the nine-mile reach from Cabot Station to the Route 116 Bridge in Sunderland, the proposed springtime bypass minimum flows of 6,500 cfs (April 1 – May 31), 4,500 cfs (June 1 – June 15), and 3,500 cfs (June 16-June 30) combined with an additional 2,300 cfs (June 1-30) by baseloading one Cabot Station unit provide a substantial increase in American Shad spawning habitat as illustrated in [Table ES-5](#) (76.5 – 81.5% increase) compared to current minimum flow requirements. Proposed minimum flows would also maintain 30% more habitat for SNS larvae, which is a critical life stage that drifts into this area of the river from spawning locations near and above Cabot Station. This represents approximately 98% of the total potential SNS larval habitat within this river reach.

A key issue raised during relicensing was the effect of rising water levels below Cabot Station on dragonflies. Dragonflies live most of their lives in the water. Female adult dragonflies deposit fertilized eggs in the water during the spring and summer months. At maturity, nymphs emerge from the water, climbing onto exposed rocks, woody debris, or emergent vegetation to then emerge from their larval casings, dry their wings, and take flight. Until they take flight, this is a vulnerable time for dragonflies, and rising water levels could inundate them during this process. State-listed dragonflies have been found in the reach below Cabot Station, including the state-endangered Riverine Clubtail, the state-threatened Skillet Clubtail, and the Spine-Crowned Clubtail (listed as Special Concern). FirstLight is proposing to implement an up-ramping rate of 2,300 cfs/hour at Cabot Station from June 1 – August 15 between 8:00 am and 2:00 pm to limit the effects on dragonflies as they are emerging from the water. This is expected to protect a high percentage of state-listed dragonflies in downstream areas, along with species that are not state listed.

Finally, there is a population of the state and federally listed Puritan Tiger Beetle (PTB) located at Rainbow Beach which is approximately 25 miles downstream of Cabot Station and 8.8 miles upstream of the Holyoke Dam. PTB use of Rainbow Beach habitat is influenced by Holyoke Dam water level operations and recreation use. Rainbow Beach is co-owned by the Commonwealth of Massachusetts and the City of Northampton, MA. In the summer, when PTB activity is the greatest, boats are often beached at Rainbow Beach and the area is heavily used for various recreation activities (see inset photo). In addition to these factors, the operation of the Cabot Station to meet peak demand in concert with fluctuating Holyoke Impoundment levels could also impact adult PTBs foraging behavior occurring at the land/water interface. [Figure ES-3](#) illustrates water surface elevation (WSEL) patterns (15-min water level data) at the Montague United States Geological Survey Gage (immediately downstream of Cabot Station), Route 116 Bridge (nine miles



downstream of Cabot Station) and Rainbow Beach from July 8 – 22, 2012. As can be seen, the peak WSEL differential between Montague and Rainbow Beach is decreased as the water moves downstream such that it is minor at Rainbow Beach. However, since adult PTB use the land/water interface during the day, FirstLight is proposing measures to further ensure Cabot Station operation does not significantly contribute to WSEL fluctuations during those hours at Rainbow Beach and during the season that adults would occupy

the site. Taking these factors into account and the lag and attenuation of Cabot Station discharges to Rainbow Beach, FirstLight is proposing to restrict Cabot Station discharges to no more than 4,600 cfs of additional flow (approximately 2 Cabot units) from July 1 to August 31 from 1:00 am – 2:00 pm. These restrictions will reduce the impact of Cabot Station discharges on PTB.

FirstLight's proposed operating regime described above is complex and is summarized in [Table ES-2a](#) and [Table ES-2b](#). All minimum bypass flows, Cabot Station baseloading in June, and whitewater flows (described later) are on an or-inflow, whichever is less, basis. Inflow is defined as the Naturally Routed Flow (NRF) which includes the Vernon Project discharge plus flows on the Ashuelot and Millers Rivers<sup>14</sup> both of which empty into the TFI. Establishing minimum flows on an or-inflow basis is standard practice for similar projects licensed by FERC. The key to success of this flow regime is for FERC and other agencies with regulatory authority to ensure that FirstLight has adequate inflows from the Vernon Project to meet the intent of FirstLight's proposed flow-related PM&E measures in [Table ES-2a](#) and [Table ES-2b](#). FERC has indicated it will develop a single, comprehensive environmental review of both the FirstLight and GRH projects (Vernon, Bellows Falls, and Wilder Projects), and has directed GRH to file its applications with FERC at the same time the applications are filed by FirstLight. Thus, FERC has a significant opportunity to align the minimum flow regimes.

Similarly, FirstLight's ability to meet its proposed Cabot Station ramping rates and Cabot Station maximum flow restriction depends on accurate and timely updates of the real-time and projected operation of the Vernon Project so that FirstLight can schedule appropriate operation of its facilities to meet demand and its proposed PM&E operational measures. FirstLight believes it is essential for FERC to require GRH in any new license issued for the Vernon Project to provide the following information to FirstLight River Operations Personnel<sup>15</sup> on a daily basis:

1. Day ahead hourly projections of total Vernon Project outflow (generation flows and spillage) provided by 8:00 am each day to FirstLight River Operations Personnel;
2. Day ahead hourly total Vernon Project outflow projections will be updated once the day ahead power bidding market closes and ISO-NE issues the day ahead schedule;
3. If ISO-NE updates the day ahead hourly total Vernon Project outflow schedule, then that schedule will be provided to FirstLight within two (2) hours of GRH receiving an update from ISO-NE;
4. In same day operations, GRH will supply FirstLight with deviations in the total Vernon Project outflow schedule in real time as well as an updated hourly projection for the remainder of the day. GRH will provide this information each time its outflow deviates from the last hourly projection.

Having the information outlined above will greatly assist FirstLight in meeting its proposed Cabot Station ramping rates and Cabot Station maximum flow restrictions. However, even with this, there will be times when the ISO-NE calls upon GRH and/or FirstLight to run their facilities to meet electrical demand. These times could include fast start needs such that FirstLight's Cabot Station up- and down-ramping requirements or Cabot Station maximum discharge restrictions for PTBs could not be met. As such, FirstLight proposes certain exceptions from its proposed Cabot Station up- and down-ramping requirements and Cabot Station maximum discharge restrictions when called upon by ISO-NE or when unanticipated flows from the Vernon Project would result in unnecessary spillage or fluctuations in the TFI such that it

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<sup>14</sup> Both rivers are equipped with United States Geological Survey (USGS) gages.

<sup>15</sup> FirstLight agrees that the information provided to it shall be used solely for the purpose of operating its downstream hydroelectric licenses in accordance with the conditions established by FERC. Accordingly, it will agree to conditions that will restrict information provided pursuant to this request shall not be provided, either directly or indirectly, to any of its employees, consultants, agents or any other representative that are engaged in FirstLight's merchant activities, including but not limited to such activities as submitting bids to ISO-NE in connection with the dispatch of any of its generating units.

would significantly impact both power and/or nonpower resources. FirstLight is proposing to track and cap this use at no more than 10% of the time the limitations apply during the period April 1 to August 31.

### *Turners Falls Impoundment*

Similar to the effect of rising water levels below Cabot Station on dragonflies, the same issue was raised relative to the rate of rise in the TFI water levels. Given this concern, FirstLight's proposal includes limiting the rate of increase of the TFI water level, as measured at the Turners Falls Dam, to no more than 0.9 feet/hour from May 15 to August 15 between 8:00 am and 2:00 pm which would protect a high percentage of dragonflies known to reside in the Barton Cove area of the TFI from operational effects.

Erosion causation and the need for mitigation was an issue raised in the licensing proceeding. A causation analysis was conducted as part of the licensing process using the state of the science Bank Stability and Toe Erosion Model (BSTEM). This analysis found that the major cause of erosion in the TFI was attributed to either naturally high flows or boat waves. Project operations are not a major cause of erosion anywhere in the TFI but were found to be a contributing factor to erosion at only two sites. The first of these sites was affected by existing operations and has already been remediated under the existing license.<sup>16</sup> The second detailed study site where the cumulative effects (e.g. minimum flows, ramping, etc.) of the proposed operating regime were found to be a contributing cause of erosion has a moderate rate of erosion. Of this, the proposed operating regime contributes to 8% of the erosion processes, which is a negligible amount of erosion attributed to the proposed operations. Given this negligible effect, FirstLight is not proposing any additional erosion remediation measures.

### *FirstLight Proposed Management Plans*

In addition to the PM&E measures proposed for aquatic species, FirstLight is also proposing the following management plans for the Turners Falls Project and Northfield Mountain Project:

- Invasive Plant Species Management Plan
- Bald Eagle Management Plan

FirstLight is also proposing measures to protect the federally-endangered Northern Long-eared Bat. FirstLight proposes to avoid cutting trees greater than three inches in diameter within each Project's Boundary from April 1 to October 31, unless they pose an immediate threat to human life or property.

### *Impacts to Clean Energy Generation due to FirstLight's Operating Proposal*

FirstLight evaluated the impact on generation resulting from its proposed operating regime in [Table ES-2a](#) and [Table ES-2b](#) using its operations model. Under the proposed operational regime to protect bypass habitat, the Turners Falls Project will lose approximately 33,512 MWh/year of renewable, carbon free electric generation. This is a loss of 11.3% of the energy production of Massachusetts' largest hydroelectric facility and translates to approximately \$107,168,000 of associated revenue over a 50-year term.<sup>17</sup>

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<sup>16</sup> FirstLight remediated 10.7 miles of TFI shoreline under the existing license at a cost of \$8,735,000 regardless of causation.

<sup>17</sup> As described more fully in the Turners Falls and Northfield Mountain Project Exhibit Ds, there is considerable uncertainty in the value of future energy sales. However, the loss of greater than ten percent of the generation of zero-emissions electricity at Cabot Station represents a significant impact to Massachusetts' existing baseline of installed hydroelectric energy, which comprised 4% of Massachusetts' generation in 2019 (per the U.S. Energy Information Agency: <https://www.eia.gov/state/?sid=MA>).

FirstLight proposes to increase the allowed usable storage of the Northfield Mountain Project's Upper Reservoir from the current 1000.5 to 938 feet to 1004.5 to 920 feet.<sup>18</sup> This increased use of storage in the Upper Reservoir will allow Northfield to increase its maximum energy storage from 8,729 MWhs to 10,779 MWhs which, as described above, provides significant regional reliability benefits in the form of longer-duration energy storage.

## **Recreation**

As part of FirstLight's commitment to environmental awareness and sustainability, and to support outdoor recreational opportunities for the residents of our host communities, FirstLight maintains and operates nature trails and recreation and environmental programs at our facilities in Massachusetts and Connecticut. The Turners Falls and Northfield Mountain Projects include several existing Project Recreation Facilities as described in [Table ES-6](#). In addition to these facilities, there are several informal recreation facilities as well as formal recreation facilities owned and operated by others.

Recreation-related studies conducted by FirstLight as part of the relicensing process demonstrate that the existing Project recreation sites, combined with other public recreation sites and facilities, as well as informal access areas, provide the public with a diversity of recreation opportunities, and an abundance of options for accessing and utilizing Project lands and waters for recreation. Given this, the continued operation and maintenance of the existing Project Recreation Facilities is supportive of current recreation use and demand levels.

FirstLight proposes to implement a project-specific Recreation Management Plan (RMP) for each Project during the term of the new licenses, which will provide for the O&M of Project Recreation Sites.

In addition, and notwithstanding the fact that the existing recreation facilities were judged to be in excellent condition and more than adequate to meet forecasted demand, FirstLight is proposing several enhancements to existing Project Recreation Sites and to provide several new or modified recreation sites. These sites include:

1. At the Turners Falls Project, FirstLight proposes to install a put-in just below the Turners Falls Dam to kayak/canoe/raft the bypass reach. The proposed access would be provided via the existing "IP" bridge spanning the power canal. Once over the canal, a formal path would lead recreationists to the base of the dam.
2. At the Turners Falls Project, FirstLight proposes to create a formal access trail and stairs for a take-out at Poplar Street, which is currently a non-Project recreation site. There is an existing take-out at Poplar Street; however, it is extremely steep. FirstLight has limited options due to steep topography and land ownership at this site. FirstLight proposes to use the existing gravel parking lot leading to timber stairs with a boat slide railing leading to a concrete landing/abutment. A gangway would be anchored to the concrete abutment and lead to a floating dock in the Connecticut River to accommodate fluctuations in the river elevation. The land necessary for the site will be included within the proposed Turners Falls Project boundary.
3. At the Northfield Mountain Project, FirstLight proposes to relocate the boat tour dock at Riverview further upstream of its current location and extend the existing road further north. The relocation is necessary because the proposed barrier net would enclose the existing boat dock from August 1 to November 15.

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<sup>18</sup> FERC has approved temporary amendments in the past to operate between 1004.5 and 920 feet.

4. FirstLight proposes to create a new access trail with stairs for a put-in at Riverview located off of Pine Meadow Road, where Fourmile Brook discharges into the TFI. Pine Meadow Road would be widened to add approximately seven (7) parking spots.
5. At the Northfield Mountain Project, FirstLight proposes to create a formal path leading from the Cabot Camp parking area to an access point on the Millers River just upstream of the confluence with the Connecticut River. There is currently an informal path in this area.

In addition to FirstLight’s operating proposal in [Table ES-2a](#) and [Table ES-2b](#) FirstLight proposes to provide whitewater releases to benefit whitewater boaters at the Turners Falls Dam per the table below.

<b>Date</b>	<b>Turners Falls Dam Magnitude of Discharge</b>	<b>Turners Falls Dam Release Duration</b>
1 Saturday in July	2,500 cfs or the NRF, whichever is less	4 hours
1 Saturday in August	2,500 cfs or the NRF, whichever is less	4 hours
3 Saturdays in September	3,500 cfs or the NRF, whichever is less	4 hours
1 Saturday in October	3,500 cfs or the NRF, whichever is less	4 hours
2 Saturdays in October	5,000 cfs or the NRF, whichever is less	4 hours

FirstLight also proposes to establish a weblink that would report the forecasted Turners Falls Dam discharge each day during the daylight hours from July 1 to October 15 to benefit whitewater boaters. FirstLight is not proposing to post the Turners Falls Dam discharge from April 1 to June 30 because it is a period when the federally endangered SNS could be utilizing the bypass reach for spawning and incubation which could be disturbed by whitewater boaters. FirstLight will provide an annual schedule of releases, on its website, for the period July 1 to October 31 by May 31 of each year.

**Cultural/Historical Resources**

To date, FirstLight has completed Phase 1A, Phase 1B (on over 15 miles of shoreline), and Phase 2 (17 sites) archaeological investigations as well as a study of project structures for the National Register of Historic Places (NRHP). The results of the studies determined that six archaeological sites and 13 structures within the Project’s Area of Potential Effect (APE) are eligible for the NRHP.

To protect eligible cultural resources over the term of a new license, FirstLight developed a Draft Historic Properties Management Plan (HPMP) for each Project, which was filed with FERC and sent to the MA, New Hampshire and Vermont State Historic Preservation Offices and Tribes as non-public. The purpose of the HPMP is to set forth specific actions and processes to manage historic properties within the Project APE. It is intended to serve as a guide for FirstLight’s operating personnel when performing necessary activities and to prescribe site treatments designed to address ongoing and future effects to historic properties. The HPMP also describes a process of consultation with state and federal agencies. Measures included in the HPMP are identification surveys and site NRHP evaluations, site management measures; training of staff; routine monitoring of known cultural resources; and periodic review and revision of the HPMP. A Final HPMP for each Project is being filed with FERC as non-public with this AFLA. Although the total cost of HPMP implementation is unknown at this time FirstLight is estimating a cost of approximately \$5,000,000 over the life of the license.

**5. Conclusion**

Building upon years of extensive study and stakeholder outreach, FirstLight has crafted a robust relicensing proposal that will provide substantial benefits to habitat and species, and to the Western Massachusetts economy, while balancing the need to preserve clean energy production from the largest hydroelectric

facility in Massachusetts (Turners Falls), and the largest zero-emissions energy storage facility in New England (Northfield Mountain).

As noted above, this proposal is based on sound data and scientific reasoning to expand habitat for both state and federally listed species, as well as restrict operations to produce flow regimes that will protect species during critical time periods. Importantly, the changes offered herein create a balance that will sufficiently protect species while simultaneously enabling Massachusetts to continue to leverage the flexibility of these clean energy resources to achieve the Commonwealth's climate change targets. To achieve this, FirstLight is proposing PM&E measures including energy revenue losses, capital costs, periodic costs and O&M costs of \$238,339,000 over a 50-year license term. Of these costs \$193,158,000 and \$45,182,000 will be spent at the Turners Falls Project and Northfield Mountain Project, respectively.

The proposal will also retain the ability of Northfield and Turners Falls to support significant contributions to the tax base in the Western Massachusetts communities of Erving, Montague, Gill and Northfield, and to maintain its status as a significant employer in Franklin County.

And of importance, the Turners Falls and Northfield Mountain Projects will continue to displace fossil-fuel emitting energy sources to meet peak energy demands, while moving the Commonwealth of Massachusetts closer to its goal of zero-carbon emissions by 2050. FirstLight's proposal provides for the continued production of approximately 1,188,684<sup>19</sup> MWh of emissions-free energy production and provides for those same resources to both store energy from other more intermittent renewables such as wind and solar and to continue acting as a critical tool for reliability of the New England electric grid as it transitions to a low or zero carbon future state. Together, the carbon reduction and air pollution benefits of these Projects are clearly significant on a state and regional scale.

In conclusion, the proposal included in FirstLight's comprehensive AFLA submission demonstrates that the Projects will provide enormous environmental and economic benefits to Massachusetts and New England-- today and for the next 50 years.

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<sup>19</sup> The average annual generation from 2011-2019 at the Turners Falls Project and Northfield Mountain Project are 332,351 MWh and 889,845 MWh, respectively, for a total of 1,222,196 MWh. After losing 33,512 MWhs of Turners Falls Project generation, the total will be 1,188,684 MWhs going forward.

**Table ES-2a. Proposed Turners Falls Bypass Flows (Year 1-3 of License)**

<b>Date</b>	<b>Total Bypass Flow<sup>2</sup></b>	<b>Turners Falls Dam</b>	<b><sup>3</sup>Station No. 1</b>
01/01-03/31	1,500 cfs or the Naturally Routed Flow (NRF), whichever is less	300 cfs	1,200 cfs <sup>4</sup>
04/01-05-31 <sup>1</sup>	6,500 cfs or the NRF, whichever is less	4,290 cfs	2,210 cfs <sup>4</sup>
06/01-06/15 <sup>1</sup>	4,500 cfs or the NRF, whichever is less	2,990 cfs	1,510 cfs <sup>4</sup>
06/16-06/30 <sup>1</sup>	3,500 cfs or the NRF, whichever is less	2,280 cfs	1,220 cfs <sup>4</sup>
07/01-08/31	1,800 cfs or the NRF, whichever is less	670 cfs	1,130 cfs <sup>4</sup>
09/01-11/30	1,500 cfs or the NRF, whichever is less	500 cfs	1,000 cfs <sup>4</sup>
12/01-12/31	1,500 cfs or the NRF, whichever is less	300 cfs	1,200 cfs <sup>4</sup>

<sup>1</sup>The flow split during these periods is approximately 67% from the Turners Falls Dam and 33% from Station No. 1. If FirstLight conducts further testing, in consultation with the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS) and Massachusetts Department of Fish and Wildlife (MADFW), and determines that migratory fish are not delayed by passing a greater percentage of the bypass flow via Station No. 1, it may increase the percentage through Station No. 1 upon written concurrence of those agencies.

<sup>2</sup>If the NRF is less than 6,500 cfs (04/01-05/31), 4,500 cfs (06/01-06/15) or 3,500 cfs (06/16-06/30) the flow split will still be set at approximately 67% of the NRF from the Turners Falls Dam and 33% of the NRF from Station No. 1. If the NRF is less than 1,800 cfs (7/1-8/31), 1,500 cfs (9/1-11/30), or 1,500 cfs (12/1-3/31), the Licensee shall maintain the Turners Falls Dam discharges at 670 cfs, 500, cfs, and 300 cfs, respectively.

<sup>3</sup>To maintain the flow split, Station No. 1 must be automated, which will not occur until Year 3 of the license. FirstLight proposes to maintain the flow split such that the Turners Falls Dam discharge will be as shown above, or higher flows will be spilled, in cases where the additional flow cannot be passed through Station No. 1.

<sup>4</sup>The Turners Falls Hydro (TFH) project (FERC No. 2622) and Milton Hilton, LLC project (unlicensed) are located on the power canal and discharge into the bypass reach upstream of Station No. 1. The hydraulic capacity of the TFH project and Milton Hilton, LLC project is 289 and 113 cfs, respectively. If the TFH project is operating, FirstLight will reduce its Station No. 1 discharge by 289 cfs. If the Milton Hilton, LLC project is operating, FirstLight will reduce its Station No. 1 discharge by 113 cfs.



**Table ES-2b. Proposed Turners Falls Bypass Flows and Downstream Reach Operations (Years 4-50 of License)**

<b>Date</b>	<b>Total Bypass Flow<sup>2,3</sup></b>	<b>Minimum Flow below Cabot Station (Bypass Flow + Cabot Discharge)</b>	<b>Maximum Flow below Cabot Station to Protect Puritan Tiger Beetles</b>	<b>Cabot Down-Ramping Rate to Protect Shortnose Sturgeon</b>	<b>Cabot Up-Ramping Rate to Protect Shortnose Sturgeon (4/1-5/31) and Odonates (6/1-8/15)</b>
01/01-03/31	1,500 cfs or the Naturally Routed Flow (NRF), whichever is less	1,500 cfs or the NRF, whichever is less			
<sup>1</sup> 04/01-05/31	6,500 cfs or the NRF, whichever is less	6,500 cfs or the NRF, whichever is less		Down to 2,300 cfs/hour	Up to 2,300 cfs/hour
<sup>1</sup> 06/01-06/15	4,500 cfs or the NRF, whichever is less	6,800 cfs or the NRF, whichever is less			Up to 2,300 cfs/hr from 8:00 am to 2:00 pm
<sup>1</sup> 06/16-06/30	3,500 cfs or the NRF, whichever is less	5,800 cfs or the NRF, whichever is less			Up to 2,300 cfs/hr from 8:00 am to 2:00 pm
07/01-08/15	1,800 cfs or the NRF, whichever is less	1,800 cfs or the NRF, whichever is less	Add no more than 4,600 cfs additional flow from Cabot Station from 1 am to 2 pm		Up to 2,300 cfs/hr from 8:00 am to 2:00 pm
08/16-08/31	1,800 cfs or the NRF, whichever is less	1,800 cfs or the NRF, whichever is less	Add no more than 4,600 cfs additional flow from Cabot Station from 1 am to 2 pm		
09/01-11/30	1,500 cfs or the NRF, whichever is less	1,500 cfs or the NRF, whichever is less			
12/01-12/31	1,500 cfs or the NRF, whichever is less	1,500 cfs or the NRF, whichever is less			

<sup>1</sup>The flow split during these periods is approximately 67% from the Turners Falls Dam and 33% from Station No. 1. If FirstLight conducts further testing, in consultation with the National Marine Fisheries Service (NMFS), U.S. Fish and Wildlife Service (USFWS) and Massachusetts Department of Fish and Wildlife (MADFW), and determines that migratory fish are not delayed by passing a greater percentage of the bypass flow via Station No. 1, it may increase the percentage through Station No. 1 upon written concurrence of those agencies.

<sup>2</sup>If the NRF is less than 6,500 cfs (04/01-05/31), 4,500 cfs (06/01-06/15) or 3,500 cfs (06/16-06/30) the flow split will still be set as approximately 67% of the NRF from the Turners Falls Dam and 33% of the NRF from Station No. 1. If the NRF is less than 1,800 cfs (7/1-8/31), 1,500 cfs (9/1-11/30), or 1,500 cfs (12/1-3/31), the Licensee shall maintain the Turners Falls Dam discharges at 670 cfs, 500, cfs, and 300 cfs, respectively.

<sup>3</sup>The Turners Falls Hydro (TFH) project (FERC No. 2622) and Milton Hilton, LLC project (unlicensed) are located on the power canal and discharge into the bypass reach upstream of Station No. 1. The hydraulic capacity of the TFH project and Milton Hilton, LLC project is 289 and 113 cfs, respectively. If the TFH project is operating, FirstLight will reduce its Station No. 1 discharge by 289 cfs. If the Milton Hilton, LLC project is operating, FirstLight will reduce its Station No. 1 discharge by 113 cfs.

**Table ES-3: Amount of Suitable Habitat for Spring Spawning Fish Species in the River Reach Upstream of Rawson Island**

Species	Lifestage	Months Present	Amount of Suitable Habitat at Minimum Flows (square feet)					
			Existing Operations			Proposed Operations		
			April	May 1 to Passage Season*	Passage Season*	April-May	June 1-15	June 16-30
Shortnose Sturgeon	Spawning	April-May	-	255,439	419,106	1,305,646	-	-
Shortnose Sturgeon	Egg/Embryo	April-June	-	923,087	1,232,100	3,377,958	3,349,794	3,312,290
American Shad	Spawning/Incu	May-June	-	-	489,293	2,034,085	1,755,374	1,528,867
American Shad	Adult	May-June	-	-	462,866	1,594,864	1,305,009	1,109,372
Fallfish	Spawn/Incu	May-June	-	18,742	18,685	26,523	39,116	43,561
Fallfish	Fry	May-June	-	98,462	104,430	39,467	60,207	80,216
Walleye	Spawning/Incu	April-May	-	60,745	109,930	598,732	-	-
Walleye	Fry	April-May	-	15,682	17,284	10,928	-	-
White Sucker	Spawn/Incu	April-May	-	1,201	1,540	6,646	-	-
White Sucker	Fry	May-June	-	1,066,876	1,130,971	144,251	267,442	514,838
Sea Lamprey	Spawning	May-June	-	-	142,700	221,785	253,167	257,610

*Note: Habitat amounts are approximate, based on models nearest to the actual flow rates, and averaged models for certain flow rates, from Study No. 3.3.1. For baseline operations, there are currently no minimum flows in April. Zero flow in the bypass reach was not modeled as part of relicensing studies. Habitat increases for the proposed condition are depicted in blue.*

*\*The Connecticut River Atlantic Salmon Commission establishes an annual schedule for the operation of upstream fish passage facilities at the Connecticut River dams. Therefore, the exact dates of the "Passage Season" may vary from year-to-year but would typically start in May.*

**Table ES-4. Amount of Suitable Habitat for Spring Spawning Fish Species between Rawson Island and the Montague Bridge**

Species	Life Stage	Months Present	Minimum Amount of Suitable Habitat Given Minimum Flows (square feet)					
			Existing Operations			Proposed Operations		
			April	May 1 to Passage Season*	Passage Season*	April-May	June 1-15	June 16-30
Shortnose Sturgeon	Spawning	April-May	-	42,978	54,406	143,820	-	-
Shortnose Sturgeon	Egg/Embryo	April-June	-	132,194	144,436	228,194	232,809	229,583
American Shad	Spawning/Incu	May-June	-	-	902,050	1,981,674	1,925,569	1,767,126
American Shad	Adult	May-June	-	-	1,302,531	2,300,221	2,307,139	2,139,341
Fallfish	Spawn/Incu	May-June	-	220,742	231,305	104,886	147,397	179,481
Fallfish	Fry	May-June	-	316,767	326,356	162,598	199,993	227,006
Walleye	Spawning/Incu	April-May	-	277,669	332,559	572,221	-	-
Walleye	Fry	April-May	-	140,889	128,886	120,472	-	-
White Sucker	Spawn/Incu	April-May	-	11,420	14,815	25,131	-	-
White Sucker	Fry	May-June	-	1,946,281	1,849,393	994,909	11,180,965	1,204,539
Sea Lamprey	Spawning	May-June	-	-	270,872	1,108,106	975,092	840,598

*Note: Habitat amounts are approximate, based on models nearest to the actual flow rates, and averaged models for certain flow rates, from Study No. 3.3.1. For baseline operations, there are currently no minimum flows in April. Zero flow in the bypass reach was not modeled as part of relicensing studies. Habitat increases for the proposed condition are depicted in blue. Habitat amounts are the minimum amount that would be available at the potential range of Cabot Station generation flows.*

*\*The Connecticut River Atlantic Salmon Commission establishes an annual schedule for the operation of upstream fish passage facilities at the Connecticut River dams. Therefore, the exact dates of the "Passage Season" may vary from year-to-year but would typically start in May.*

**Table ES-5. Amount of Suitable Habitat for Fish Species between Montague and Sunderland (~9 miles of river below Cabot Station)**

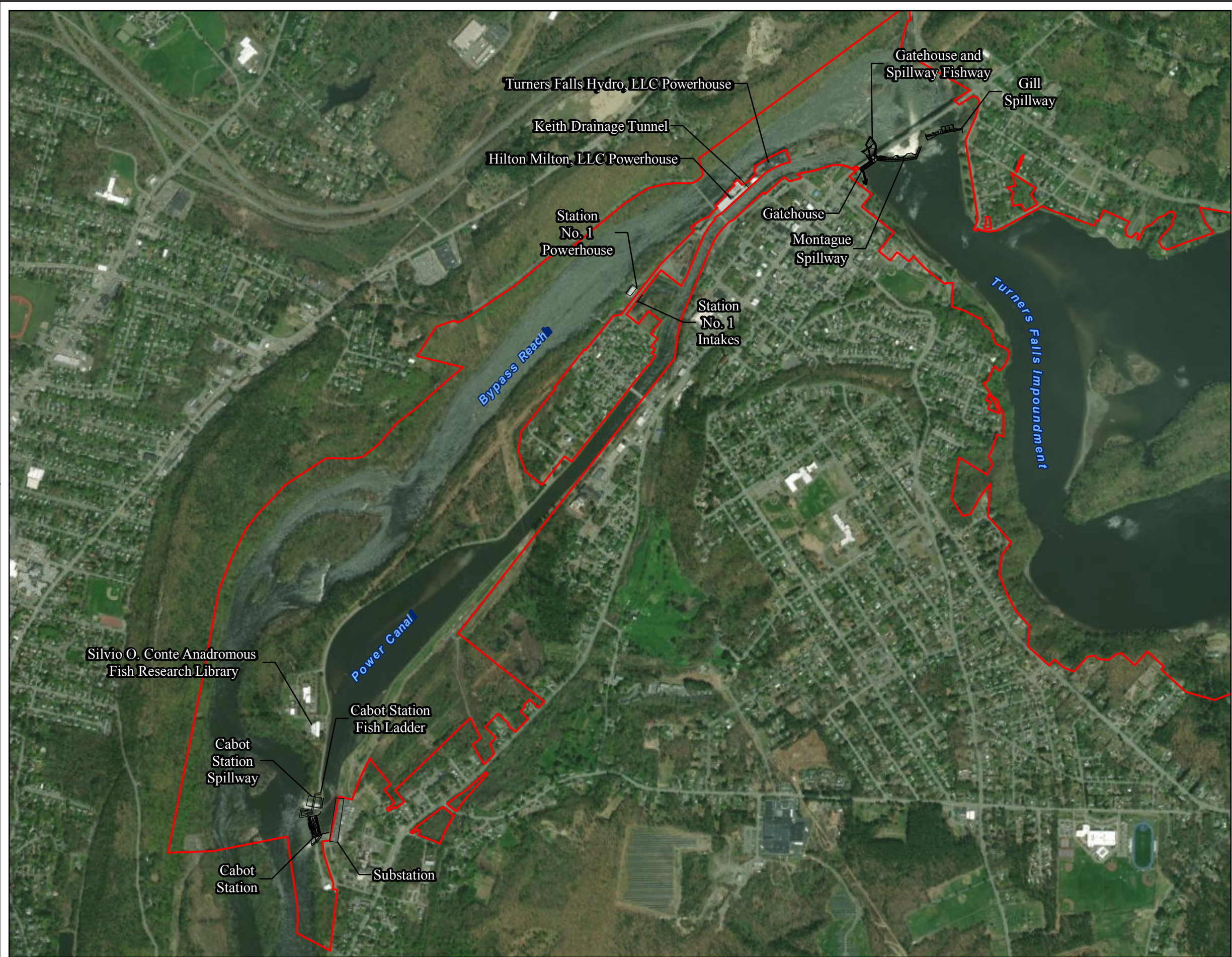
Species	Life Stage	Months Present	Amount of Suitable Habitat at Minimum Flows (square feet)			
			Existing	Proposed		
			Minimum Flow	April-May	June 1-15	June 16-30
Shortnose Sturgeon	Fry	May-June	12,314,447	16,128,365	16,056,977	16,257,214
American Shad	Spawning/Incu	May-June	7,169,286	12,879,109	13,013,709	12,595,627
American Shad	Adult	May-June	14,884,729	24,336,843	24,569,327	23,822,383
Fallfish	Spawn/Incu	May-June	4,230,052	1,508,510	1,388,633	1,767,075
Fallfish	Fry	May-June	6,682,346	1,938,259	1,832,162	2,171,864
White Sucker	Spawn/Incu	April-May	647,509	65,312	-	-
White Sucker	Fry	May-June	15,488,036	6,432,174	6,308,923	6,658,176
Walleye	Spawning/Incu	April-May	1,634,274	2,394,329	-	-
Walleye	Fry	April-May	781,469	849,060	-	-
Sea Lamprey	Spawning	May-June	5,561,317	4,446,423	4,189,692	4,725,831

*Note: Habitat amounts are approximate, based on models nearest to the actual flow rates, and averaged models for certain flow rates, from Study No. 3.3.1. Habitat increases for the proposed condition are depicted in blue. Shortnose Sturgeon spawning and rearing are not known to occur in this reach, but sturgeon fry is a critical life stage that drifts into this reach from areas near and above Cabot Station.*

**Table ES-6. FERC Approved Recreation Facilities at the Turners Falls and Northfield Mountain Projects**

Recreation Site Name	Recreation Facilities/Amenities
<i>Turners Falls Project</i>	
Gatehouse Fishway Viewing Area	<ul style="list-style-type: none"> <li>• parking area (approximately 27 single vehicle spaces; 2 ADA spaces)</li> <li>• picnic area (approximately 6 tables)</li> <li>• bike rack</li> <li>• trail</li> <li>• fishway viewing visitor center (ADA accessible)</li> <li>• restrooms (ADA accessible)</li> <li>• interpretive sign</li> </ul>
Turners Falls Branch Canal Area	<ul style="list-style-type: none"> <li>• overlook (approximately 4 benches)</li> </ul>
Cabot Woods Fishing Access	<ul style="list-style-type: none"> <li>• parking areas (approximately 17 single vehicle spaces; 2 ADA spaces)</li> <li>• picnic area (approximately 3 tables)</li> </ul>
Turners Falls Canoe Portage	<ul style="list-style-type: none"> <li>• canoe portage take-out (at Barton Cove Canoe &amp; Kayak Rental area)</li> <li>• canoe portage put-in (at Poplar Street Access Site)</li> <li>• On-call vehicular canoe &amp; kayak transport service</li> </ul>
<i>Northfield Mountain Project</i>	
Bennett Meadow Wildlife Management Area	<ul style="list-style-type: none"> <li>• hunting area</li> </ul>
Munn's Ferry Boat Camping Recreation Area	<ul style="list-style-type: none"> <li>• water access only campsites (approximately 4 Tent platform sites and 1 shelter site)</li> <li>• pedestrian foot bridge</li> <li>• restrooms</li> <li>• picnic area (1 table)</li> <li>• dock</li> </ul>
Boat Tour and Riverview Picnic Area	<ul style="list-style-type: none"> <li>• parking area (approximately 54 single vehicle spaces; 2 ADA)</li> <li>• restroom (ADA compliant)</li> <li>• picnic area (approximately 12 tables)</li> <li>• pedestrian foot bridge</li> <li>• picnic pavilion (approximately 8 tables)</li> <li>• interpretive boat tour</li> <li>• dock</li> </ul>
Northfield Mountain Tour and Trail Center	<ul style="list-style-type: none"> <li>• parking area (approximately 50 single vehicle spaces; 3 ADA)</li> <li>• restroom</li> <li>• picnic area (approximately 7 tables)</li> <li>• overlook</li> <li>• visitor center and interpretive displays</li> <li>• winter area</li> <li>• trail system</li> </ul>
Barton Cove Nature Area and Campground	<ul style="list-style-type: none"> <li>• nature area parking area (approximately 26 single vehicle spaces)</li> <li>• campground parking (approximately 28 single vehicle spaces)</li> <li>• showers</li> <li>• restroom facilities (2 facilities; ADA compliant)</li> <li>• picnic area (approximately 15 tables)</li> <li>• overlook</li> <li>• interpretive sign</li> <li>• walk-in campground (2 group sites; 28 campsites; 1 ADA campsite)</li> <li>• nature trail</li> <li>• dock</li> </ul>
Barton Cove Canoe and Kayak Rental Area	<ul style="list-style-type: none"> <li>• parking area (approximately 28 single vehicle spaces)</li> <li>• picnic area (approximately 6 tables)</li> </ul>

Recreation Site Name	Recreation Facilities/Amenities
	<ul style="list-style-type: none"><li>• seasonal restroom</li><li>• paddlecraft rental service</li><li>• canoe put-in and take-out (serves as portage take-out)</li><li>• on-call vehicular canoe &amp; kayak transport service</li></ul>



Northfield Mountain Pumped Storage Project No. 2485  
 Turners Falls Hydroelectric Project No. 1889

Amended Final License Application  
 Executive Summary

Figure ES-1:  
 Turners Falls Hydroelectric Project Features

**Legend**

Project Boundary

N

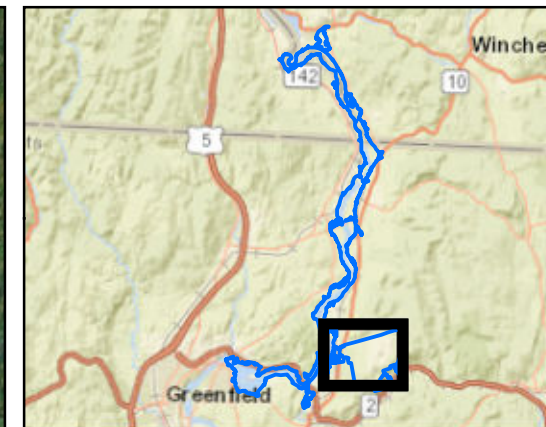
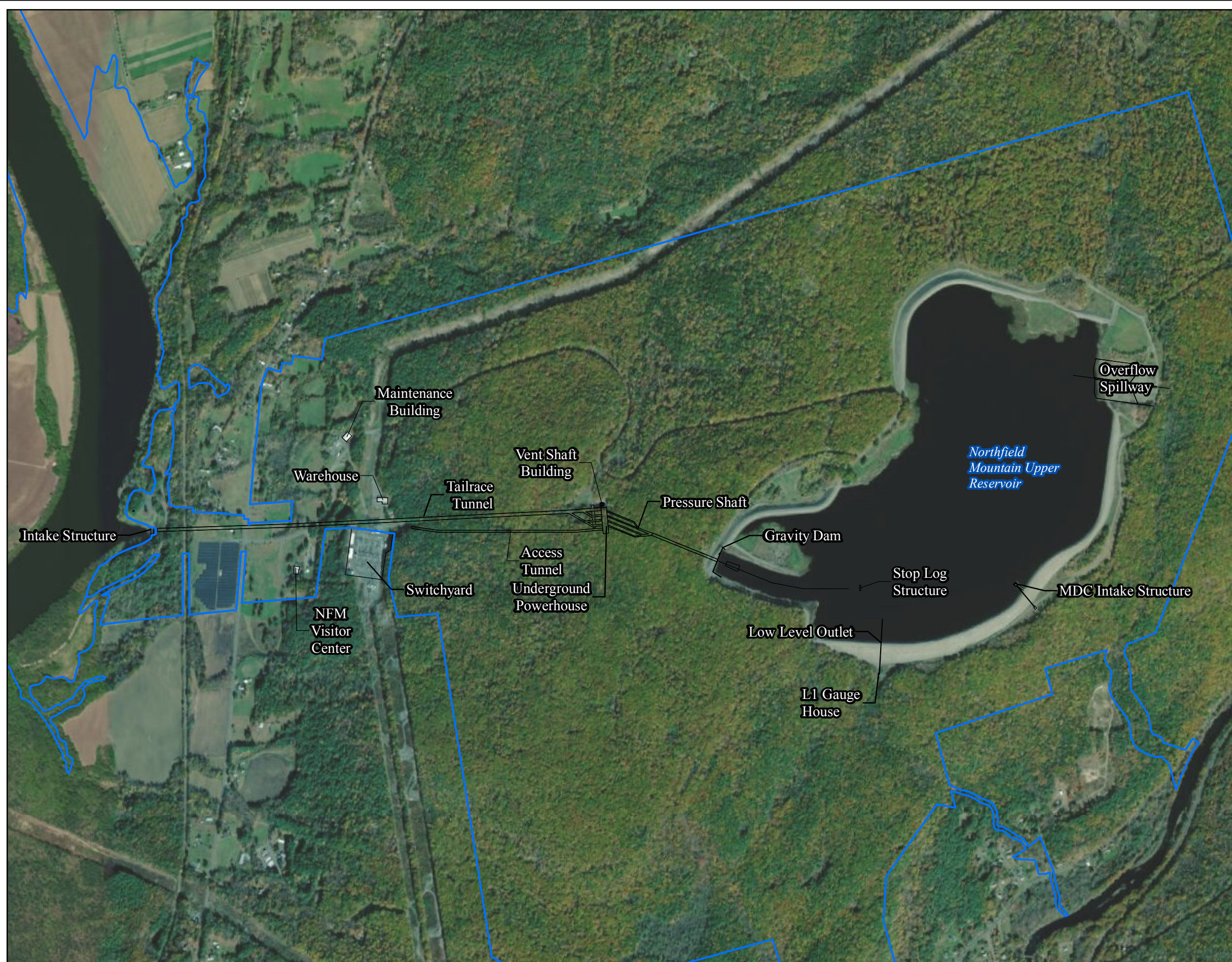
Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and the GIS User Community  
 National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS,

0 600 1,200 2,400 Feet

1 inch = 1,200 feet



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Northfield Mountain Pumped Storage Project No. 2485  
Turners Falls Hydroelectric Project No. 1889

Amended Final License Application  
Executive Summary

Figure ES-2:  
Northfield Mountain Pumped Storage  
Project Features

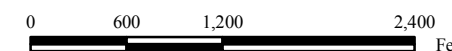
Legend

Project Boundary

N



Service Layer Credits: Source: Esri, Maxar, GeoEye, Earthstar  
Geographics, CNES/Airbus DS, USDA, USGS, AeroGRID, IGN, and  
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Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P,

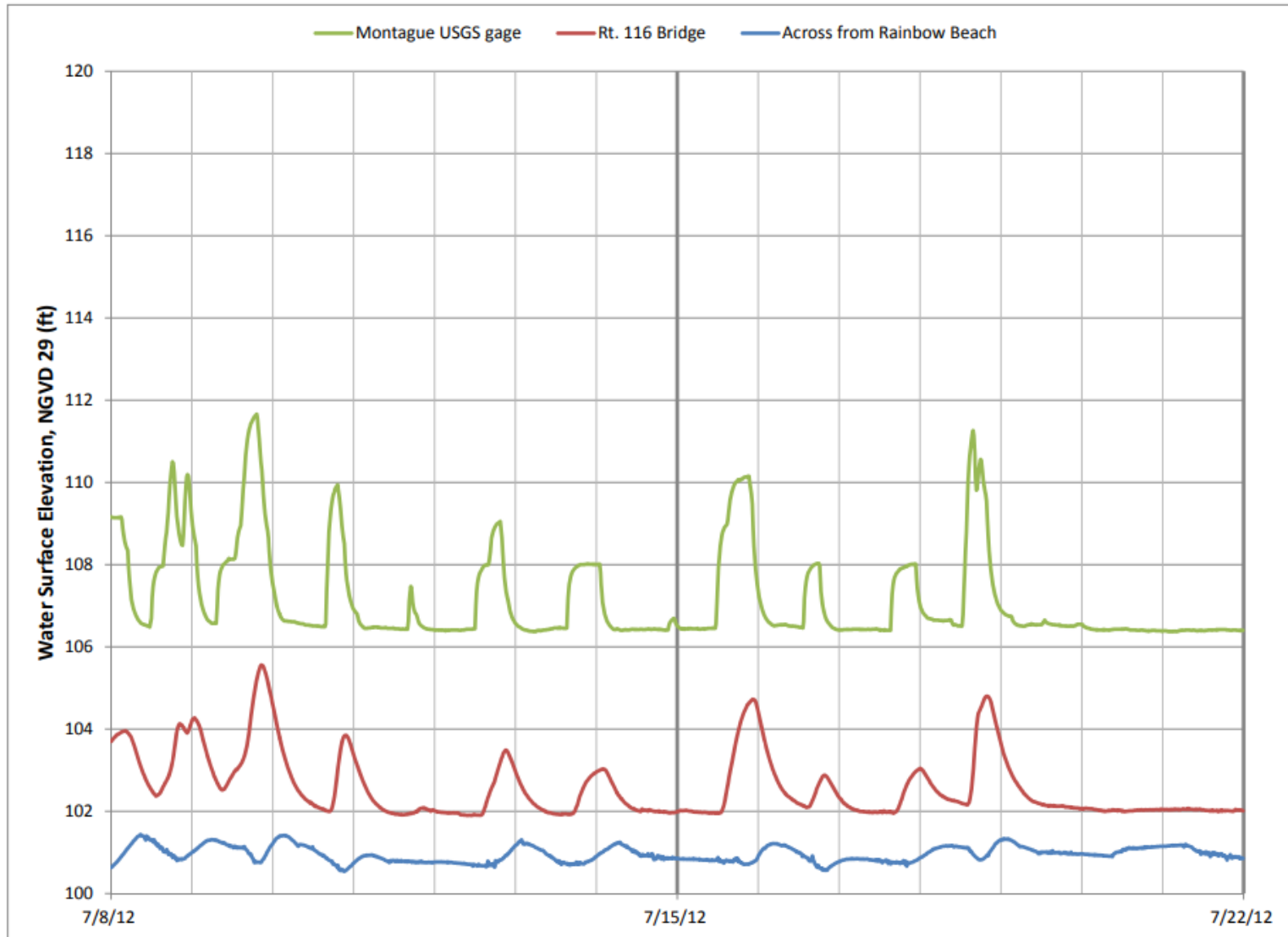


1 inch = 1,200 feet



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**Figure ES-3. Hourly Observed Water Surface Elevations at Montague USGS Gage, Route 116 Bridge, and across from Rainbow Beach in July 2012**