

**Turners Falls Hydroelectric Project (FERC No. 1889)
Northfield Mountain Pumped Storage Project (FERC No. 2485)**

401 Water Quality Certificate Application



Submitted to:



**Massachusetts
Department of
Environmental
Protection**

April 22, 2024

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LIST OF ABBREVIATIONS

Acronym	Description
2025 Clean Energy Plan	Massachusetts Clean Energy and Climate Plan for 2025
2050 Roadmap Study	Massachusetts 2050 Decarbonization Roadmap
401 Application	401 Water Quality Certificate Application
ADA	American with Disabilities Act
AFLA	Amended Final License Application
AIP	Agreement in Principle
AIR	Additional Information Request
AMC	Appalachian Mountain Club
AMM	adaptative management measures
AW	American Whitewater
BSTEM	Bank Stability and Toe Erosion Model
CAW	Crab Apple Whitewater, Inc.
CFD	Computational Fluid Dynamics
cfs	cubic feet per second
Cowasuck	Cowasuck Band of the Pennacook-Abenaki People
CRC	Connecticut River Conservancy
CRSEC	Connecticut River Streambank Erosion Committee
CRWC	Connecticut River Watershed Council (now CRC)
CWA	Clean Water Act
DLA	Draft License Application
DO	dissolved oxygen
EIS	Environmental Impact Statement
EJ	Environmental Justice
Elnu	Elnu Tribe of the Abenaki
ENF	Environmental Notification Form
EEA	Massachusetts Executive Office of Energy and Environmental Affairs
F/F Agreement	Flows and Fish Passage Settlement Agreement (filed with FERC on 3/31/2023)
FERC	Federal Energy Regulatory Commission
FL or FirstLight	Collectively FirstLight Hydro LLC and Northfield Mountain LLC
FirstLight MA Hydro LLC	Owner and Operator of Turners Falls Hydroelectric Project
FLA	Final License Application
FOMP	Fishway Operations and Maintenance Plan
FRCOG	Franklin Regional Council of Governments
FRD	Franklin Conservation District
FRR	Full River Reconnaissance
GRH	Great River Hydro- owners of the Vernon, Bellows Falls, and Wilder Hydro Projects
GW	gigawatt
HPMP	Historic Properties Management Plan
IPRP	Independent Peer Review Panel
ILP	Integrated Licensing Process

Acronym	Description
ISO-NE	Independent System Operator- New England
LCCLC	Landowners and Concerned Citizens for License Compliance
MA	Commonwealth of Massachusetts
MDCR	Massachusetts Department of Conservation and Recreation
MDEP	Massachusetts Department of Environmental Protection
MDFW	Massachusetts Division of Fisheries and Wildlife
MEPA	Massachusetts Environmental Policy Act
MHHI	Massachusetts Annual Median Household Income
MW	Megawatt
MWh	Megawatt-hour
Narragansett	Narragansett Indian Tribe
NE FLOW	New England Flow
NEPA	National Environmental Policy Act
NGVD29	National Geodetic Vertical Datum of 1929
NFM	Northfield Mountain
NH	New Hampshire
NHESP	Massachusetts Natural Heritage and Endangered Species Program
NMFS	National Marine Fisheries Service
NOI	Notice of Intent
Nolumbeka	The Nolumbeka Project, Inc.
Northfield Mountain LLC	Owner and Operator of the Northfield Mountain Pumped Storage Project
Northfield Mountain Project	Northfield Mountain Pumped Storage Project (FERC No. 2485)
NPS	National Park Service
NRF	Naturally Routed Flow
O&M	Operation and Maintenance
PAD	Pre-Application Document
PSH	Pumped Storage Hydro
PM&E	Protection, Mitigation and Enhancement
Project(s)	Collectively Turners Falls Hydroelectric Project and Northfield Mountain Pumped Storage Project
PSP	Proposed Study Plan
QAPP	Quality Assurance Project Plan
REA	Ready for Environmental Analysis
Recreation Agreement	Recreation Settlement Agreement (filed with FERC on 6/12/2023)
RMP	Recreation Management Plan
RSP	Revised Study Plan
RTE	Rare, Threatened, and Endangered
Stockbridge Munsee	Stockbridge-Munsee Tribal Historic Preservation
TCP	Traditional Cultural Properties
TF	Turners Falls Hydroelectric Project
TFI	Turners Falls Impoundment
TMDL	Total Maximum Daily Load
TNC	The Nature Conservancy
Turners Falls Project	Turners Falls Hydroelectric Project (FERC No. 1889)

Acronym	Description
FirstLight Hydro LLC	Owner and Operator of the Turners Falls Hydroelectric Project
UPSP	Updated Proposed Study Plan
USACE	United States Army Corps of Engineers
USEPA	United States Environmental Protection Agency
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VT	Vermont
VY	Vermont Yankee
WMCC	Western Massachusetts Climbing Coalition
WQC	Water Quality Certificate
ZO	Zoar Outdoor

1 Introduction and Roadmap to 401 Water Quality Certificate Application

1.1 Introduction

FirstLight MA Hydro LLC is the owner and operator of the Turners Falls Hydroelectric Project (Turners Falls Project, FERC No. 1889). Northfield Mountain LLC is the owner and operator of the Northfield Mountain Pumped Storage Project (Northfield Mountain Project, FERC No. 2485). The Turners Falls and Northfield Mountain Projects are collectively referred to herein as the Project or Projects. FirstLight Hydro LLC and Northfield Mountain LLC are collectively referred to herein as FirstLight. The current Federal Energy Regulatory Commission (FERC) licenses for the Projects expired on April 30, 2018. FERC has issued annual licenses for each Project under the terms and conditions of the current license until a new license is issued.

On February 22, 2024, FERC issued its Ready for Environmental Analysis (REA) notice. By FERC regulation, 60 days after issuing the REA Notice, FirstLight is required to file with the Massachusetts Department of Environmental Protection (MDEP) its 401 Water Quality Certificate Application (401 Application). FirstLight is filing a single 401 Application with MDEP for both Projects; however, separate MDEP-required BRP WW28 forms are provided for each Project.

1.2 Roadmap to 401 Water Quality Certificate Application

This application is organized as follows. [Chapter 1](#) is an introduction and road map to the application. [Chapter 2](#) contains Project Descriptions. [Chapter 3](#) summarizes the History of FERC Licensing and the Settlement Process. [Chapter 4](#) describes Project Benefits and Value in Meeting Massachusetts' Goals for Decarbonization. [Chapter 5](#) contains FirstLight's Comprehensive Proposal for conditions to ensure compliance with Section 401 of the Clean Water Act.

The form for an Application for Hydroelectric Power Generation Project 401 Water Quality Certification is MDEP Bureau of Water Resources form WW28 (found at <https://www.mass.gov/doc/ww-28-application-for-hydroelectric-power-generation-project-401-water-quality-certification/download>). For the Turners Falls Project, a copy of the form can be found in [Attachment A](#). For the Northfield Mountain Project, a copy of the form can be found in [Attachment B](#).

Section 7 of the form requires various additional documentation.

Questions 7(a) and 7(b) ask for the following:

- **Question 7a.** *The license application, and amendments thereto, filed with FERC for the project.*
- **Question 7b.** *An annotated table or compendium organized according to the subject with hyperlinks to all reports relevant to this application, including any related data and quality assurance project plans, documenting the results of all related studies, include those requested by MassDEP, state and federal fish, wildlife and natural resource agencies, tribes, and other groups of individuals, regardless of whether the reports are or are not on file in the above referenced FERC Docket.*

These documents can be accessed two ways including through a website as discussed in [Section 1.3](#) of this Application or in [Appendix A](#). Note that all Appendices are included after all of the Attachments.

Question 7(c) requires submission of a **“Draft Water Quality Mitigation and Enhancement Plan with hyperlinks to relevant reports provided above describing measures to improve water quality and demonstrate that the project will meet the Massachusetts Surface Water Quality Standards (SWQS, 314 CMR 4.00) after accounting for dam and all other pre-related impacts to, and any currently associated impairments of, the relevant water body segments.”** This Plan is included as [Attachment C](#).

Question 7(d) requires submission of a **“Draft Long-Term Sampling and Analysis Plan for post-certification physical, chemical, and biological monitoring, including the proposed monitoring objectives, types, methodologies, and schedules, in order to provide quality-controlled information, and data necessary for MassDEP’s assessment of all designated uses in affected segments, per MassDEP’s Consolidated Assessment and Listing Methodology Guidance.”** This Plan is included as [Attachment D](#).

Question 7(e) requires submission of **“a summary of stakeholder outreach conducted prior to filing this 401 WQC application, including any specific outreach to Environmental Justice Populations affected by the project.”** That summary is included as [Attachment E](#).

1.3 Documents Submitted with 401 Application

As discussed above, to address Question 7a, FirstLight developed a website for MDEP and the public which includes the Draft License Application (DLA), Final License Application (FLA), and Amended Final License Application (AFLA). Since filing the AFLA in December 2020, FirstLight reached Settlement Agreements in 2023 relative to Project operations, fish passage, recreation and other protection, mitigation and enhancement measures (PM&E). The Settlement Agreements are also included on the website.

Regarding Questions 7b, FirstLight is providing MDEP and the public with approximately 400 documents (including the DLA, FLA, AFLA, Settlement Agreements) related to the licensing of these Projects. As noted above, there are two ways to access the documents. [Appendix A](#) includes all of the documents in a table and a link to download the document is available.

The other way to access the documents is from the following public website: [401 WQC Documents - List | Northfield Relicensing \(northfield-relicensing.com\)](#). The public website is exactly the same as [Appendix A](#); however, it allows for filtering of the documents. A screenshot of the website filtering capabilities is shown below.

FirstLight

Filter

YEAR	CATEGORY	AUTHOR	STUDY NO.	
<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	<input style="width: 100%;" type="text"/>	FILTER

Date ▼	Description	Category	Author	Study No.	Download
03/22/2024	FirstLight files BSTEM Analysis of Flows and Fish Passage Agreement	Process	FirstLight		↓ DOWNLOAD
03/22/2024	FirstLight files Draft Biological Assessment for Shortnose Sturgeon	Process	FirstLight		↓ DOWNLOAD

The various documents can be filtered as follows:

- Date. All documents are presented in chronological order from newest to oldest. Privileged FERC filings containing sensitive information are not included on the website but were provided to MDEP. To filter by **YEAR**, type in the year and click filter.
- Description. Includes a high-level description of each document.
- Category: Each document was categorized by its resource area (in the case of study reports) or “other”. The study report resource areas include: *Geology, Water Quality, Hydraulic, Aquatic, Terrestrial, RTE, Recreation, Cultural and Hydro*. “Other” documents were categorized as: *Scoping Document 1, Scoping Document 2, Scoping Meeting, Proposed Study Plan, Updated Proposed Study Plan, Revised Study Plan, FERC Determination, Meeting Minutes, Response to Comments, Draft License Application, Final License Application, Amended FLA, Process, Agreement in Principle, 401WQC, Settlement Agreement, BSTEM Report, or Boating Study*. To filter by **CATEGORY** type in the resource area as listed in italics above and click filter.
- Author: Lists the document author. Most documents were authored by FirstLight or FERC. Any correspondence with the MDEP or the Massachusetts Executive Office of Energy and Environmental Affairs (EEA) is also included. To filter by **AUTHOR**, click the dropdown menu, select the author and then click filter.
- Study No. (if applicable): There were a total of 39 FERC approved studies and each study was assigned a study number. The names and numbers of the 39 studies and resource categories are provided in [Table 1.3-1](#) (this table is also included on the website). Note that when filtering by Study No., enter the last two digits of the study. For example, to filter by **STUDY NO.**, the user would type in 3.1.02¹ (Northfield Mountain/Turners Falls Operations Impact on Existing and Potential Bank Instability) to obtain all filings related to Study 3.1.02.

MDEP Question 7b requests that all reports relevant to the application, including study results, including those requested by MDEP, state and federal fish, wildlife and natural resource agencies, tribes, and other groups or individuals be provided. All study requests, proposed study plans, updated proposed study plans, revised study plans, study reports and responses to study requests and study reports are included on the website and in [Appendix A](#). FirstLight intends that these documents be included as part of the record for this Application.

¹ Please remember to enter the last two digits of the study number. Any study numbers ending in .1, .2....9 should be entered as .01, .02....09.

Table 1.3-1. Study No., Name, and Resource Area

Study No.	Study Name	Resource Area
3.1.01	2013 Full River Reconnaissance	Geology
3.1.02	Northfield Mountain/Turners Falls Operations Impact on Existing and Potential Bank Instability	Geology
3.1.03	Northfield Mountain Project Sediment Management Plan	Geology
3.2.01	Water Quality Monitoring Study	Water Quality
3.2.02	Hydraulic Study of Turners Falls Impoundment, Bypassed Reach and the Connecticut River below Cabot Station	Hydraulic
3.3.01	Conduct Instream Flow Habitat Assessments in the Bypass Reach and below Cabot Station	Aquatic
3.3.02	Evaluate Upstream and Downstream Passage of Adult American Shad	Aquatic
3.3.03	Evaluate Downstream Passage of Juvenile Shad	Aquatic
3.3.04	Evaluate Upstream Passage of American Eel at the Turners Falls Project (two year study)	Aquatic
3.3.05	Evaluate Downstream Passage of American Eel	Aquatic
3.3.06	Impact of Project Operation on Shad Spawning, Spawning Habitat and Egg Deposition in the Area of the Northfield Mountain and Turners Falls Projects	Aquatic
3.3.07	Fish Entrainment and Turbine Mortality Study	Aquatic
3.3.08	Computational Fluid Dynamics Modeling of the Fishway Entrances and Powerhouse Forebays	Hydraulic
3.3.09	Two-Dimensional Modeling of the Northfield Mountain Pumped Storage Project Intake/Tailrace Channel and Connecticut River Upstream and Downstream of the Intake/Tailrace	Hydraulic
3.3.10	Assess Operational Impacts on Emergence of State-Listed Odonates in the Connecticut River	Aquatic
3.3.11	Fish Assemblage Assessment	Aquatic
3.3.12	Evaluate Frequency and Impact of Emergency Water Control Gate Discharge Events and Bypass Flume Events on Shortnose Sturgeon Spawning and Rearing Habitat in the Tailrace and Downstream from Cabot Station	Aquatic
3.3.13	Impacts of the Turners Falls Project and Northfield Mountain Project on Littoral Zone Fish Habitat and Spawning Habitat	Aquatic
3.3.14	Aquatic Habitat Mapping of Turners Falls Impoundment	Aquatic
3.3.15	Assessment of Adult Sea Lamprey Spawning within the Turners Falls Project and Northfield Mountain Project Areas	Aquatic
3.3.16	Habitat Assessment, Surveys, and Modeling of Suitable Habitat for State-listed Mussel Species in the CT River below Cabot Station	Aquatic
3.3.17	Assess the Impacts of Project Operations of the Turners Falls Project and Northfield Mountain Project on Tributary Backwater Area Access and Habitat	Aquatic
3.3.18	Impacts of the Turners Falls Canal Drawdown on Fish Migration and Aquatic Organisms	Aquatic
3.3.19	Evaluate the Use of an Ultrasonic Array to Facilitate Upstream Movement to Turners Falls Dam by Avoiding Cabot Station Tailrace	Aquatic

Study No.	Study Name	Resource Area
3.3.20	Entrainment of American Shad Ichthyoplankton at the Northfield Mountain Pumped Storage Project	Aquatic
3.4.01	Baseline Study of Terrestrial Wildlife and Botanical Resources at the Turners Falls Impoundment, in the Bypass Reach and below Cabot Station within the Project Boundary	Terrestrial
3.4.02	Effects of Northfield Mountain Project-related Land Management Practices and Recreation Use on Terrestrial Habitat	Terrestrial
3.5.01	Baseline Inventory of Wetland, Riparian, and Littoral Habitat in Turners Falls Impoundment, and Assessment of Operational Impacts on Special-Status Species	RTE
3.6.01	Recreation Use/User Contact Survey	Recreation
3.6.02	Recreation Facilities Inventory and Assessment	Recreation
3.6.03	Whitewater Boating Evaluation	Recreation
3.6.04	Assessment of Day Use and Overnight Facilities Associated with Non-Motorized Boats	Recreation
3.6.05	Land Use Inventory	Recreation
3.6.06	Assessment of Effects of Project Operation on Recreation and Land Use	Recreation
3.6.07	Recreation Study of Northfield Mountain, including Assessment of Sufficiency of Trails for Shared Use	Recreation
3.7.01	Phase 1A Archaeological Survey	Cultural
3.7.02	Reconnaissance-Level Historic Structures Survey	Cultural
3.7.03	Traditional Cultural Properties Study	Cultural
3.8.01	Evaluate the Impact of Current and Potential Future Modes of Operation on Flow, Water Elevation and Hydropower Generation	Hydro

2 Project Descriptions

2.1 Turners Falls Project

The Turners Falls Project is located on the Connecticut River in the Commonwealth of Massachusetts (MA), as well as in the states of New Hampshire (NH), and Vermont (VT). The greater portion of the Turners Falls Project, including developed facilities and most of the lands within the FERC Project boundary, is located in Franklin County, MA; specifically, in the towns of Erving, Gill, Greenfield, Montague and Northfield. The Turners Falls Dam is located at approximately river mile 122 (above Long Island Sound) on the Connecticut River in the towns of Gill and Montague, MA. The Turners Falls Project Boundary is shown on [Figure 2.1-1](#). Key features of the Project are shown in [Figure 2.1-2](#) and are described below.

The Turners Falls Dam creates the Turners Falls Impoundment (TFI), which is approximately 20-miles-long, and extends upstream to the base of Great River Hydro's Vernon Hydroelectric Project and Dam (FERC No. 1904). Most of the TFI lies in MA, however, approximately 5.7 miles of the northern portion of the TFI lies in NH and VT. The TFI also serves as the lower reservoir for the Northfield Mountain Project.

The Turners Falls Dam is located on a "Z turn" in the river, and is oriented on a northeast-southwest axis, with the impounded area on the east side of the dam and extending north. At the southwest end of the Turners Falls Dam is the gatehouse. Below the dam, originating at the gatehouse, is the Turners Falls power canal. Paralleling this power canal is a bypassed section of the Connecticut River. Associated with this power canal are the two hydroelectric generating facilities owned by FirstLight: Station No. 1 and Cabot Station. Station No. 1 is located approximately one-third of the way down the power canal. Water is conveyed from the power canal to a small branch canal feeding the Station No. 1 turbines, before discharging into the bypassed reach of the Connecticut River. Cabot Station is located at the downstream terminus of the power canal, where it rejoins the main stem of the Connecticut River. Station No. 1 and Cabot Station discharge into the Connecticut River approximately 0.9 miles and 2.5 miles downstream of the Turners Falls Dam, respectively.

In addition to Station No. 1 and Cabot Station, there are two other hydropower facilities on the canal that discharge into the bypass reach, when operating. Located between the Turners Falls Dam and Station No. 1 tailrace is Turners Falls Hydro, LLC project (FERC No. 2622), which is owned and operated by Eagle Creek Renewable Energy. Also, Milton Hilton, LLC, a FERC non-jurisdictional hydroelectric facility owned by a private developer, is located between the Turners Falls Hydro, LLC project and Station No. 1.

The Turners Falls Project is equipped with three upstream fish passage facilities, including (in downstream to upstream order): the Cabot ladder, the Spillway ladder, and the Gatehouse ladder. Fish enter the Cabot ladder below Cabot Station, enter the power canal, and then move 2.1 miles upstream in the canal to the Gatehouse ladder and eventually into the TFI. Those fish bypassing the Cabot ladder move upstream via the bypass reach where they will ultimately encounter the Turners Falls Dam. Fish arriving here are passed upstream via the Spillway ladder into a gallery leading to the Gatehouse ladder and eventually into the TFI.

The downstream fish passage facilities are located at Cabot Station at the downstream terminus of the power canal. Fish moving downstream pass through the gatehouse (which has no racks) and into the power canal. Downstream fish passage facilities at Cabot Station consist of: reduced bar-spacing in the

upper 11 feet of the intake racks; a broad-crested weir² with an elliptical floor and side walls developed specifically to enhance fish passage at the log sluice; the log sluice itself, which has been resurfaced to provide a passage route; above-water lighting; and a sampling facility.

The operating requirements under the current FERC license include:

- The TFI operating band is from elevation 176.0 feet NGVD29³ to 185.0 feet, as measured at the Turners Falls Dam.
- Maintain a continuous minimum flow of 1,433 cfs or inflow, whichever is less, below the Turners Falls Project.
- Maintain a continuous minimum flow of 200 cfs in the bypass reach starting on May 1 and increasing to 400 cfs when fish passage starts by releasing flow through a bascule gate at the dam. The 400 cfs continuous minimum flow is provided through July 15, unless the upstream fish passage season has concluded early, then reduced to 120 cfs to provide a zone of passage for Shortnose Sturgeon. The 120 cfs continuous minimum flow is maintained in the bypass reach from the date the fishways are closed (or by July 16) until the river temperature drops below 7°C, which typically occurs around November 15.

2.2 Northfield Mountain Project Description

The Northfield Mountain Project is a pumped-storage facility using the TFI as its lower reservoir. The Northfield Mountain Project Boundary is shown on [Figure 2.1-1](#). Key Project features are shown in [Figure 2.2-1](#) and are described below.

The Northfield Mountain Project is approximately 5.2 miles upstream of Turners Falls Dam, on the east side of the TFI. The Project's Upper Reservoir is a man-made structure situated atop Northfield Mountain, to the east of the Connecticut River. During pumping operations, water is pumped from the TFI to the Upper Reservoir. When generating, water is passed from the Upper Reservoir through an underground pressure shaft to a powerhouse cavern and then a tailrace tunnel delivers the water back to the TFI.

The Upper Reservoir has a gross storage capacity of 17,050 acre-feet. Per the current FERC license, the Upper Reservoir may operate between 1000.5 feet and 938 feet, equating to a usable storage capacity of approximately 12,318 acre-feet. This is equivalent to approximately 8,729 MWhs of stored energy. The Upper Reservoir was constructed to accommodate water up to an elevation of 1004.5 feet as approved by FERC in 1976. In addition, the reservoir retains usable storage capacity down to elevation 920 feet. The usable storage volume between elevation 1004.5 feet and 920 feet is approximately 15,327 acre-feet, which is equivalent to approximately 10,779 MWhs of stored energy.

The powerhouse contains four reversible pump/turbines operating at gross heads ranging from 753 to 824.5 feet. Each of the four units has an electrical capacity of 291.7 MW, for a total station nameplate capacity of 1,166.80 MW. Alternatively, when operating in a generation mode, the maximum hydraulic capacity (4 turbines) is approximately 20,000 cfs (5,000 cfs/turbine).

² A uniform acceleration weir.

³ All elevations in this document are based on the National Geodetic Vertical Datum of 1929 (NGVD29).

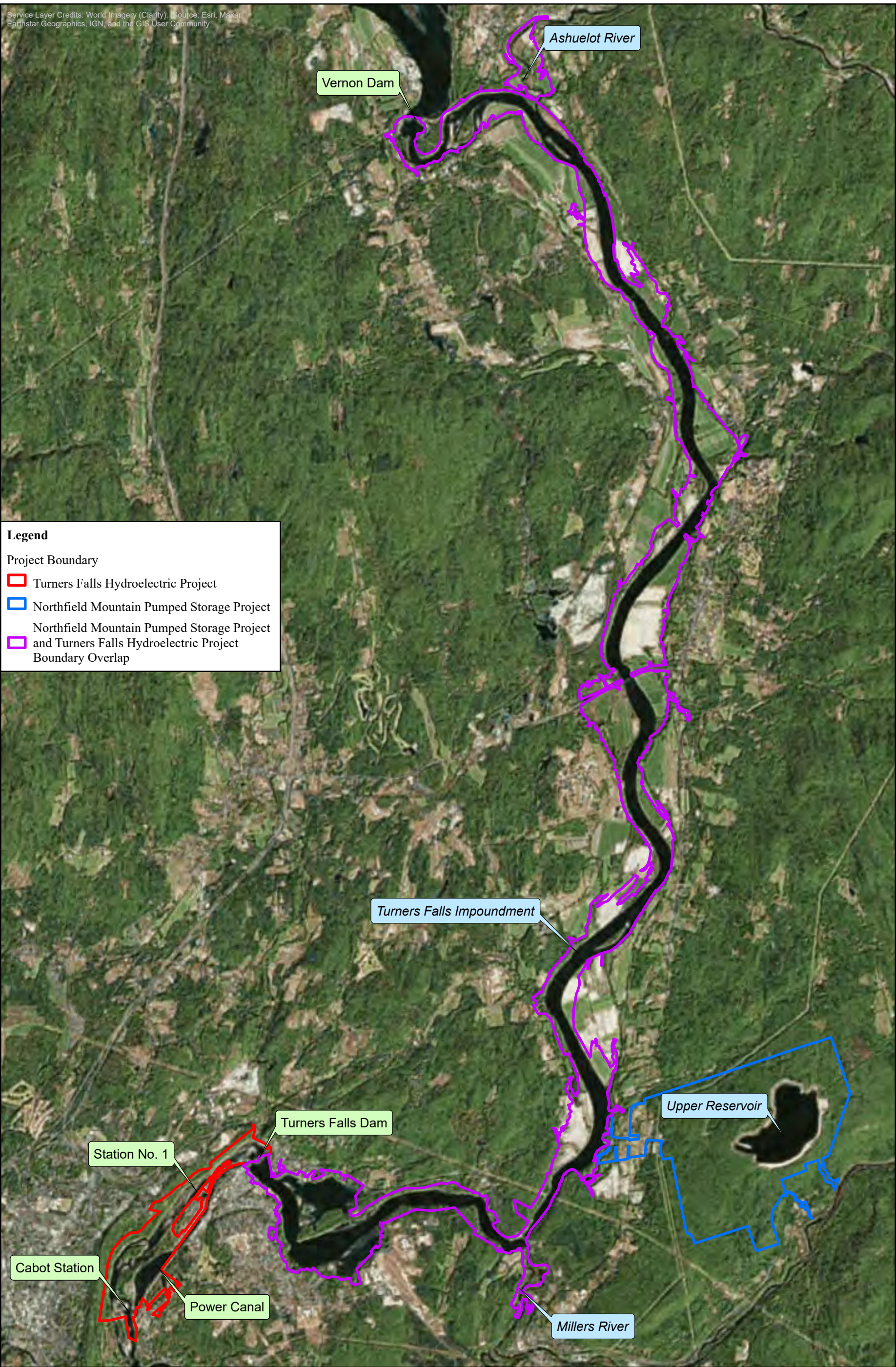
Legend

Project Boundary

Turners Falls Hydroelectric Project

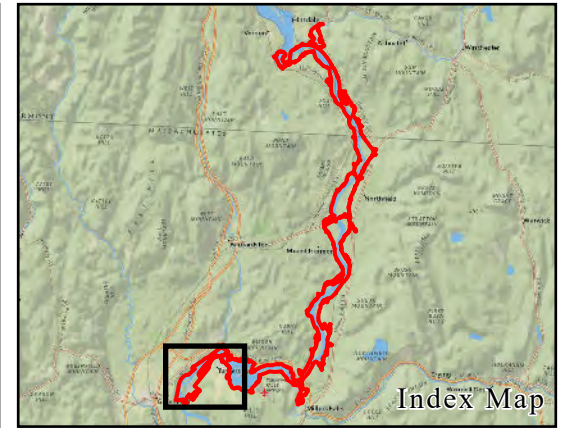
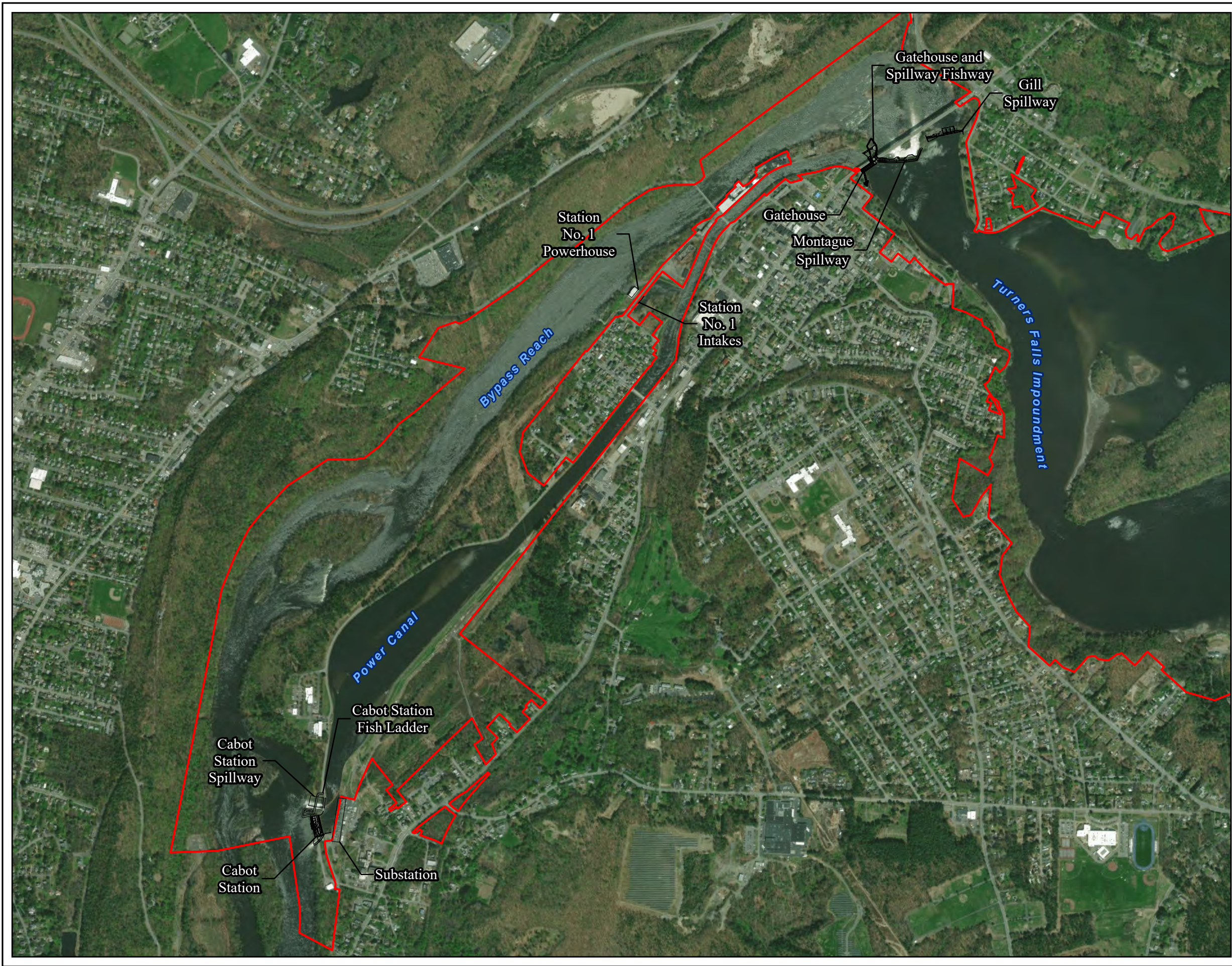
Northfield Mountain Pumped Storage Project

Northfield Mountain Pumped Storage Project and Turners Falls Hydroelectric Project Boundary Overlap



FIRSTLIGHT MA HYDRO LLC
Turners Falls Hydroelectric Project (No. 1889)
401 Water Quality Certification Application
0 0.5 1 2
Miles

Figure 2.1-1:
Turners Falls Hydroelectric Project and
Northfield Mountain Pumped Storage Project
Project Boundary




FIRSTLIGHT MA HYDRO LLC
Turners Falls Hydroelectric Project No. 1889

401 Water Quality Certification Application

Figure 2.1-2:
Turners Falls Hydroelectric Project
Features

Legend

 Project Boundary



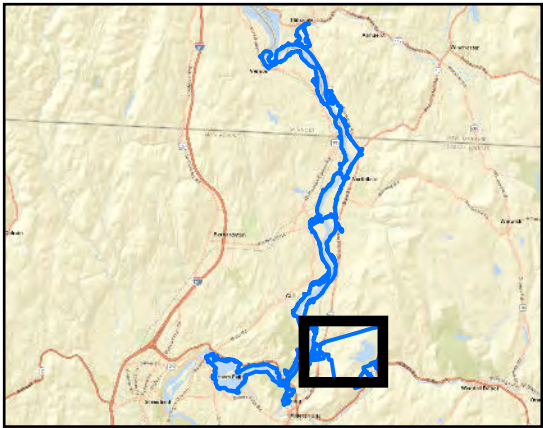
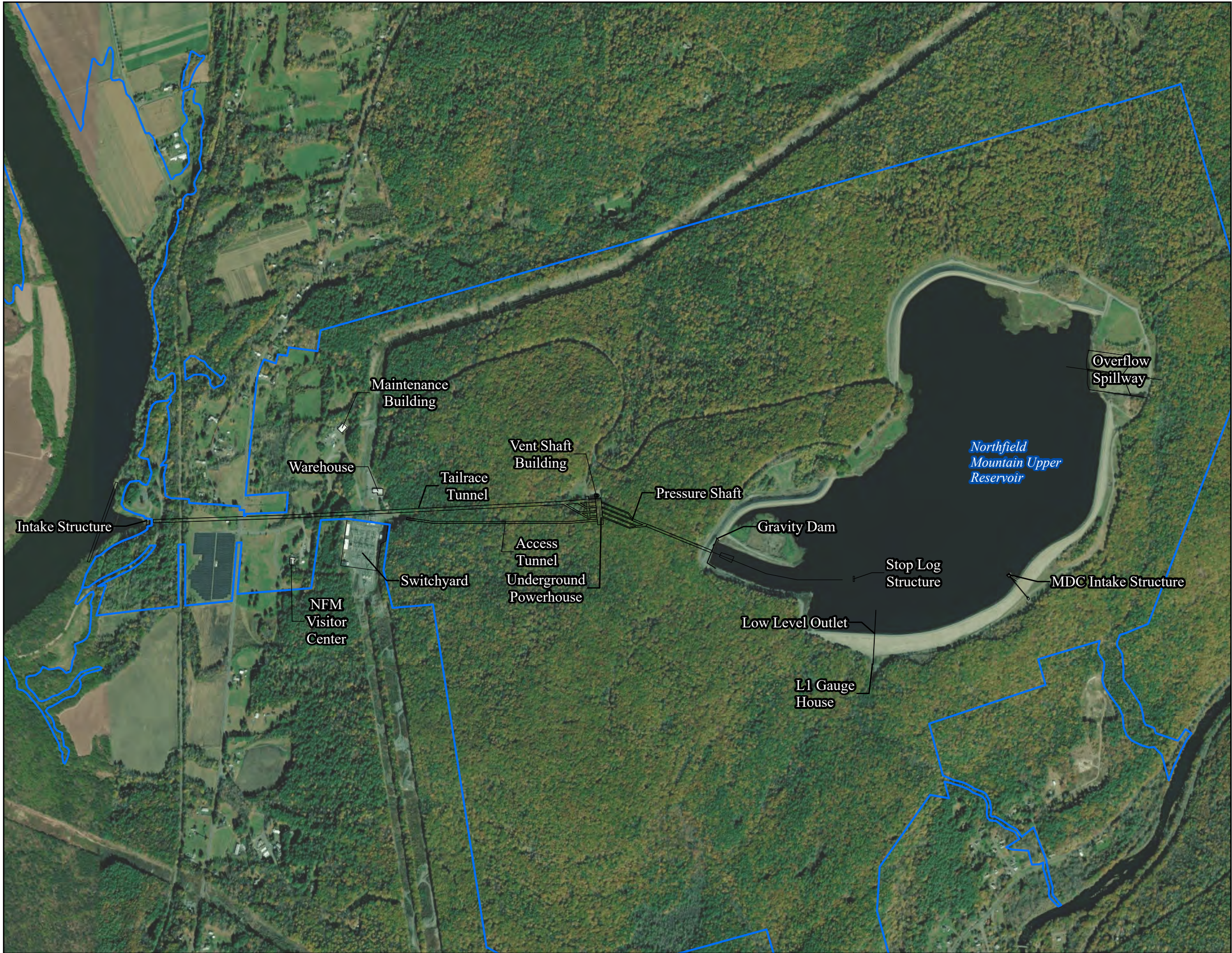
Service Layer Credits: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.
World Imagery: Maxar

0 500 1,000 2,000
Feet

1:14,400



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NORTHFIELD MOUNTAIN LLC
Northfield Mountain Pumped Storage Project No. 2485

401 Water Quality Certification Application

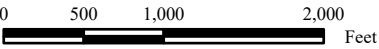
Figure 2.2-1:
Northfield Mountain Pumped Storage
Project Features

Legend

Project Boundary



Service Layer Credits: World Street Map: Esri, HERE, Garmin, NGA,
USGS, NPS
World Imagery: Maxar



1:14,400



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3 History of FERC Licensing and Settlement Process

A chronological summary of the FERC licensing and settlement process is provided below. The chronology summary includes milestone dates when certain documents were filed with FERC. The documents referenced below are listed in [Appendix A](#) and can be obtained at the website accompanying this Application. Filtering the website ([401 WQC Documents - List | Northfield Relicensing \(northfield-relicensing.com\)](#)) by date (type in the year) is the easiest way to locate specific documents referenced herein.

3.1 FERC Licensing

EEA Consultation

On July 6, 2012, prior to initiating the FERC licensing process, FirstLight sent a letter to EEA requesting the Secretary's Advisory Opinion as to Massachusetts Environmental Policy Act (MEPA) applicability, including whether the relicensing of the Projects by FERC necessitated the prior filing of an Environmental Notification Form (ENF) or an Environmental Impact Statement (EIS) with MEPA prior to the taking of any Agency Actions. On July 12, 2012, EEA replied in a letter to FirstLight indicating that the facilities were not subject to MEPA review and that submission of an ENF was not required.

Study Scoping and Planning Process

On October 30, 2012, FirstLight initiated the FERC relicensing process with issuance of its Notice of Intent (NOI) and Pre-Application Document (PAD). FirstLight opted to use FERC's Integrated Licensing Process (ILP) which had FERC directly involved throughout the entire licensing process including scoping. In general, the ILP involves extensive interactions with stakeholders, including submitting study requests, meetings to review study plans, reviewing/commenting on study plans, reviewing study reports, meetings to review study reports, and reviewing/commenting on study reports.

On December 31, 2012, FERC issued Scoping Document 1 requesting stakeholders to submit comments on the PAD and study requests by March 1, 2013. On January 30 (day), and January 31 (day and evening meetings), FERC held its public scoping meetings. By March 1, 2013, approximately 48 comment letters and over 200 study requests were filed with FERC. On April 15, 2013, FERC issued Scoping Document 2. Note that typically stakeholder site visits to a Project, as required by FERC regulations, occur after the PAD and NOI are filed, which would have been in the winter. Given this, prior to FirstLight filing its PAD and NOI, FERC requested FirstLight hold its required site visits earlier such that stakeholders could see more of the Projects. On October 4, 5, and 11, 2012, FirstLight held site visits for stakeholders to view its facilities and tour the TFI via boat.

A lengthy study scoping and planning process extended from March 2013 to February 2014 where three rounds of study plans [Proposed Study Plans (PSP), Updated Proposed Study Plans (UPSP) and Revised Study Plans (RSP)] were developed and provided to stakeholders for review and comment. Extensive stakeholder consultation occurred during this period. On April 15, 2013, FirstLight filed its PSP along with all of the study request letters. On May 14, 2013, FirstLight held an initial meeting on the PSP and then held nine resource-specific study plan meetings⁴ to allow for discussions on each PSP. On June 28, 2013,

⁴ Meetings were held on May 14, 15, 21, 22, June 4, 5, 11, 12 and 14, 2013.

although not required by FERC regulations, FirstLight filed its UPSP to further reflect changes to the PSP based on comments received at the meetings. Approximately 22 comment letters were filed by stakeholders on the UPSP. On August 14, 2013, FirstLight filed its RSP and included responses to comment letters received on the UPSP (the consultation record is included in the RSP).

On August 27, 2013, Entergy Corporation, owner of the Vermont Yankee Nuclear Power Plant (VY), located on the downstream end of the Vernon Impoundment and upstream of the Projects, announced that it would be closing no later than December 29, 2014. With the closure of VY, certain environmental baseline conditions were anticipated to change during the relicensing study period.

On September 13, 2013, FERC approved 20 studies unrelated to aquatic resources. On November 25, 2013, FERC held a technical meeting with stakeholders to discuss any adjustments to the study designs and/or schedules associated with the aquatic studies due to the impending VY closure. On February 21, 2014, FERC approved the remaining studies, which called for delaying the aquatic studies until after VY was closed. In all, FERC approved 39 study plans.

Over the next several years, FirstLight conducted the required studies. Per the ILP regulations, the following FERC process steps were followed once study reports were filed with FERC: a) FirstLight filed study report(s) and notified stakeholders of meeting dates/times, b) study report(s) meeting(s) were held, c) FirstLight filed study report(s) meeting minutes, d) stakeholders filed comments on the study(ies), e) FirstLight filed responses to stakeholder comments, and f) FERC issued its study plan determination letter.

In its comments on study reports, stakeholders could request modifications to a study or request new studies. In FERC's study plan determination letters, it would either a) adopt in full a stakeholder modification, b) adopt a portion of a stakeholder modification study, or c) not adopt a stakeholder modification. FERC would also either adopt or reject stakeholder requests for new studies. Collectively, FERC issued nine determination letters on September 13, 2013, February 21, 2014, January 22, 2015, January 15, 2016, June 29, 2016, February 17, 2017, June 27, 2017, May 31, 2018, and January 22, 2019. In all, there were approximately seven years' worth of studies. Note that when FERC required modifications to an existing study, FirstLight filed addendums to the original study report.

Draft License Application, Final License Application, Amended Final License Application

On December 2, 2015, as required by FERC regulations, FirstLight filed a single DLA for both Projects. Because studies were still ongoing, FirstLight did not include an extensive licensing proposal. On April 29, 2016, also as required by FERC regulations, FirstLight filed a single FLA for both Projects two years prior to license expiration. Again, because the licensing studies were still incomplete, it was premature for FirstLight to put forth a licensing proposal. On December 2, 2020, FirstLight filed separate Amended Final License Applications (AFLAs) for each Project, which included a combined Exhibit E (Environmental Report) for both Projects. Exhibit E of the AFLA included FirstLight's licensing proposal relative to Project Operations, Fish Passage, and Recreation. The proposal also included the following plans: Recreation Management Plan, Historic Properties Management Plan, Bald Eagle Protection Plan and Invasive Plant Species Management Plan. As described later, FirstLight began formal settlement discussions with relicensing participants in 2017 and while a settlement agreement was not reached in time for filing the AFLAs, FirstLight's proposed PM&E measures included in the AFLAs were informed by the settlement discussions.

Additional Information Request and Ready for Environmental Analysis Notice

With the AFLAs filed, on January 14, 2021, FERC issued FirstLight a letter outlining additional information requests (AIRs) and deficiencies with the AFLAs. FERC required this information so it had a complete application before initiating the National Environmental Policy Act (NEPA) process. On March 15, 2021, FirstLight addressed the AIRs and deficiencies. On April 19, 2021, FERC issued a second round of AIRs and on June 18, 2021, June 23, 2021, July 2, 2021, and August 4, 2021, FirstLight filed its responses. At this juncture, FERC had everything it needed to start the NEPA process and the next step in the licensing process was for FERC to issue its Notice of Acceptance and Ready for Environmental Analysis (REA). Issuance of the REA would trigger FirstLight having to file its 401 Application with MDEP within 60 days. Also, within 60 days, the stakeholders could submit Section 10(a) license recommendations, federal/state agencies would be required to submit 10(j) recommendations and the United States Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS) would be required to submit their Section 18 fishway prescription. Sections 10(a), 10(j) and 18 are all parts of the Federal Power Act.

3.2 Settlement

Requested Delays of Ready for Environmental Analysis Notice

As noted above, starting in 2017, FirstLight and stakeholders engaged in settlement discussions; however, no agreement occurred prior to filing the AFLAs. Settlement discussions paused as FirstLight prepared its AFLAs, but discussions were reinitiated in early 2021.

Given that there was good progress on settlement discussions, on August 3, 2021, MDEP requested FERC to defer issuance of the REA notice until November 12, 2021, to afford additional time for settlement. Letters supporting delay in issuing the REA notice were filed by FirstLight (August 5, 2021), Massachusetts Division of Fisheries and Wildlife (MDFW, August 5, 2021) and USFWS (August 18, 2021).

Several additional filings relevant to the timing of the REA Notice were made. On November 12, 2021, FirstLight requested delaying the REA notice until January 31, 2022, which was supported by USFWS, NMFS, and American Whitewater (AW). On November 22, 2021, MDEP filed a letter also supporting the delay until after January 31, 2022. On July 25, 2022, FERC requested a status update on settlement, which FirstLight addressed in an August 9, 2022, filing. On September 22, 2022, MDEP filed another letter with FERC requesting it to delay the REA notice until after December 2022. On January 12, 2023, FERC indicated it would delay the REA notice until May 31, 2023, but also required that FirstLight file bi-weekly status updates, which it did.

Agreements in Principle

During this time, FirstLight met with groups pertaining to Flows and Fish Passage, Recreation, Cultural Resources and Shoreline Erosion. Also, during 2022 and early 2023 various agreement in principle (AIP) documents were filed with FERC including:

- Whitewater AIP, February 28, 2022,
- Flows and Fish Passage AIP, March 17, 2022,
- Revised Flows and Fish Passage AIP, October 31, 2022, and
- Memorandum of Understanding in Principle relative to Cultural Resources, February 15, 2023.

During this time, on June 12, 2022, the Connecticut River Conservancy (CRC) sent the Executive Office of Energy and Environmental Affairs (EEA) a letter raising concern that the Flows and Fish Passage Agreement AIP would not comply with Massachusetts Surface Water Quality Standards. On June 29, 2022, FirstLight responded to CRC's letter in a letter to EEA. On August 18, 2022, CRC sent another letter to EEA responding to FirstLight's letter. MDEP partially responded to CRC in its letter to FERC dated September 22, 2022.

Settlement Agreements

On March 31, 2023, FirstLight filed the Flows and Fish Passage Settlement Agreement (F/F Agreement). Signatories to the F/F Agreement included FirstLight, USFWS, NMFS, MDFW, The Nature Conservancy (TNC), AW, Appalachian Mountain Club (AMC), Crab Apple Whitewater, Inc. (CAW), New England Flow (NE FLOW), and Zoar Outdoor (ZO). The F/F Agreement resolved issues pertaining to a) fish passage, b) flows for fishery, ecological conservation and recreation purposes, and c) protected, threatened and endangered species.

FERC issued notice of the F/F Agreement and requested that stakeholder comments be filed by May 26, 2023. Numerous comment letters were filed and FirstLight responded to the comments in its June 12, 2023, filing. Also, during this period, on April 26, 2023, FERC issued FirstLight several AIRs pertaining to the F/F Agreement, which FirstLight responded to on May 11, 2023.

On June 12, 2023, FirstLight filed a Recreation Settlement Agreement (Recreation Agreement). Filed as an Appendix to the Recreation Agreement was a single Recreation Management Plan (RMP) for both Projects including proposed recreation PM&E measures. Signatories to the Recreation Agreement included FirstLight, National Park Service (NPS), Massachusetts Department of Conservation and Recreation (MDCR), Towns of Erving, Gill, Montague and Northfield, AW, AMC, CAW, NE FLOW, ZO, Access Fund, Franklin Regional Council of Governments (FRCOG), and Western Massachusetts Climbers Coalition (WMCC). Note that the parties to the Recreation Agreement, who are not parties to the F/F Agreement, agreed that they would not oppose the F/F Agreement but reserved the right to advocate for conditions related to the prevention and mitigation of erosion in the TFI.

Similar to the F/F Agreement, FERC noticed the Recreation Agreement and requested stakeholder comments be filed by July 10, 2023. Comment letters were filed and FirstLight responded to the comments in its July 25, 2023, filing. Also during this period, on November 9, 2023, FERC issued FirstLight three AIRs pertaining to the Recreation Agreement, which FirstLight responded to on December 11, 2023.

While a Memorandum of Understanding in Principle was filed with FERC, FirstLight, Nolumbeka Project, Inc, Elnu Abenaki Tribe and Chaubunagungamaug Band of Nipmuck Indians have not yet reached agreement. Similarly, although there were several settlement meetings pertaining to shoreline erosion, no agreement has been achieved.

4 Project Benefits and Project Value in Meeting Commonwealth Decarbonization Goals and Community Benefits

4.1 Project Benefits

FirstLight is a leading clean power producer, developer and energy storage company serving North America with a portfolio that includes over 1.6 gigawatts (GW) of pumped-hydro storage, battery storage, hydroelectric generation, and solar generation and a 4+ GW development pipeline of hydro, solar, battery, onshore and offshore wind projects.

The 62.016 megawatt (MW) Cabot Station is the fourth largest conventional hydroelectric station in New England and the largest in Massachusetts. Cabot Station operates to meet peak demand and provide voltage control and reserve capacity, producing an average of 332,351 megawatt hours (MWh) per year of renewable carbon-free energy. The 5.693 MW Station No. 1 operates 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). Station No. 1 produces an average of 18,341 MWh per year of renewable energy. Combined, Cabot and Station No. 1 facilities generate enough renewable energy to power approximately 48,500⁵ Massachusetts homes each year. Through power purchase agreements, these facilities support 21 different municipalities in Massachusetts in their efforts to comply with the Commonwealth's climate mandates.

The 1,166.8 MW Northfield Mountain Project is the region's largest energy storage project. Built initially to store excess nuclear energy during nighttime hours, the Northfield Mountain Project is now the perfect complement to large amounts of intermittent renewables such as solar and offshore wind as New England's electric supply transitions to meet regional carbon and greenhouse gas emission targets. Northfield Mountain can generate enough clean electricity to power approximately 1.3 million homes for up to 7.5 hours and is the largest source of energy storage capacity in New England. The Northfield Mountain Project's ability to store 8,729 MWhs of energy, its large MW capacity, and its ability to rapidly ramp up electric production 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 growth and penetration of intermittent renewable energy. Most other fast-start resources are less than 100 MW in comparison, and many are fossil-fuel generators. ISO-NE calls on Northfield Mountain to rapidly deploy significant amounts of electricity to balance the electric grid as needed, preventing power outages. Northfield is also often relied upon to support grid operations when there is excess renewable energy on the system, absorbing large quantities of electricity and helping to avoid the necessity to curtail solar and wind generation.

As described earlier, the Upper Reservoir was built to accommodate an operating range between 920 and 1,004.5 feet or a storage capacity of 15,327 acre-feet, equivalent to about 10,779 MWhs of stored energy. FirstLight is proposing to expand the operating limits to increase its energy storage capabilities, which will enable the Northfield Mountain Project to generate electricity for more than 10 hours. On October 18,

⁵ Assumes 7,237 MWh per month consumption per home, per EIA 2020 Massachusetts figures.

2017, [ISO-New England filed a letter with FERC](#) supporting FirstLight's request for a temporary amendment to increase the storage capacity, as described above, to assure reliable electric service.

4.2 Turners Falls and Northfield Mountain Projects Importance to Achieving Massachusetts Decarbonization Goals

FirstLight's Projects are the largest hydro and energy storage assets in Massachusetts and are already contributing, as emissions-free sources of energy generation, to the Commonwealth's efforts to decarbonize the electric grid in order to meet its climate mandate of net zero emissions by 2050, as required by the *Next Generation Roadmap Act*, signed into law in 2021.⁶

In December 2020, EEA published a report entitled *Massachusetts 2050 Decarbonization Roadmap* ("2050 Roadmap Study").⁷ The goal of the 2050 Roadmap Study was to provide the Commonwealth with a comprehensive understanding of the necessary strategies and transitions in the near- and long-term to achieve Net Zero by 2050 using best available science and research methodology. In 2022, the 2050 Roadmap Study was followed by EEA's report *Massachusetts Clean Energy and Climate Plan for 2025 and 2030* (2025 Clean Energy Plan) which laid out interim targets, including objectives to achieve 50% reduction in greenhouse gas emissions by 2030.⁸ Both of these documents discuss the importance of hydropower and additional renewable energy and battery storage in achieving the Commonwealth's goals of decarbonizing its electric grid.

The 2050 Roadmap Study stated:

- *"Although highly reliable and predictable on a daily and seasonal basis, renewable resources such as wind and solar power must be complemented by a range of resources both on the demand-side and on the supply-side, due to their inherent variability and in order to ensure the reliability of the electricity grid in every hour of the year."*
- The report further stated, relative to hydropower: *"Particularly in this respect, the abundant hydropower available in New England, New York, Quebec, and New Brunswick represents a valuable resource for New England. The cumulative quantity of stored energy in dammed reservoirs is a key solution to balance and manage a regional electricity system with high penetrations of renewable generation. Unlike most traditional dispatchable generation resources, such as coal power, gas generators, and oil plants, hydropower is a clean generation resource that is nevertheless highly controllable and effectively dispatchable at-will."*

Similarly, national and international energy agencies have recognized the importance and established value of hydropower and pumped energy storage.

- US Department of Energy:
*"Pumped storage hydropower (PSH) is currently the only source of long-duration energy storage that has been widely commercialized"*⁹ and represents 96% of all utility-scale energy storage in US.
- National Renewable Energy Laboratory (NREL):

⁶ Link to the report is here: [Session Law - Acts of 2021 Chapter 8 \(malegislature.gov\)](#)

⁷ Link to the report is here: [MA Decarbonization Roadmap | Mass.gov](#)

⁸ Link to the report is here: [Massachusetts Clean Energy and Climate Plan for 2025 and 2030 | Mass.gov](#)

“Pumped Storage Hydro (PSH) has a unique ability to enable utility-scale energy storage... making it extremely valuable to the existing and future grid. PSH can act as a renewable energy bank that can switch on when power is needed. That kind of flexibility makes it a great complement to other variable clean energy sources like wind and solar.”¹⁰

- International Energy Agency (IEA):

“Hydropower currently generates more electricity than all other renewable technologies combined and is expected to remain the world’s largest source of renewable electricity generation into the 2030s. Thereafter, it will continue to play a critical role in decarbonizing the power system and improving system flexibility. While hydro is expected to be eventually overtaken by wind and solar, it will continue to play a key role as a dispatchable power source to back up variable renewables. Pumped storage could also potentially play a major role in balancing out variations in solar and wind generation. Hydropower plants, especially of the reservoir type, are the most suited to providing the power system with much needed emissions-free flexibility.”¹¹

As Massachusetts looks to incorporate significant amounts of additional renewable energy to achieve net zero, including a minimum of 25 GW of offshore wind, there will be an increasing need for utility-scale energy storage and generation assets that can be rapidly deployed to balance the electric grid. However, Massachusetts is faced with several challenges in bringing new renewables onto the electric grid, including difficulties in the process of siting and permitting new projects, ongoing supply chain issues, and interconnection delays, all of which result in increased costs to electric ratepayers and delays in meeting climate targets. This has further emphasized the need to maximize the use of the existing emissions free resources, and to fully utilize the existing longer-duration energy storage resources that ultimately reduce the number of new renewable resources needed to meet net zero climate mandates.

As existing facilities, the Northfield Mountain Project and Turners Falls Project bring long-lasting benefits towards achieving the state’s climate mandates. The hydroelectric power produced at the Turners Falls Project and hydroelectric power and energy storage provided by the Northfield Mountain Project are critical assets in achieving the Commonwealth’s decarbonization goals and supporting the resiliency of a rapidly changing electric grid with increasingly variable resources. Specific climate benefits that the Northfield Mountain Project brings to the Commonwealth include:

Carbon Emissions Reductions: Given the expected power generation mix in Massachusetts and New England through 2030, the Northfield Mountain Project offers a means of reducing carbon emissions. By pumping when the marginal electric generating unit emits zero or low carbon and generating to displace units that are more carbon intensive (e.g., gas, oil or coal units), the Northfield Mountain Project reduces carbon emissions.

Peak Price Shaving and Reduced Cost to Load: The Northfield Mountain Project storage is used to reduce cost to load in Massachusetts and New England. By generating during the hours of highest demand, the Northfield Mountain Project can shave peak prices and realize significant price reductions for ratepayers by minimizing the use of more expensive fossil-fired peaking plants. This is particularly notable during

winter peaking operations when carbon-intensive resources like oil and older gas peaking facilities are used most frequently.

Improved Energy Security: The Northfield Mountain Project offers a means to reduce reliance on natural gas during winter months by pumping when more efficient resources are on the margin and dispatching when fossil-fired peaking plants would otherwise operate. The Northfield Mountain Project supports the transformation of New England’s electric supply towards intermittent resources like solar and wind by balancing the grid.

Ramping Capability and Reserves: As an increasing amount of renewables enter into the system, the need for fast-acting ramping reserves also increases. The Northfield Mountain Project’s ability to ramp up production quickly protects against sudden drops in wind and solar energy supply. As more renewables come online, ISO-NE will need to ensure that it procures adequate ramping capability to cover intra-hour and inter-hour losses of renewable generation, ensuring the grid is reliable and resilient.

4.3 Community Benefits

In addition to the benefits around grid resilience and decarbonization, the Projects provide many benefits to local communities, including environmental justice communities in Montague and Greenfield.

Economic Benefits

FirstLight's Projects are important contributors to the local economy:

- FirstLight is an important employer in Franklin County, providing **more than 50 jobs**, including union-labor, to Massachusetts residents, contributing to the overall health of the economy and local rates of employment in Western Massachusetts.
- FirstLight is the largest taxpayer in the towns of Erving, Gill, Montague, and Northfield. In 2023, the Projects paid **more than \$15.6 million** in property taxes to its host communities.
- The energy storage operations of the Northfield Mountain Project saves electric ratepayers money. A great example of this occurred during a recent outage for planned maintenance in the Fall of 2023. According to ISO-NE, “fossil fuel-fired units filled the need for fast-start generation and required more uplift than pumped-storage generators due to higher operating costs.” According to ISO-NE, the use of the fossil fuel-fired units contributed to increased ratepayer costs of **\$4.4 million**.⁹
- FirstLight’s facilities and events support the recreation and tourism industry that brings in over **\$79 million** annually to Franklin County.
- FirstLight purchases goods and services from many Massachusetts-based vendors, spending nearly **\$35 million** in the local Massachusetts economy since 2020.

⁹ [2023-fall-quarterly-markets-report.pdf \(iso-ne.com\)](https://www.iso-ne.com/markets-and-operations/market-operations/2023-fall-quarterly-markets-report.pdf)

- [FirstLight Sustains](#) is a competitive grant program to improve the quality of life in the communities where FirstLight's US facilities are located. In 2023, FirstLight provided more than **\$220,000** in total charitable giving to 39 local organizations here in New England.

Recreation Benefits

As part of FirstLight's commitment to environmental awareness and sustainability, FirstLight invests approximately **\$1 million** annually to maintain and operate year-round nature trails, recreation spaces, and environmental programs at the facilities. These activities are enjoyed by approximately **100,000 visitors** annually.

Outdoor recreation is vital to the economy of Franklin County and plays a major role in shaping the identity of this area. The recreation facilities provided by FirstLight are a critical part of the regional network of recreational assets that enhance the lives of those who reside or work here and attract visitors to the region. Supporting projects that enhance outdoor adventure, recreation and cultural tourism was among the top strategic goals for the 2021 regional economic development plan for Franklin County. In support of this goal and in line with FirstLight's responsibility to steward and provide access to the shared spaces it maintains, FirstLight is committed to working with host communities and regional stakeholders to maintain and improve its recreational facilities and to protect cultural and natural resources located in the Project Areas.

Examples of FirstLight's ample recreation resources include:

- *Northfield Mountain Recreation and Environmental Visitor Center and Trails:* FirstLight offers a wide variety of recreational opportunities and environmental and recreation programs, including a four-season recreation facility, with satellite facilities located along a 7-mile stretch of the Connecticut River. FirstLight maintains 26 miles of trails that offer year-round activities, including cross-country skiing, classical skiing, snowshoeing, hiking and biking. Visitors can take advantage of ski and snowshoe rentals, restrooms, a visitor center, and yurt and pavilion rentals.
- *Connecticut River boat cruise:* Visitors and students can enjoy a narrated 1 ½ hour cruise on FirstLight's scenic riverboat, taking in the picturesque sites and history of the Connecticut River.
- *Watercraft rentals:* FirstLight provides watercraft rentals for recreation at Barton Cove including canoes, kayaks, and stand-up paddleboards.
- *Barton Cove and Munn Ferry Campgrounds:* FirstLight provides tent camping sites for visitors to rent along the Connecticut River.
- *Turners Falls Fishway:* Staffed by FirstLight's knowledgeable guides, visitors and students can learn and enjoy watching American shad, sea lamprey and other anadromous fish make their way up the Connecticut River as they begin their annual spring migration.
- *Programming for local students and residents:* FirstLight offers regular nature and educational programming to the public, including monthly nature art programming for children. FirstLight is also committed to being inclusive in providing access to its recreation facilities. Seasonally, FirstLight provides library passes to the local libraries in Erving, Gill, Montague, and Northfield for free watercraft rentals (summer) and cross-country skiing trail passes and equipment rentals (winter). To increase accessibility, in 2024 FirstLight was certified as an Autism WelcomingSM organization by the Autism Alliance, and beginning in Spring 2024, FirstLight will offer sensory-friendly programming and recreation opportunities at the Turners Falls Fishway and on the Connecticut River boat cruise.

Recreation Settlement Agreement

In June 2023, FirstLight reached a Recreation Settlement Agreement on recreation issues with 16 stakeholders, including FirstLight, MDCR, the Towns of Gill, Montague, Erving, and Northfield, FRCOG, NPS, AMC, Access Fund, 3 boating groups, and the Western MA Climbers Association. Dozens of newly constructed recreation facilities, significant enhancements to existing facilities, and new programs totaling **nearly \$6 million** will be designed to provide increased and safer access to the river, increase available recreational activities, and improve public awareness of the Projects' recreation offerings. Further details of the settlement agreement are provided in [Section 5.3](#). A high-level summary of the Recreation Settlement Agreement includes the following:

- New campsites, new canoe/kayak put-ins at Unity Park, and two new put-ins just below Turners Falls Dam.
- Improved take-out at Poplar Street.
- Two new pocket parks in Northfield, and a new picnic area and viewing platform overlooking the dam in Montague.
- Five new miles of mountain biking trails at Northfield Mountain.
- Access for rock climbing in Erving.
- Conservation easements on 761 acres of FirstLight lands along the Connecticut River.
- Conserve, via a permanent trail easement, the approximately 1.3-mile-long portion of the New England National Scenic Trail in the Northfield Mountain Project Boundary.
- Access improvements at Cabot Woods and establishing a new portage around Rock Dam.
- Variable flow releases to support recreational boating.
- Install interpretive cultural signage at key locations in consultation with the Nolumbeka Project Inc., Elnu Abenaki Tribe, and the town of Montague Historical Commission.
- ADA improvements implemented wherever possible at recreation sites, including an ADA-accessible dock at Riverview Park.
- Real-time and forecasted flow and water level data webpage to facilitate safe recreational use of the Project area.
- Creation of a Recreation Advisory Group to address shorter-term recreation needs, intended to supplement the ten-year periodic reviews committed in the RMP.
- Enhanced promotion of Project recreation facilities with local communities and organizations, including Environmental Justice communities, Indigenous communities, those with disabilities, visitors to the region, residents, and local communities and organizations.

Environmental Stewardship

FirstLight takes very seriously the preservation and stewardship of over **4,000 acres** of land surrounding its Projects in Massachusetts. In addition to active monitoring, land management, and permitting efforts throughout the Project Boundary, FirstLight has made significant investments in **approximately 10.3 miles** of riverbank stabilization, restoration, and protection projects in support of the local environment and ecology. We remain committed to ensuring those investments continue to perform as expected.

Riverbank Stabilization

Since inception of the 1998 Erosion Control Plan, FirstLight (or its predecessors) have stabilized 26,125 linear feet of banks throughout the Turners Falls Impoundment. In general, these projects have succeeded in meeting the objectives of the Erosion Control Plan by stabilizing eroding slopes, protecting adjacent property, and reducing sediment loading to the river. In addition to the 26,125 linear feet of TFI banks that have been stabilized since 1998, previous stabilization work associated with construction of the Northfield Mountain Project totaled 25,900 feet of rip-rap or rip-rap with vegetation with an additional 2,600 feet of grading and planting. An additional 2,000 feet of experimental stabilization was also constructed by the United States Army Corps of Engineers (USACE) in the 1970s. Overall, approximately 56,625 linear feet (10.7 miles, which includes the 2,000 feet of experimental stabilization) of TFI banks have been stabilized through construction of the Northfield Mountain Project, implementation of the Erosion Control Plan, or other efforts (e.g., USACE). The cost to repair the sites in the Erosion Control Plan is **approximately \$18,000,000 in 2024 dollars**.

Source to Sea Cleanup

FirstLight has supported and participated in the Connecticut River Conservancy's Source to Sea Cleanup for 27 years. This effort has resulted in 4,285 volunteers removing 1,600+ cubic yards of debris from eastern Franklin County, Massachusetts communities. FirstLight's annual organizing efforts for the event include marketing, registration, site selection, coordinating waste removal, providing supplies, training volunteers, and tracking and sharing results.

Invasive Plant Species

FirstLight has helped to manage invasive Water chestnut, *Trapa natans*, around power generation facilities and recreation facilities for 14 years. In recent years, CRC has taken over the watershed wide Water chestnut management and FirstLight continues to collaborate with CRC and other long-time volunteers. FirstLight's efforts have largely been focused in areas that are typically deemed too dangerous for the public to boat in. This allows FirstLight's rigorous safety culture to be applied to the areas between the boat barrier and Turners Falls Dam and in the Turners Falls Power Canal.

Land Conservation

As part of the Recreation Settlement Agreement, FirstLight has agreed to place lands it owns that are not used for specific Project activities (e.g., power production, Project recreation facilities, etc.) along the TFI shoreline, into conservation easement/restriction to maintain riparian buffers. FirstLight will also permanently conserve its lands within Bennett Meadow and via permanent trail easement the about 1.3-mile-long portion of the New England National Scenic Trail in the Northfield Mountain Project Boundary. Collectively, the conservation easements/restrictions equate to **761.4 acres**.

4.4 Community Benefits -Fish Passage and Operation

Fish Passage and Connecticut River Flows Settlement Agreement:

In early 2023, FirstLight reached a Fish Passage and Flows Agreement (F/F Agreement) on fish passage and river flow regime for the new license that was filed with FERC on March 31, 2023. Signatories included FirstLight, MDFW, USFWS, NMFS, TNC, American Whitewater, AMC, Zoar Outdoor, Crabapple Whitewater, and New England FLOW. The F/F Agreement addressed issues pertaining to fish passage,

flows for fishery, ecological conservation, recreation purposes, and protected, threatened, and endangered species for relicensing of the Northfield Mountain and the Turners Falls Projects. Total cost is estimated at **more than \$152 million** in capital improvements and **approximately \$200 million** in reduced future revenue. A high-level summary of the F/F Agreement (further details included at [Sections 5.1](#) and [5.2](#)) relative to operational changes is summarized below:

- Significant increase in bypass flows and flows below Cabot Station to provide fish passage through the bypass, protect aquatic resources, and increase spawning habitat for the federally endangered Shortnose Sturgeon and American Shad.
- Ramping rate restrictions to protect Shortnose Sturgeon spawning and incubation, protect state-listed odonates and protect downstream flora and fauna.
- Maintaining stable flow regime below Cabot Station to protect state-endangered Cobblestone Tiger Beetle, federally endangered Puritan Tiger Beetle and Shortnose Sturgeon, and state-listed odonates.
- Variable releases from Station No. 1 and Turners Falls Dam to support recreational boating.

Relative to fish passage, the F/F Agreement requires FirstLight to install a new fish lift at the Turners Falls Dam as the significantly higher bypass flows will attract migratory fish to the new fish lift entrance. Signatories to the F/F Agreement agreed that moving all upstream fish passage to one location at the Turners Falls Dam was preferred to having migratory fish passage at Cabot Station where fish entering the canal had poor passage efficiency. FirstLight will also install temporary American eel passage structures while studying their placement and effectiveness before eventually installing permanent structures.

In addition to upstream passage, FirstLight has proposed several measures for downstream passage including a barrier net around the Northfield Mountain Project intake/tailrace, a plunge pool below a portion of the Turners Falls Dam, an exclusion bar rack at Station No. 1 and upgrades to the Cabot Station downstream fish passage structure.

To ensure the efficacy of the upstream and downstream fish passage facilities, two years of effectiveness testing will be conducted at any new fish passage facility and if the fish passage efficiency and time-to-pass performance criteria are not achieved, FirstLight and the federal and state agencies will consult to identify adaptive management measures, which are already outlined in the F/F agreement. Further details on the upstream and downstream fish passage facilities, performance criteria and adaptive management measures are discussed in detail in [Section 5.2](#).

The process of reaching the F/F and Recreation Settlement Agreements was years-long and included significant engagement with stakeholders and careful balancing of competing priorities. In all cases, FirstLight relied on the input of stakeholders and science backed by over 40 studies to guide its efforts, and FirstLight is grateful to the many stakeholders who participated in this process.

Additional environmental stewardship measures proposed by FirstLight under the license include erosion mitigation measures (see [Section 5.4](#)), invasive plant species management plans (see [Appendix B](#) for the Turners Falls and [Appendix C](#) for the Northfield Mountain Project invasive plant species management plans), and protection for bald eagles (see [Section 5.3](#)) and bats (see [Section 5.7](#)).

5 FirstLight Comprehensive Proposal

The following sections include FirstLight’s comprehensive proposal for the Turners Falls and Northfield Mountain Projects for the 401 Application. It reflects the agreements in the F/F Agreement, Recreation Agreement, other PM&E measures included in the AFLA, and other measures to address impairments in the TFI.

[Section 5.1](#) and [5.2](#) include the Draft License Articles (verbatim) that were contained in the F/F Agreement regarding Project operations and fish passage, respectively. Note that several of the Draft License Articles include footnotes. Any footnotes are included at the end of the Draft License Article.

[Section 5.3](#) summarizes the recreation enhancements included in the Recreation Management Plan. The remaining sections include various protection measures and management plans.

[Section 5.4](#) summarizes the Sediment Management Plan and Periodic Dredging of the Upper Reservoir Intake Channel.

[Section 5.5](#) includes background on the BSTEM model, a summary of the BSTEM modeling results of the F/F Agreement and FirstLight’s Streambank Erosion Proposal.

[Section 5.6](#) and [5.7](#) discuss bald eagle protection plans and bat protection measures, respectively.

[Section 5.8](#) includes Invasive Plant Species Management Plans that have been updated from the versions filed with the AFLA.

5.1 Project Operations

5.1.1 Turners Falls Project

Article A100. Station No. 1 Upgrades

Within 3 years of license issuance, the Licensee shall automate Station No. 1 such that it is capable of being operated remotely and over a range of flows. The Licensee shall submit design plans to the Commission for automating Station No. 1. Upon Commission approval, the Licensee shall automate Station No. 1, including any changes required by the Commission.

Article A110. Minimum Flows below Turners Falls Dam

Upon license issuance, the Licensee shall discharge from the Turners Falls Dam or from the gate located on the power canal (“canal gate”) just below the Turners Falls Dam the following seasonal minimum flows.

Date	Minimum Flows below Turners Falls Dam
01/01-03/31 ¹	<ul style="list-style-type: none"> • If the Naturally Routed Flow (NRF- definition provided later in this article) is ≤ 400 cubic feet per second (cfs), the Minimum Flow below Turners Falls Dam shall be 400 cfs or the NRF, whichever is less. • If the NRF is > 400 cfs, the Minimum Flow below Turners Falls Dam shall be 400 cfs.
04/01-05/31	<ul style="list-style-type: none"> • If the NRF is $\leq 6,500$ cfs, the Minimum Flow below Turners Falls Dam shall be 67% of the NRF. • If the NRF is $> 6,500$, the Minimum Flow below Turners Falls Dam shall be 4,290 cfs.
06/01-06/15 ^{2,3}	<ul style="list-style-type: none"> • If the NRF is $\leq 4,500$ cfs, the Minimum Flow below Turners Falls Dam shall be 67% of the NRF. • If the NRF is $> 4,500$ cfs, the Minimum Flow below Turners Falls Dam shall be 2,990 cfs.
06/16-06/30 ³	<ul style="list-style-type: none"> • If the NRF is $\leq 3,500$ cfs, the Minimum Flow below Turners Falls Dam shall be 67% of the NRF. • If the NRF is $> 3,500$ cfs, the Minimum Flow below Turners Falls Dam shall be 2,280 cfs.
07/01-11/15 ¹	<ul style="list-style-type: none"> • If the NRF is ≤ 500 cfs, the Minimum Flow below Turners Falls Dam shall be 500 cfs or the NRF, whichever is less. • If the NRF is > 500 cfs, the Minimum Flow below Turners Falls Dam shall be 500 cfs.
11/16-12/31 ¹	<ul style="list-style-type: none"> • If the NRF is ≤ 400 cfs, the Minimum Flow below Turners Falls Dam shall be 400 cfs or the NRF, whichever is less. • If the NRF is > 400 cfs, the Minimum Flow below Turners Falls Dam shall be 400 cfs.

¹From November 16 through March 31, the 400 cfs minimum flow below Turners Falls Dam will be provided from the canal gate, having a design maximum capacity of 400 cfs. The Licensee shall open the canal gate to its maximum opening and implement ice mitigation measures, if necessary, to maintain the maximum opening. The Licensee shall monitor canal gate operations to determine if supplemental measures, such as cable-heating the gate, are needed to maintain flows at or as close to 400 cfs as possible.

²One of the upstream fish passage adaptive management measures (AMMs) described in Article A330 calls for increasing the Total Minimum Bypass Flow below Station No. 1 (see Article A120) from June 1 to June 15 from 4,500 cfs to 6,500 cfs. If this AMM is enacted, and if the NRF is $\leq 6,500$ cfs, the Minimum Flow below the Turners Falls Dam shall be 67% of the NRF, subject to the conditions in Article A330. If this AMM is enacted, and if the NRF is $> 6,500$ cfs, the Minimum Flow below the Turners Falls Dam shall be 4,290 cfs, subject to the conditions in Article A330.

³The magnitude of the Minimum Flow below Turners Falls Dam from June 1 to June 30 may be modified in the future pending fish passage effectiveness studies (see Article A330). If the Licensee conducts fish passage effectiveness studies, in consultation with the Massachusetts Division of Fisheries and Wildlife (MDFW), National Marine Fisheries Service (NMFS), and United States Fish and Wildlife Service (USFWS)

and determines that migratory fish are not delayed by passing a greater percentage of the Total Minimum Bypass below Station No. 1 (see Article A120) via Station No. 1 discharges, the Licensee may file for a license amendment to increase the Station No. 1 discharge upon written concurrence of MDFW, NMFS, and USFWS. Prior to filing for a license amendment with the Commission, the Licensee shall consult the Massachusetts Department of Environmental Protection (MDEP) and address any of its comments in the license amendment filing.

Definition of Naturally Routed Flow

From December 1 through June 30, the NRF is defined as the hourly sum of the discharges from 12 hours previous as reported by the: Vernon Hydroelectric Project (FERC No. 1904), Ashuelot River United States Geological Survey gauge (USGS, Gauge No. 01161000), and Millers River USGS gauge (Gauge No. 01166500).

From July 1 through November 30, the NRF is defined as the hourly sum of the discharges averaged from 1 to 12 hours previous as reported by the: Vernon Hydroelectric Project, Ashuelot River USGS gauge, and Millers River USGS gauge. Upon license issuance until 3 years thereafter, the Licensee shall operate the Turners Falls Project based on the NRF computational method from July 1 through November 30 to determine if the Turners Falls Project can be operated in this manner. If the Turners Falls Project cannot be operated in this manner, the Licensee shall consult MDFW, NMFS, and USFWS on alternative means of computing the NRF that are feasible for Turners Falls Project operation and sufficiently dampen upstream hydroelectric project flexible operations.

The Minimum Flow below Turners Falls Dam may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Minimum Flow below Turners Falls Dam is so modified, the Licensee shall notify the Commission, MDEP, MDFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The Minimum Flow below Turners Falls Dam may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MDEP, MDFW, NMFS and USFWS, and upon 5 days' notice to the Commission.

Article A120. Total Minimum Bypass Flows below Station No. 1

Upon license issuance, the Licensee shall maintain the Total Minimum Bypass Flows below Station No. 1 as follows:

Date	Total Minimum Bypass Flows below Station No. 1¹
01/01-03/31	<ul style="list-style-type: none"> • If the NRF is \leq 400 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 400 cfs, or the NRF, whichever is less. • If the NRF is $>$ 400 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 1,500 cfs, or the NRF, whichever is less.
04/01-05/31	<ul style="list-style-type: none"> • If the NRF is \leq 6,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF. • If the NRF is $>$ 6,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 6,500 cfs.
06/01-06/15 ^{2,4}	<ul style="list-style-type: none"> • If the NRF is \leq 4,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF.

Date	Total Minimum Bypass Flows below Station No. 1 ¹
	<ul style="list-style-type: none"> • If the NRF is > 4,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 4,500 cfs.
06/16-06/30 ⁴	<ul style="list-style-type: none"> • If the NRF is ≤ 3,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF. • If the NRF is > 3,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 3,500 cfs.
07/01-08/31 ³	<ul style="list-style-type: none"> • If the NRF is ≤ 500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 500 cfs, or the NRF, whichever is less. • If the NRF is > 500 cfs and ≤ 1,800 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF or 90% of the NRF. • If the NRF is > 1,800 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,800 cfs, or 90% of the NRF, whichever is less.
09/01-11/15 ³	<ul style="list-style-type: none"> • If the NRF is ≤ 500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 500 cfs, or the NRF, whichever is less. • If the NRF is > 500 cfs and ≤ 1,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF, or 90% of the NRF. • If the NRF is > 1,500 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,500 cfs, or 90% of the NRF, whichever is less.
11/16-12/31 ³	<ul style="list-style-type: none"> • If the NRF is < 400 cfs, then the Total Minimum Bypass Flow below Station No. 1 shall be 400 cfs, or the NRF, whichever is less. • If the NRF is > 400 cfs and ≤ 1,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF or 90% of the NRF. • If the NRF is > 1,500 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,500 cfs, or 90% of the NRF, whichever is less.

¹From license issuance until 3 years thereafter, Station No. 1 will not be automated. During those 3 years, if Station No. 1 is the only source, other than the Fall River, Turners Falls Hydro, LLC, or Milton Hilton, LLC to provide the additional flow needed to meet the Total Minimum Bypass Flow below Station No. 1, the Licensee shall maintain the Station No. 1 discharge such that the Turners Falls Dam Minimum Flow will be as shown in Article A110, or higher flows, in cases where the additional flow cannot be passed through Station No. 1.

²One of the upstream fish passage adaptive management measures (AMMs) described in Article A330 calls for increasing the Total Minimum Bypass Flow below Station No. 1 from June 1 to June 15 from 4,500 cfs to 6,500 cfs. If this AMM is enacted, and if the NRF is ≤ 6,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be the NRF, subject to the conditions in Article A330. If this AMM is enacted, and the NRF > 6,500 cfs, the Total Minimum Bypass Flow below Station No. 1 is 6,500 cfs, subject to the conditions in Article A330.

³From July 1 to August 31, when the NRF is greater than 1,800 cfs, the Total Minimum Bypass Flow below Station No.1 shall be 1,800 or 90% of the NRF, whichever is less. From September 1 to December 31, when the NRF is greater than 1,500 cfs, the Total Minimum Bypass Flow below Station No. 1 shall be 1,500 cfs or 90% of the NRF, whichever is less. From July 1 to December 31, if the Total Minimum Bypass Flow

below Station No. 1 shall be reduced by 10%, it will not be taken from the Turners Falls Dam Minimum Flow (Article 110).

⁴The amount of flow needed from Station No. 1 from June 1 to June 30 may be modified in the future pending fish passage effectiveness studies. If the Licensee conducts fish passage effectiveness studies, in consultation with the MDFW, NMFS, and USFWS and determines that migratory fish are not delayed by passing a greater percentage of the Total Minimum Bypass Flow below Station No. 1 via Station No. 1 discharge, the Licensee may file for a license amendment to increase the magnitude of Station No. 1 discharge upon written concurrence of MDFW, NMFS, and USFWS. Prior to filing for a license amendment with the Commission, the Licensee shall consult AW, AMC, CAW, MDEP, NEF and ZO and address any comments of those entities in the license amendment filing.

If the Station No. 1 units are used to maintain the Total Minimum Bypass Flow below Station No. 1, and if some or all of the Station No. 1 units become inoperable, the balance of the flow needed to maintain the Total Bypass flow below Station No. 1 will be provided from either the Turners Falls Dam Minimum Flow (dam or canal gate), Fall River, Turners Falls Hydro, LLC or Milton Hilton, LLC.

The Total Minimum Bypass Flow below Station No. 1 may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Total Minimum Bypass Flow below Station No. 1 is so modified, the Licensee shall notify the Commission, MDEP, MDFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The total bypass flow below Station No. 1 may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MDEP, MDFW, NMFS, and USFWS, and upon 5 days' notice to the Commission.

Article A130. Minimum Flows below Cabot Station

Upon license issuance, the Licensee shall maintain Minimum Flows below Cabot Station, or the NRF, whichever is less, as follows.

Date	Minimum Flow below Cabot Station
01/01-03/31	3,800 cfs or the NRF, whichever is less
04/01-05/31	8,800 cfs from midnight to 7:00 pm or the NRF, whichever is less and 6,500 cfs from 7:00 pm to midnight or the NRF, whichever is less.
06/01-06/15	6,800 cfs or the NRF, whichever is less
06/16-06/30	5,800 cfs or the NRF, whichever is less
07/01-08/31 ¹	1,800 cfs or 90% of the NRF, whichever is less
09/01-11/15 ¹	1,500 cfs or 90% of the NRF, whichever is less
11/16-11/30 ¹	1,500 cfs or 90% of the NRF, whichever is less
12/01-12/31	3,800 cfs or NRF, whichever is less

¹From July 1 to November 30, the Minimum Flow below Cabot Station is 1,800 (07/01-08/31) and 1,500 cfs (09/01-11/30) or 90% of the NRF, whichever is less. If the Minimum Flow below Cabot Station is reduced by 10% during these periods, it will not be taken from the Turners Falls Dam Minimum Flow (Article A110).

The Minimum Flow below Cabot Station may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Minimum Flow below Cabot Station is so modified, the Licensee shall notify the Commission, MDEP, MDFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The Minimum Flow below Cabot Station may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MDEP, MDFW, NMFS and USFWS, and upon 5 days' notice to the Commission.

Article A140. Cabot Station Ramping Rates

Upon license issuance until 3 years after license issuance, the Licensee shall ramp Cabot Station as follows.

Date	Cabot Station Ramping Rates¹
04/01-06/30	Up and Down Ramping at a rate of 2,300 cfs/hour
07/01-08/15	Up Ramping at a rate of 2,300 cfs/hour from 8:00 am to 2:00 pm

Three years after license issuance, the Licensee shall ramp Cabot Station as follows.

Date	Cabot Station Ramping Rate¹
04/01-06/30	Up and Down Ramping at a rate of 2,300 cfs/hour

¹If the NRF is greater than the sum of the hydraulic capacity of Cabot Station and Station No. 1 and the Minimum Flow below Turners Falls Dam in effect at the time, the Cabot Station up-ramping rates will not apply.

The Cabot Station Ramping Rates above will take precedence over the Flow Stabilization below Cabot Station (Article A160).

The Cabot Station Ramping Rates may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Cabot Station Ramping Rates are so modified, the Licensee shall notify the Commission, MDEP, MDFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The Cabot Station Ramping Rate may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MDEP, MDFW, NMFS, and USFWS, and upon 5 days' notice to the Commission.

Article A150. Variable Releases from Turners Falls Dam and Variable Flow below Station No. 1

For recreation and ecological conservation purposes, upon license issuance, the Licensee shall provide variable releases from the Turners Falls Dam and a variable flow below Station No. 1 as shown below.

Variable Releases from Turners Falls Dam

Magnitude of Variable Release from Turners Falls Dam	¹ 4,000 cfs, or the NRF, whichever is less
Dates when Variable Releases may occur	² July 1 through October 31
³ Total No. of 2-day events	5 events for a total of 10 Variable Releases, but could potentially be 11 Variable Releases subject to footnote 3

Days of Variable Release for 2 day-events	Saturday and Sunday- must be two consecutive days
Hours of Variable Release	10:00 am to 2:00 pm, 4 hrs/day, Saturday and Sunday
Magnitude of Variable Release from Turners Falls Dam from Saturday at 2:00 pm to Sunday at 10:00 am.	See footnote 4
⁵ Up-Ramping Rates at Start of Variable Release	See footnote 5
⁶ Down-Ramping Rates at End of Variable Release	See footnote 6

¹If the NRF < 2,500 cfs during the scheduled variable release (see footnote 2 below relative to scheduling variable releases), there will be no variable release and it will not be rescheduled.

²The Licensee shall consult American Whitewater (AW), Appalachian Mountain Club (AMC), commercial outfitters, MDEP, MDFW, National Park Service (NPS), New England FLOW (NE FLOW), and USFWS no later than March 1 annually over the license term to develop a mutually agreeable schedule for the variable releases. When developing the schedule, there will be at least one weekend per month, between July 1 and October 31, when no variable releases are provided.

³The Licensee conducts annual canal drawdowns for maintenance purposes resulting in the NRF being passed at the Turners Falls Dam. If the canal drawdown occurs between July 1 and October 31 and the NRF is being passed either on Saturday from 10:00 am- 2:00 pm or Sunday from 10:00 am-2:00 pm, the total number of releases at the Turners Falls Dam shall remain at 10 releases. However, if the canal drawdown does not occur between July 1 and October 31 on Saturday from 10:00 am-2:00 pm or Sunday from 10:00 am-2:00 pm, the Licensee shall provide an additional consecutive day of variable release such that one of the 2-day events is a 3-day consecutive event resulting in a total of 11 releases. The additional day shall either be Friday from 10:00 am-2:00 pm before the scheduled weekend variable release or Monday from 10:00 am-2:00 pm after the scheduled weekend variable release. If there ends up being one 3-day event, the magnitude of release from Friday at 2:00 pm to Saturday at 10:00 am (or Sunday at 2:00 pm to Monday at 10:00 am), shall be computed as noted in footnote 4.

⁴This flow will be calculated as: [(Variable Flow Release- Minimum Flow below Turners Falls Dam as defined in Article A110)/2]. If there is a 3-day event as noted in footnote 3, the variable flow release from Friday at 2:00 pm to Saturday at 10:00 am (or from Sunday at 2:00 pm to Monday at 10:00 am) will be based on the same calculation.

⁵At the beginning of the variable release, if the NRF is > 4,000 cfs, the Licensee shall up-ramp from the Minimum Flow below Turners Falls Dam as defined in Article A110 to 4,000 cfs in two hours, not to exceed 2,000 cfs/hr.

At the beginning of the variable release, if the NRF is between 2,500 and 4,000 cfs, the Licensee shall up ramp at 50% of the NRF per hour.

⁶At the end of the variable release, if Turners Falls Dam variable release is between 2,500 and 4,000 cfs, the Licensee shall down ramp at 50% of the variable release per hour.

Variable Flow below Station No. 1

Magnitude of Variable Flow below Station No. 1	¹ 2,500 cfs, or the NRF, whichever is less
Dates when Variable Flow may occur	² July 1 through October 31
Total No. of 2-day events	7 events for a total of 14 Variable Flows
Days of Variable Flow	Saturday and Sunday- must be two consecutive days
Hours of Variable Flow	10:00 am to 2:00 pm, 4 hrs/day
Magnitude of Variable Flow below Station No. 1 from Saturday at 2:00 pm to Sunday at 10:00 am.	See Footnote 3

¹If the NRF < 2,500 cfs, during the scheduled flow (see footnote 2 below relative to scheduling the flow), there will be no 2,500 cfs flow and it will not be rescheduled.

²The Licensee shall consult AW, AMC, commercial outfitters, MDEP, MDFW, NPS, NE FLOW, and USFWS no later than March 1 annually over the license term to develop a mutually agreeable schedule for the variable flow. When developing the schedule there will be at least one weekend per month, between July 1 and October 31, when no variable flow is provided.

³From July 1 to August 31, the Total Minimum Bypass Flow below Station No. 1 is defined in Article A120. If the NRF is > 1,800 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,800 cfs, or 90% of the NRF, whichever is less. The magnitude of flow below Station No. 1 from Saturday at 2:00 pm to Sunday at 10:00 am from July 1 to August 31 will be computed as follows:

$(2,500 \text{ cfs} + \text{Total Minimum Flow below Station No. 1 as defined in Article A120})/2$.

From September 1 to November 15, the Total Minimum Bypass Flow below Station No. 1 is defined in Article A120. If the NRF is > 1,500 cfs, the Total Minimum Bypass below Station No. 1 shall be 1,500 cfs, or 90% of the NRF, whichever is less. The magnitude of flow below Station No. 1 from Saturday at 2:00 pm to Sunday at 10:00 am from September 1 to November 15 will be computed as follows:

$(2,500 \text{ cfs} + \text{Total Minimum Flow below Station No. 1 as defined in Article A120})/2$.

When implementing the variable releases from the Turners Falls Dam or the 2,500 cfs flow below Station No. 1, the Licensee is still required to maintain the operational requirements in License Articles A110, A120, A130, A140, A160 and A190.

The above variable release from the Turners Falls Dam and variable flow below Station No. 1 may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Turners Falls Dam variable release or variable flow below Station No. 1 are so modified, the Licensee shall notify AW, AMC, commercial outfitters, MDEP, MDFW, NMFS, NPS, NE FLOW, and USFWS as soon as possible. The Turners Falls Dam variable release or variable flow below Station No. 1 may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), AW, AMC, commercial outfitters, MDEP, MDFW, NMFS, NPS, NE FLOW and USFWS.

Article A160. Flow Stabilization below Cabot Station and Allowable Deviations for Flexible Operations

Three years after license issuance, the Licensee shall maintain $\pm 10\%$ of the NRF below Cabot Station as follows.

Date	Flow Stabilization below Cabot Station ¹
04/01-05/15 ²	Provide $\pm 10\%$ of the NRF below Cabot Station from 7:00 pm to midnight, with allowable deviations up to $\pm 20\%$ of the NRF for up to 22 hours total from 04/01-05/15 (the 22 hours will be used from 7:00 pm to midnight).
05/16-05/31 ²	Provide $\pm 10\%$ of the NRF below Cabot Station from 7:00 pm to midnight, with allowable deviations up to $\pm 20\%$ of the NRF for up to 18 hours total from 05/16-05/31 (the 18 hours will be used from 7:00 pm to midnight).
06/01-06/15 ²	Provide $\pm 10\%$ of the NRF below Cabot Station with allowable deviations up to $\pm 20\%$ of the NRF for up to 7 hours total from 06/01-06/15.
06/16-06/30 ²	Provide $\pm 10\%$ of the NRF below Cabot Station with allowable deviations up to $\pm 20\%$ of the NRF for up to 7 hours total from 06/16-06/30.
07/01-08/15 ³	Provide $\pm 10\%$ of the NRF below Cabot Station with allowable deviations up to $\pm 20\%$ of the NRF for up to 55 hours total from 07/01-08/15.
08/16-08/31 ³	Provide $\pm 10\%$ of the NRF below Cabot Station with allowable deviations up to $\pm 20\%$ of the NRF for up to 27 hours total from 08/16-08/31.
09/01-10/31 ³	Provide $\pm 10\%$ of the NRF below Cabot Station with allowable deviations up to $\pm 20\%$ of the NRF for up to 44 hours total from 09/01-10/31.
11/01-11/30 ³	Provide $\pm 10\%$ of the NRF below Cabot Station with allowable deviations up to $\pm 20\%$ of the NRF for up to 11 hours total from 11/01-11/30.

¹If the NRF is greater than the sum of the hydraulic capacity of Cabot Station and Station No. 1 and the Minimum Flow below Turners Falls Dam in effect at the time, the Flow Stabilization below Cabot Station will not apply.

²From April 1 to June 30, the NRF flow may be reduced by 10% or up to 20% for select hours. If the NRF is reduced during this period, the flow will be taken from Cabot Station generation.

³From July 1 to November 30, the NRF flow may be reduced by 10% or up to 20% for select hours. If the NRF is reduced during this period, the flow will not be taken from the Turners Falls Dam Minimum Flow.

Beginning three years after license issuance, the Licensee may deviate from the Flow Stabilization below Cabot Station and Cabot Station Ramping Rates (Article A140) for a certain number of hours in July, August, September, October and November, hereinafter referred to as flexible operations.

The Licensee has restricted discretionary flexible operating capability to respond to elevated energy prices, as defined in paragraph (a) below, from July 1 to November 30, as well as unrestricted capability to respond to emergencies, Independent System Operator-New England (ISO-NE, or its successors) transmission and power system requirements, and other regulatory requirements as defined in paragraph (b) below.

- (a) The Licensee may deviate from the Flow Stabilization below Cabot Station and Cabot Station Ramping Rates (Article A140). The number of hours of flexible operations, which may be used at the discretion of the Licensee, are as follows.

Date	Allowable Deviations from Cabot Station Ramping Rates (Article A140) and Flow Stabilization below Cabot Station
07/01-07/31	20 hours of flexible operations with no more than 7 flexible events per month
08/01-08/31	26 hours of flexible operations with no more than 7 flexible events per month
09/01-09/30	23 hours of flexible operations with no more than 7 flexible events per month
10/01-10/31	20 hours of flexible operations with no more than 7 flexible events per month
11/01-11/30	28 hours of flexible operations with no more than 7 flexible events per month

- (b) If compliance with the Flow Stabilization below Cabot and Cabot Station Ramping Rates (Article A140) would cause the Licensee to violate or breach any law, any applicable license, permit, approval, consent, exemption or authorization from a federal, state, or local governmental authority, any applicable agreement with a governmental entity, the Licensee may deviate from the Flow Stabilization below Cabot and Cabot Station Ramping Rates (Article A140) to the least degree necessary to avoid such violation or breach. The Licensee may also deviate from the Flow Stabilization below Cabot and Cabot Station Ramping Rates for the following reasons:

- (1) To implement Flood Flow Operations as defined in Article A170.
- (2) To perform demonstrations of the resources' operating capabilities under ISO-NE, or its successors, rules and procedures such as, maintaining the Licensee's capacity accreditation (or its successor) or its fast start reserve eligibility. The Licensee shall seek to perform these demonstrations at times that will not cause it to deviate from the conditions in Articles A110-A160, with recognition that April 1 to June 30 should be avoided, to the maximum extent possible.
- (3) To manage the Turners Falls Impoundment to stay within its licensed operating limits in Article A190, with recognition that deviations from April 1 to June 30 should be avoided to the maximum extent possible.
- (4) If compliance with Articles A110-A160 would cause a public safety hazard or prevent timely rescue.

*ISO-NE, or its successors, (or another recognized entity with responsibilities for regional energy and capacity supply) requirements are circumstances when ISO-NE requires the Licensee to be fully available and, if necessary, responsive.

The Flow Stabilization below Cabot Station may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the Flow Stabilization below Cabot Station is so modified, the Licensee shall notify the Commission, MDEP, MDFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The Flow Stabilization below Cabot Station may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MDEP, MDFW, NMFS, and USFWS, and upon 5 days' notice to the Commission.

Article A170. Flood Flow Operations

Upon license issuance, the Licensee shall operate the Project in accordance with its existing agreement with the United States Army Corps of Engineers (USACE). This agreement, memorialized in the Reservoir and River Flow Management Procedures (1976), as it may be amended from time to time, governs how the Turners Falls Project will operate during flood conditions and coordinate its operations with the Licensee of the Northfield Mountain Pumped Storage Project (FERC No. 2485).

Article A180. Cabot Station Emergency Gate Use

Upon license issuance, the Licensee will use the Cabot Station Emergency Gates under the following conditions: a) a Cabot load rejection which could cause overtopping of the canal, b) dam safety issues such as potential canal overtopping or partial breach, and c) to discharge up to approximately 500 cfs from April 1 to June 15 for debris management. The Licensee shall avoid discharging flows higher than 500 cfs through the gates from April 1 to June 15 if practicable; however, if necessary to discharge higher flows, the Licensee shall coordinate with NMFS to minimize potential impacts to Shortnose Sturgeon in the area below Cabot Station.

Article A190. Turners Falls Impoundment Water Level Management

Upon license issuance, the Licensee shall operate the Turners Falls Impoundment, as measured at the Turners Falls Dam, as follows:

- (a) Maintain water levels between elevation 176.0 feet and 185.0 feet National Geodetic Vertical Datum of 1929 (NGVD29).
- (b) Limit the rate of rise of the Turners Falls Impoundment water level to be less than 0.9 feet/hour from May 15 to August 15 from 8:00 am to 2:00 pm. However, if the NRF is greater than the sum of the hydraulic capacity of Cabot Station and Station No. 1 and the Minimum Flow below Turners Falls Dam in effect at the time, the Turners Falls Impoundment rate of rise requirement will not apply.
- (c) The rate of rise of the Turners Falls Impoundment may be temporarily modified if required by equipment malfunction or operating emergencies reasonably beyond the control of the Licensee. If the rate of rise of the Turners Falls Impoundment is so modified, the Licensee shall notify the Commission, MDEP, MDFW, NMFS, and USFWS as soon as possible, but no later than 10 days after such incident. The rate of rise of the Turners Falls Impoundment may also be temporarily modified for short periods upon mutual agreement with the Licensee for the Northfield Mountain Pumped Storage Project (FERC No. 2485), MDEP, MDFW, NMFS, and USFWS, and upon 5 days' notice to the Commission.
- (d) The Licensee may increase the allowable NRF deviation from $\pm 10\%$ to $\pm 20\%$ to better manage Turners Falls Impoundment water levels. The increased flow deviation is limited by the number of hours shown in the first table of Article A160. This allowance for an increased flow deviation is in addition to the exceptions outlined in paragraphs (a) and (b) of Article A160. As such, the increased flow

allowable deviations outlined in this paragraph will not count against any time allotment for exceptions outlined in paragraphs (a) and (b) of Article A160. Similarly, operations meeting the exception criteria outlined in paragraphs (a) and (b) of Article A160 will not count against any time allotment for allowable deviations outlined in this paragraph. Allowable flow deviations in excess of $\pm 10\%$ of NRF resulting from conflicting operational requirements will not count against any time allotment for allowable deviations outlined in this paragraph.

Article A200. Project Operation, Monitoring and Reporting Plan

Within 1 year of license issuance, the Licensee shall file with the Commission, for approval, a Project Operation, Monitoring and Reporting Plan describing how the Licensee will document compliance with the operating conditions. The Plan will include the following:

- (a) a description of how the Licensee will comply with Minimum Flows below Turners Falls Dam (Article A110), Total Minimum Bypass Flows below Station No. 1 (Article A120), Minimum Flows below Cabot Station (Article A130), Cabot Station Ramping Rates (Article A140), Variable Releases from Turners Falls Dam and Variable Flow below Station No. 1 (Article A150), Flow Stabilization below Cabot Station (Article A160, implementation starting 3 years after license issuance), and Turners Falls Impoundment Water Level Management (Article A190). These are collectively referred to hereinafter as the operating requirements.
- (b) a provision to file with the Commission, after consultation with the MDEP, MDFW, NFMS, and USFWS, a minimum flow and operation compliance report detailing implementation of the plan, including any allowable deviations that occurred during the reporting period. For the period January 1 to March 31 and July 1 to December 31, the compliance report, including any deviations, will be filed with the Commission by March 1 of the following year. For the months of April, May and June, the monthly compliance report, including any deviations, will be filed with the Commission on June 1, July 1 and August 1, respectively. Upon license issuance until 3 years thereafter, the Licensee shall document on an hourly basis for each day any allowable deviations from the Cabot Station Ramping Rates (Article A140) and demonstrate progress towards meeting the Flow Stabilization below Cabot Station (Article A160). Beginning three years after license issuance until license expiration, the Licensee shall document on an hourly basis for each day any allowable deviations from the Cabot Station Ramping Rates restrictions (Article A140) and Flow Stabilization below Cabot Station restrictions (Article A160). Each day, from April 1 to November 30, the Licensee shall record any allowable deviations in a spreadsheet showing the daily deviations, the reason for the deviation, the number of hours, and scope. The Licensee shall provide the total number of deviations to the MDEP, MDFW, NFMS, and USFWS per the reporting schedule above. Allowable deviations will be tracked as follows:
 - Identify Allowable Deviations: The Licensee shall record the NRF, Turners Falls Dam discharge, Station No. 1 discharge, Cabot Station discharge and total Turners Falls Project discharge (below the Cabot Station tailrace) at the top of each hour. Allowable deviations in both the Cabot Station Ramping Rate and Flow Stabilization below Cabot Station requirements will be recorded. At the top of each hour, the Licensee shall record the change in Cabot Station discharge from the previous hour to determine if any deviation has occurred from the agreed

upon Cabot Station Ramping Rate. In addition, the NRF (as detailed in paragraph (b) of the “Operational Regime” section) will be compared with the recorded total Turners Falls Project discharge in a given hour to identify if a Flow Stabilization below Cabot Station deviation occurred over the past hour. Any deviation of either the Cabot Station Ramping Rate or total Turners Falls Project discharge within the hour will be counted in one-hour increments.

- Categorize Allowable Deviations: When an allowable deviation is identified it will be categorized as either Regulatory, as detailed in paragraph (b) of Article A160, NRF Allowance, as detailed in paragraph (d) of the Article A190 or Discretionary, as detailed in paragraph (a) of Article A160.

The Licensee shall develop the Plan after consultation with MDEP, MDFW, NMFS, and USFWS. The Licensee shall include with the Plan documentation of consultation after it has been prepared and provided to MDEP, MDFW, NMFS, and USFWS. The Licensee shall provide a minimum of 30 days for MDEP, MDFW, NMFS, and USFWS to comment and to make recommendations before filing the Plan with the Commission. If the Licensee does not adopt a recommendation, the filing will include the Licensee’s reasons, based on project-specific information.

The Commission reserves the right to require changes to the Plan. Implementation of the Plan will not begin until the Licensee is notified by the Commission that the Plan is approved. Upon Commission approval, the Licensee shall implement the Plan, including any changes required by the Commission.

Article A210. Flow Notification and Website

Within 1 year of license issuance, the Licensee shall provide the following information year-round on a publicly available website:

- (a) On an hourly basis, the Turners Falls Impoundment water elevation, as measured at the Turners Falls Dam, the Turners Falls Dam total discharge, and the Station No. 1 discharge.
- (b) On an hourly basis, the anticipated Turners Falls Dam total discharge and the anticipated Station No. 1 discharge for a 12-hour window into the future. Should the Licensee deviate from passing the 12-hour previous NRF from December 1 to May 31 or the 12-hour average NRF from June 1 to November 30, it will post the revised flows (in the 12-hour look ahead window) to a website as soon as practicable after they are known. Should the Licensee of the Vernon Hydroelectric Project provide the Licensee with flow data more than 12 hours in advance, the Licensee shall publish the information sooner.
- (c) Within one month prior to its annual power canal drawdown, the Licensee shall post on its website the starting and ending time/date of the drawdown, which will last at least 4 days. Throughout the duration of the canal drawdown, the NRF, as defined in Article A110, will be maintained below the Turners Falls Dam.

5.1.2 Northfield Mountain Project

Article B100. Project Operations

Upon license issuance, the Licensee shall:

- (a) operate the Northfield Mountain Pumped Storage Project in accordance with its existing agreement with the United States Army Corps of Engineers (USACE). This agreement, memorialized in the Reservoir and River Flow Management Procedures (1976), as it may be amended from time to time, governs how the Project will operate during flood conditions and coordinate its operations with the Licensee of the Turners Falls Hydroelectric Project (FERC No. 1889).
- (b) operate the Northfield Mountain Pumped Storage Project upper reservoir between elevation 1004.5 and 920.0 feet National Geodetic Vertical Datum of 1929 (NGVD29).

5.2 Fish Passage

5.2.1 Turners Falls Project

Article A300. Fish Passage Facilities and Consultation

The Licensee shall implement the following fish passage measures on the schedule specified. When due dates cited in this and other articles are in “years after license issuance,” this shall mean on the appropriate date in the specified calendar year after license issuance, regardless of the quarter in which the license is issued. For example, “Year 1 after license issuance” begins on the first January 1 following license issuance.

Upstream Fish Passage

- (a) construct a Spillway Lift at the Turners Falls Dam to be operational no later than April 1 of Year 9 after license issuance.
- (b) rehabilitate the Gatehouse Trapping facility (sampling facility) to be operational no later than April 1 of Year 9 after license issuance.
- (c) retire, either by removal or retaining in place, the Cabot Ladder and the power canal portions of the Gatehouse Ladder within 2 years after the Spillway Lift becomes operational.
- (d) install and operate interim upstream eel passage in the vicinity of the existing Spillway Ladder within 1 year of license issuance and continue operating it until permanent upstream eel passage facilities are operational. The Licensee shall consult MDFW, NMFS, and USFWS on the location and design of the interim eelway(s).
- (e) conduct up to 2 years of eelway siting studies after the Spillway Lift becomes operational, using a similar methodology to relicensing Study 3.3.4 for both years. Based on the siting survey results, design, construct, operate, and maintain up to two permanent upstream eel passage facilities at the Turners Falls Project no later than 3 years after completing the final siting survey. The Licensee shall consult MDFW, NMFS, and USFWS on the location of the two permanent upstream eel passage

facilities. The final eelway siting will take into account the ability to maintain the eelway(s) in light of spillage conditions at the Turners Falls Project. The Licensee will not be required to place any eelways at the foot of any active spillway structures.

Downstream Fish Passage

- (f) Within 4 years¹ of license issuance, replace the existing Cabot Station trashrack structure with a new full depth trashrack with 1-inch clear spacing. The new trashracks will have multiple openings for fish passage, including openings on the top and bottom of the water column. The Licensee will attempt to maximize the hydraulic capacity of these openings within the constraints of the conveyance mechanisms. The Licensee will base detailed design alternatives on the following conceptual design; however, the Parties will remain flexible on design alternatives as necessary to meet fish passage goals.

The new trashrack will have multiple surface entrances including a.) between Cabot Units 2 and 3; b.) between Cabot Units 4 and 5; and c.) at the right wall of the intake (looking downstream) at Cabot Unit 6. The openings will be 3-feet-wide by 2-feet-tall and will connect to the existing trash trough located behind the racks. Each opening at the top of the trashrack will have an approximate hydraulic capacity of 24 cfs, and the existing trash trough will convey a total hydraulic capacity of approximately 72 cfs from these openings. The new trashrack will have an additional entrance near the bottom at the left wall of the intake (looking downstream) at Unit 1. This entrance will be approximately 3-feet-wide by 3-feet-tall and will connect to a vertical pipe to safely convey fish to the existing trash trough or log sluice. This entrance will be sized to provide a velocity that attracts fish to the bypass relative to the turbine intakes (approximately 5 feet-per-second). In addition to the entrances integral to the new trashrack structure, fish will be conveyed via a new uniform acceleration weir (UAW) and log sluice. The log sluice will be resurfaced to limit turbulence and injury to migrants. A steel panel (or equivalent) will be provided below the UAW to exclude migrants from being delayed in the space below the UAW. Total flow from all downstream passage components at Cabot Station will be 5% (685 cfs) of maximum hydraulic station capacity (13,728 cfs). The conveyance at each bypass entrance will be determined during the design phase.

- (g) Within 4 years¹ of license issuance, construct a ¾-inch clear-spaced bar rack at the entrance to the Station No. 1 branch canal.

¹Relative to the Cabot Intake Protection and Downstream Passage Conveyance and the Station No. 1 Bar Rack, the times cited are from license issuance based on the time needed to complete construction. The actual first year of operation of these two facilities will depend on when the license is issued. If the License is issued in quarter 1 (Q1, Jan 1-Mar 31) then these two facilities will be operational no later than April 1 of Year 4 after license issuance; if it is issued in Q2 then these two facilities will be operational no later than August 1 of Year 4 after license issuance; and if it is issued after Q2 then these two facilities will be operational no later than April 1 of Year 5 after license issuance.

- (h) Construct a plunge pool downstream of the Turners Falls Dam Bascule Gate No. 1 as part of the construction of the Spillway Lift, to be operational no later than April 1 of Year 9 after license issuance.

Consultation

For any new fish passage facility, the Licensee shall consult and obtain approval from MDFW, NMFS, and USFWS on the facility design and on operation and maintenance procedures. The Licensee shall consult MDFW, NMFS, and USFWS at the 30%, 60%, 90% and 100% design plan milestones. The Licensee shall file the 100% design plans with the Commission, along with documentation of consultation with MDFW, NMFS, and USFWS. If any fish passage adaptive management measures (AMMs) are implemented as discussed in Articles A320 and A330 and require facility design and operation and maintenance procedures, then the Licensee shall follow the same consultation process as the initial fish passage build-out.

The Commission reserves the right to require changes to the design plans. Implementation of the design plans will not begin until the Licensee is notified by the Commission that the design plans are approved. Upon Commission approval, the Licensee shall implement the design plans, including any changes required by the Commission.

Article A310. Schedule of Initial Effectiveness Testing, Consultation Process on Effectiveness Testing Study Plans, and Fish Passage Performance Goals

Schedule of Initial Effectiveness Testing

The Licensee shall complete construction of each fish passage facility, operate the fish passage facility for one season (shakedown year), and then conduct representative and quantitative fish passage effectiveness testing per the schedule below.

Facility	Operational/Shakedown Date	Initial Effectiveness Study Years and Locations to be Tested
Cabot Rack and Downstream Conveyance	Year 4 after license issuance ¹	Years 6-7, the Cabot Downstream Fish Passage Structure and Station No. 1 Rack will be tested.
Station No. 1 Bar Rack	Year 4 after license issuance ¹	
Turners Falls Dam Plunge Pool	Year 9 (by April 1 st) after license issuance	Years 10-11, the Turners Falls Plunge Pool and Spillway Lift will be tested.
Spillway Lift	Year 9 (by April 1 st) after license issuance	
Rehabilitate Gatehouse Trapping Facility (Sampling Facility)	Year 9 (by April 1 st) after license issuance	Not Applicable
Retire Cabot Ladder and Portions of Gatehouse Ladder	No later than Year 11 after license issuance (tied to within 2 years after the Spillway Lift becomes operational).	Not Applicable
Permanent Eel Passage Structure(s)	Year 13 after license issuance	Year 14, the internal efficiency of the permanent eel passage structure(s) will be tested.

¹Relative to the Cabot Intake Protection and Downstream Passage Conveyance and the Station No. 1 Bar Rack, the times cited are from license issuance based on the time needed to complete construction. The actual first year of operation of these two facilities will depend on when the license is issued. If the license is issued in quarter 1 (Q1, Jan 1-Mar 31) then these two facilities will be operational no later than April 1 of Year 4 after license issuance; if it is issued in Q2 then these two facilities will be operational no later than August 1 of Year 4 after license issuance; and if it is issued after Q2 then these two facilities will be operational no later than April 1 of Year 5 after license issuance.

Consultation Process on Effectiveness Study Plans

For any initial fish passage effectiveness studies and any subsequent fish passage effectiveness studies required after implementing any AMMs described in Article A320 and A330, the Licensee shall provide the effectiveness study plans to MDFW, NMFS, and USFWS and request comments on the study plans within 30 days. The Licensee shall consult MDFW, NMFS, and USFWS and obtain their approval on the study plans before conducting the effectiveness studies. The Licensee shall file the effectiveness study plans with the Commission, along with any consultation records.

Fish Passage Performance Goals

The Licensee shall compare the effectiveness study results to the following fish passage performance goals:

Downstream Passage

- 95% of juvenile American Shad arriving 500 meters upstream of the Turners Falls Dam survive migration past the Turners Falls Project within 24 hours.
- 95% of adult American Shad arriving 1 kilometer upstream of the Turners Falls Dam survive migration past the Turners Falls Project within 24 hours.
- 95% of American Eel arriving 1 kilometer upstream of the Turners Falls Dam survive migration past the Turners Falls Project within 48 hours of a flow event. The definition of what constitutes a flow event shall be determined by the Licensee in consultation with MDFW, NMFS and USFWS during effectiveness study plan development.

The downstream passage at the Turners Falls Project is project wide and will include all routes of passage (e.g., spill, fish bypass, and turbine passage).

Upstream Passage

- 75% of adult American Shad arriving 500 meters below Cabot Station successfully pass into the Turners Falls Impoundment within 48 hours. The 75% passage efficiency for American Shad will be based on the first 90% of the American Shad run. The effectiveness testing will be conducted over the entire adult American shad run, but the 75% passage efficiency goal will be based on the first 90% of the run as determined by the Licensee as a *a posteriori* analysis of run counts. The Licensee will determine where and how run counts will occur in consultation with MDFW, NMFS and USFWS during effectiveness study plan development. The Licensee, MDFW, NMFS and USFWS will revisit whether the 75% passage efficiency goal is achievable or should be reduced, and whether the 48-hour time-to-pass goal is achievable or should be increased, after implementing the first (Tier 1) and second (Tier 2) round of AMMs as described in Article A330.

- An internal passage efficiency of 95% within the permanent passage structure(s) for American Eel. The 95% internal efficiency assumes it is possible for the Licensee to successfully tag up-migrating eels. The Licensee shall consult MDFW, NMFS, and USFWS on the appropriate size American eel, based on available technology, to test the internal efficiency.

Article A320. Downstream Fish Passage- Initial Effectiveness Studies, Adaptive Management Measures and Subsequent Effectiveness Studies

Initial Effectiveness Studies- Years 6 and 7

The Licensee shall conduct initial effectiveness testing in Years 6 and 7 (see Article 310) to evaluate the fish passage survival and time-to-pass of the newly constructed Station No. 1 bar rack and Cabot Rack and Conveyance Structure and compare the findings at individual components (e.g., Cabot Station and Station No. 1) to the performance goals in Article 310. The Licensee shall develop reports by February 1 of Years 7 and 8 for adult American Shad and by April 1 of Years 7 and 8 for juvenile American Shad and adult American Eel summarizing the survival study findings and provide it to MDFW, NMFS, and USFWS. The Licensee shall consult MDFW, NMFS, and USFWS on the effectiveness study results and determine what, if any, adaptive management measures (AMMs) may be implemented from the table below. The Licensee will target any AMMs to those locations where fish passage performance goals are not achieved. The Licensee shall file a report with the Commission to include the effectiveness testing report and documentation of any AMMs agreed to by the Licensee, MDFW, NMFS, and USFWS, along with any consultation records. If warranted, the Licensee shall consult MDFW, NMFS, and USFWS on when to implement the Round 1 AMMs at Station No. 1 and/or Cabot Station.

Effectiveness Testing of Round 1 AMMs at Station No. 1 and/or Cabot Station and Initial Effectiveness Testing at Turners Falls Dam Plunge Pool- Years 10 and 11

The Licensee shall conduct Round 1 AMM effectiveness testing at Station No. 1 and/or Cabot Station and initial effectiveness testing of the Turners Falls Dam plunge pool in Years 10 and 11. The Licensee shall:

- Compare the effectiveness study results to the performance goals in Article 310.
- Provide the effectiveness study report to MDFW, NMFS, and USFWS by February 1 of Years 11 and 12 for adult American Shad and by April 1 of Years 11 and 12 for juvenile American Shad and adult American Eel summarizing the survival study findings.
- Consult MDFW, NMFS, and USFWS to determine what, if any AMMs may be implemented from the table below and target AMMs to those locations where passage performance goals are not achieved.
- File the effectiveness study report and documentation of any AMMs with the Commission.

If warranted, the Licensee shall consult MDFW, NMFS and USFWS on when to implement any Round 2 AMMs at Station No. 1 and/or Cabot Station and Round 1 AMMs at the Turners Falls Dam plunge pool.

Effectiveness Testing of Round 2 AMMs at Station No. 1 and/or Cabot Station and Round 1 AMMs at Turners Falls Dam Plunge Pool- Years 14 and 15

The Licensee shall conduct Round 2 AMM effectiveness testing at Station No. 1 and/or Cabot Station and Round 1 AMMs at the Turners Falls Dam plunge pool in Years 14 and 15. The Licensee shall follow the same consultations steps bulleted above; however, the Licensee shall provide the effectiveness study report to MDFW, NMFS, and USFWS by February 1 of Years 15 and 16 for adult American Shad and by April 1 of Years 15 and 16 for juvenile American Shad and adult American Eel.

If warranted, the Licensee shall consult MDFW, NMFS and USFWS on when to implement any Round 3 AMMs at Station No. 1 and/or Cabot Station and Round 2 AMMs at the Turners Falls Dam plunge pool.

Effectiveness Testing of Round 3 AMMs at Station No. 1 and/or Cabot Station and Round 2 AMMs at Turners Falls Dam Plunge Pool- Years 18 and 19

The Licensee shall conduct Round 3 AMM effectiveness testing at Station No. 1 and/or Cabot Station and Round 2 AMMs at the Turners Falls Dam plunge pool in Years 18 and 19. The Licensee shall follow the same consultations steps bulleted above however, the Licensee shall provide the effectiveness study report to MDFW, NMFS, and USFWS by February 1 of Years 19 and 20 for adult American Shad and by April 1 of Years 19 and 20 for juvenile American Shad and adult American Eel.

MDFW, NMFS, and USFWS have agreed, consistent with the terms of the Flows and Fish Passage Settlement Agreement (March 2023), not to exercise any reserved or other regulatory authority regarding downstream passage to request or require any AMMs other than those listed in the table below for the first 25 years of the license. In addition, MDFW, NMFS, and USFWS have agreed, consistent with the terms of the settlement agreement, that they will not request or require Cabot Station shutdowns over the life of the license.

Downstream Adaptive Management Measures

Adaptive Management Measure (if needed)	Timing
<p><u>Turners Falls Dam</u></p> <ul style="list-style-type: none"> Modify the bascule gate setting(s) and resultant spill (rate, location). <p><u>Station No. 1</u></p> <ul style="list-style-type: none"> Install a behavioral barrier. <p><u>Cabot Station</u></p> <ul style="list-style-type: none"> Modify the downstream passage conveyance design to reduce impact velocities and shear stresses (e.g., pump-back system; gradient reduction; piping, lining); Modify the downstream passage conveyance design to increase water depth; Modify the area of flow convergences of the trash trough, Uniform Acceleration Weir, eel pipe, and sluiceway; 	<p>Initial Effectiveness Testing at Cabot Station and Station No. 1: Years 6-7.</p> <p>Initial Effectiveness Testing at Turners Falls Dam Plunge Pool and Round 1 Effectiveness Testing for any AMMs implemented at Cabot Station and/or Station No. 1 (if needed): Years 10-11.</p> <p>Round 2 AMM Effectiveness Testing at Cabot Station and/or Station No. 1 (if needed) and Round 1 Effectiveness Testing at Turners Falls Dam Plunge Pool (if needed): Years 14-15</p> <p>Round 3 AMM Effectiveness Testing at Cabot Station and/or Station No. 1 (if needed) and Round 2 Effectiveness</p>

Adaptive Management Measure (if needed)	Timing
<ul style="list-style-type: none"> • Modify the area of flow convergence of the sluiceway and the receiving waters in the Connecticut River (e.g., adjustable lip, velocity control, and plunge pool depth) 	Testing at Turners Falls Dam Plunge Pool (if needed): Years 18-19

Article A330. Upstream Fish Passage Initial Effectiveness Studies, Adaptive Management Measures and Subsequent Effectiveness Testing

Initial Effectiveness Testing of Adult American Shad- Years 10 and 11

The Licensee shall conduct initial effectiveness testing in Years 10 and 11 (see Article 310) to evaluate upstream fish passage efficiency and time-to-pass at the Cabot Station tailrace, Rawson Island, Station No. 1 tailrace, and at the Spillway Lift through the Gatehouse Ladder exit and compare the findings to the performance goals in Article 310. The Licensee shall develop a report by February 1 of Years 11 and 12 for adult American Shad summarizing the effectiveness study findings and provide it to MDFW, NMFS, and USFWS. The Licensee shall consult MDFW, NMFS, and USFWS on the effectiveness study results and determine what, if any, Tier 1 adaptive management measures (AMMs) from the table below may be implemented.

The Licensee's implementation of Tier 1 AMMs, if warranted, will be informed by the initial effectiveness testing results. While the overall passage efficiency goal is 75% in 48 hours, there are four locations (or nodes) of interest, where the Licensee can provide enhancements as part of the AMMs for upstream passage efficiency including Cabot Station, Rawson Island, Station No. 1 and the Spillway Lift. If the individual passage efficiency at all four locations is 90% or higher, or if the overall passage efficiency goals are met, no Tier 1 AMMs will be implemented. If the individual passage efficiency at any of the four locations is less than 90%, the Licensee shall target Tier 1 enhancements to achieve an individual location passage efficiency of 90% or higher. However, if the Licensee, MDFW, NFMS, and USFWS agree that improvements can be made at other nodes that would improve the overall passage efficiency a comparable amount as an enhancement to achieve an individual location/node to at least 90%, then that enhancement can be implemented.

If warranted, the Licensee shall consult MDFW, NMFS and USFWS on when to implement the Tier 1 AMMs.

Tier 1 Adaptive Management Measures Effectiveness Testing of Adult American Shad- Years 13 and 14

The Licensee shall conduct Tier 1 AMM effectiveness testing in Years 13 and 14 and conduct the following:

- The Licensee shall compare the effectiveness study results to the performance goals in Article 310.
- The Licensee shall provide the effectiveness study report to MDFW, NMFS and USFWS by February 1 of Years 14 and 15.
- At the election of the Licensee, the Licensee may provide the effectiveness study report to an Independent Peer Review Panel (IPRP) of experts to evaluate the study results. The IPRP will consist of one member selected by the Licensee, one member selected collectively by MDFW, NMFS, and USFWS, and one member selected jointly by the Licensee, MDFW, NMFS, and USFWS. After the IPRP's review of the effectiveness study findings, the IPRP will evaluate the ability to

achieve the upstream fish passage performance goals in Article 310 and provide a summary report of its findings to the Licensee, MDFW, NMFS, and USFWS within 3 months of receiving the effectiveness study report.

- If the 75% passage efficiency/48-hour time-to-pass performance goal is not met, the Licensee shall consult MDFW, NMFS, and USFWS to determine whether the 75% passage efficiency goal is achievable or should be reduced, and/or the 48-hour time-to-pass goal is achievable or should be increased. Any modifications to the 75% passage efficiency/48-hour time-to-pass must be agreed to by the Licensee, MDFW, NMFS, and USFWS.
- The Licensee shall consult MDFW, NMFS, and USFWS to determine what, if any, AMMs will be implemented.
- The Licensee shall file the effectiveness study report and documentation of any AMMs with the Commission.

If warranted, the Licensee shall consult MDFW, NMFS and USFWS on when to implement either the remaining Tier 1 AMMs and/or Tier 2 AMMs.

Tier 1 and/or Tier 2 Adaptive Management Measures Effectiveness Testing of Adult American Shad- Years 18 and 19

The Licensee shall conduct any Tier 1 and/or Tier 2 AMM effectiveness testing in Years 18 and 19 and conduct the following:

- The Licensee shall compare the effectiveness study results to the performance goals in Article 310.
- The Licensee shall provide the effectiveness study report to MDFW, NMFS and USFWS by February 1 of Years 19 and 20.
- The Licensee shall file the effectiveness study report and documentation of any AMMs with the Commission.

If, after the Licensee implements additional Tier 1 AMMs and/or Tier 2 AMMs, the overall passage efficiency is greater than 65% or a lesser number as agreed to by the Licensee, MDFW, NMFS, and USFWS, and the overall time-to-pass is less than 60 hours or a higher number as agreed by the same group, then MDFW, NMFS, and USFWS will not exercise any reserved or other regulatory authority to require additional upstream fish passage measures or operational changes.

MDFW, NMFS, and USFWS have agreed, consistent with the terms of the Flows and Fish Passage Settlement Agreement (March 2023), not to exercise any reserved or other regulatory authority regarding upstream passage to request or require any AMMs other than those listed in the table below for the first 25 years of the license. In addition, MDFW, NMFS, and USFWS have agreed, consistent with the terms of the settlement agreement, that they will not request or require Cabot Station shutdowns or a lift at Cabot Station over the life of the license.

Effectiveness Testing of Juvenile American Eel- Year 14

The Licensee shall conduct effectiveness testing in Year 14 to evaluate the internal efficiency of the permanent eelway structure(s) and compare the findings to the performance goals in Article 310.

Upstream Adaptive Management Measures- Tier 1 and 2

Adaptive Management Measure (if needed)	Schedule
Tier 1	
<p><u>Cabot Tailrace and Rawson Island Nodes</u></p> <ul style="list-style-type: none"> Upon license issuance, the Total Minimum Bypass Flow below Station No. 1 from June 1 to June 15 is 4,500 cfs (see Article A120). This AMM includes increasing the Total Minimum Bypass Flow below Station No. 1 from June 1 to June 15 to 6,500 cfs until 90% of the American Shad run enter the Spillway Lift, upon which the Total Minimum Bypass Flow below Station No. 1 will revert to 4,500 cfs. <p>If this adaptative management measure is enacted and after two years of effectiveness testing, it improves the fish passage efficiency and time-to-pass goals, this change may be implemented throughout the remainder of the license, subject to other adaptive management measures. However, even after this change, the 6,500 cfs will revert to 4,500 cfs when 90% of the adult American Shad run enter the Spillway Lift before or within the June 1 to 15 period. The indicator as to when the 90% of the adult American Shad run passes will be determined using a predictive model to be developed by the Licensee in consultation with MDFW, NMFS, and USFWS. The Licensee shall file with the Commission the predictive model results within 6 months of license issuance and it will be updated and/or refined with data collected over intervening years.</p> <p>If this change is implemented, from June 1 to June 15, the Minimum Flow below the Turners Falls Dam (Article A110) must be 4,290 cfs or the NRF, whichever is less; and the Total Minimum Bypass Flow below Station No. 1 (Article A120) must be 6,500 cfs or the NRF, whichever is less.</p> <p><u>Station No. 1 Node</u></p> <ul style="list-style-type: none"> Shift the distribution of the Total Minimum Bypass Flow below Station No. 1 (Article A120) to increase the Total Minimum Flow below Turners Falls Dam (Article A110) from April 1 to June 30 until 90% of the adult American Shad run enter the Spillway Lift, upon which it will revert back to the flow requirements in Articles A110 and A120. The Total Minimum Bypass Flow below Station No. 1 remains the same from April 1 to June 30 as described in Article A120. <p><u>Spillway Lift</u></p> <ul style="list-style-type: none"> Adjust the new plunge pool release and/or bascule gate operation and/or, Adjust the new fish lift attraction water and entrance conditions and/or, 	<p>Years of Initial Effectiveness Testing: Years 10-11</p> <p>Time Needed to Implement AMM(s): Year 0 since all Tier 1 AMMs are operational</p> <p>Years of Post AMM Effectiveness Testing: Years 13-14</p>

Adaptive Management Measure (if needed)	Schedule
<ul style="list-style-type: none"> Adjust the timing and frequency of lift operations and/or; Adjust the entrance gate. 	
Tier 2	
<p><u>Cabot Tailrace Node</u></p> <ul style="list-style-type: none"> Install a behavioral barrier near the Cabot Station tailrace to guide fish upstream for passage at the Turners Falls Dam. If this AMM is implemented, then the Total Minimum Bypass Flow below Station No. 1 (Article A120) will be reduced from 6,500 cfs to 4,500 cfs (Tier 1 AMM) from June 1 to June 15 for the period of testing the Tier 2 measures. At the end of Tier 2 testing (and provided that the 6,500 cfs extension is not needed to significantly improve passage efficiency or time-to-pass at Rawson Island) either the increased flow of 6,500 cfs (June 1 to June 15) will be implemented or the behavioral barrier but not both unless it is demonstrated that both are needed to make a substantial improvement in passage efficiency or time-to-pass. <p><u>Rawson Island Node</u></p> <ul style="list-style-type: none"> If it is determined that the river channel adjacent to Rawson Island is inhibiting upstream fish passage, then constructing a zone of passage is an AMM. Prior to conducting any work associated with this AMM, the Licensee shall consult MDFW, NMFS, USFWS, recreational boating and Tribal interests and the Massachusetts Natural Heritage and Endangered Species Program (NHESP) on the design of the zone of passage. If the zone of passage is constructed, then the Total Minimum Bypass Flow below Station No. 1 will be reduced from 6,500 cfs to 4,500 cfs (Tier 1 AMM) from June 1 to June 15 for the period of testing the Tier 2 measures. At the end of Tier 2 testing (and provided that the 6,500 cfs extension is not needed to significantly improve passage efficiency or time-to-pass at Rawson Island) the 6,500 cfs will be reduced back to 4,500 cfs. <p><u>Station No. 1 Node</u></p> <ul style="list-style-type: none"> Install a behavioral barrier near the Station No. 1 tailrace to guide fish upstream for passage at the Turners Falls Dam. If this AMM is implemented, then the Turners Falls Dam Spill/Sum of Fall River, Turners Falls Hydro, LLC, Milton Hilton, LLL and Station No. 1 flow split will be returned to the 67%/33%, respectively, from April 1 to June 30. At the end of Tier 2 testing, either the increased Turners Falls Dam Minimum Flow component of the flow split used in Tier 1 will be implemented or the behavioral barrier but not both unless it is demonstrated that both are needed to make a substantial improvement in passage efficiency or time to pass. <p><u>Turners Falls Dam/Fish Lift Node</u></p> <ul style="list-style-type: none"> Internal structural modifications to improve hydraulics for fish movement, as necessary. 	<p>Time Needed to Implement AMM(s): Year 15-16</p> <p>Shakedown: Year 17</p> <p>Years of Post AMM Effectiveness Testing: Years 18-19</p>

Article A340. Fishway Operating Periods¹

The Licensee shall operate the fishways during the following periods:

Upstream eel passage	May 1 to November 15
Upstream anadromous	April 4 to July 15
Downstream passage	April 4 to November 15

¹Future refinement of the timing on an annual or permanent basis may be made by the MDFW, NMFS, and USFWS based on new information and after consultation with the Licensee.

Article A350. Fish Passage Facilities Operation and Maintenance Plan

The Licensee shall develop and implement a Fish Passage Facilities Operations and Maintenance Plan (FOMP). The FOMP shall detail how and when the fishways will be operated and describe routine maintenance activities that will occur both during and outside of the fish passage season. The FOMP will include a provision to provide annual fishway Operation and Maintenance (O&M) reports that summarize the status of the fish passage facilities, identify needed repairs or equipment replacement, etc. The O&M report shall be submitted to the MDFW, NMFS, and USFWS by January 31 annually. The FOMP shall be developed in consultation with and require approval by the MDFW, NMFS, and USFWS prior to submitting the final FOMP to the FERC for approval.

The FOMP shall be completed no later than 6 months after license issuance for the interim upstream eel passage which will be placed into service within 1 year of license issuance per Article A300, and for existing fish passage facilities (i.e., Cabot downstream fish bypass; Cabot Ladder; Spillway Ladder; and Gatehouse Ladder). Thereafter, the same FOMP shall be amended by the Licensee within 6 months prior to the following:

- Any fish passage structures are placed into service, as outlined in the schedule in Article A300;
- Any AMM's are placed into service, as outlined in the schedule in Articles A320 and A330; and,
- Any operational or facilities modifications resulting from new information obtained from operation of the fish passage facilities pursuant to the annual O&M reports.

FOMP provisions dealing with facilities that are decommissioned over the term of the license may be dropped from revisions of the FOMP after decommissioning.

5.2.2 Northfield Mountain Project**Article B200. Fish Intake Protection and Consultation****Intake Protection**

The Licensee shall install a barrier net in front of the Northfield Mountain tailrace/intake, having 3/8-inch mesh on the top and 3/4-inch mesh on the bottom. The barrier net design shall be based on the conceptual design in the Amended Final License Application filed with the Commission in December 2020, as modified through consultation with MDFW, NMFS, and USFWS, from June 1 to November 15 to protect out-migrating American Shad and adult American Eel, to be operational no later than June 1 of Year 7 after license issuance.

Consultation

The Licensee shall consult and obtain approval from MDFW, NMFS, and USFWS on the barrier net design and on operation and maintenance procedures. The Licensee shall consult MDFW, NMFS, and USFWS at the 30%, 60%, 90% and 100% design plan milestones. The Licensee shall file the 100% design plans with the Commission, along with documentation of consultation with MDFW, NMFS, and USFWS.

The Commission reserves the right to require changes to the design plans. Implementation of the design plans must not begin until the Licensee is notified by the Commission that the design plans are approved. Upon Commission approval, the Licensee shall implement the design plans, including any changes required by the Commission.

Article B210. Initial Intake Protection Effectiveness Testing and Fish Passage Performance Goals

Initial Effectiveness Testing

The Licensee shall complete construction of the Northfield Mountain barrier net, operate the barrier net for one season (shakedown year), and conduct representative and quantitative effectiveness testing in Years 10 and 11 to evaluate the downstream fish passage survival and time-to-pass compared to the performance goals below.

Consultation Process on Effectiveness Study Plans

For any initial fish passage effectiveness studies and any subsequent fish passage effectiveness studies required after implementing any AMMs described in Article B220, the Licensee shall provide the effectiveness study plans to MDFW, NMFS, and USFWS and request comments on the study plans within 30 days. The Licensee shall consult MDFW, NMFS, and USFWS and obtain their approval on the study plans before conducting the effectiveness study. The Licensee shall file the effectiveness study plans with the Commission, along with any consultation records.

Fish Passage Performance Goals

The Licensee shall compare the effectiveness study results to the following fish passage performance goals:

- 95% of juvenile American Shad arriving 500 meters upstream of the Northfield Mountain Pumped Storage Project tailrace survive migration past the Northfield Mountain Pumped Storage Project tailrace within 24 hours.
- 95% of adult American Shad arriving 1 kilometer upstream of the Northfield Mountain Pumped Storage Project tailrace survive migration past the Northfield Mountain Pumped Storage Project tailrace within 24 hours.
- 95% of American Eel arriving 1 kilometer upstream of the Northfield Mountain Pumped Storage Project tailrace survive migration past the Northfield Mountain Pumped Storage Project tailrace within 48 hours of a flow event. The definition of what constitutes a flow event shall be determined by the Licensee in consultation with MDFW, NMFS, and USFWS during effectiveness study plan development.

Article B220. Downstream Fish Passage- Initial Effectiveness Studies, Adaptive Management Measures and Subsequent Effectiveness Studies

Initial Effectiveness Studies- Years 10 and 11

The Licensee shall conduct initial effectiveness testing in Years 10 and 11 (Article B210) to evaluate the fish passage survival and time-to-pass of the newly constructed barrier net and compare the findings to the performance goals in Article B210. The Licensee shall develop a report by February 1 of Years 11 and 12 for adult American Shad and by April 1 of Years 11 and 12 for juvenile American Shad and adult American Eel summarizing the survival study findings and provide it to MDFW, NMFS, and USFWS. The Licensee shall consult MDFW, NMFS, and USFWS on the effectiveness study results and determine what, if any, adaptive managements measures (AMMs) may be implemented from the table below. The Licensee shall file a report with the Commission to include the effectiveness testing report and documentation of any AMMs agreed to by the Licensee, MDFW, NMFS, and USFWS, along with any consultation records. If warranted, the Licensee shall consult MDFW, NMFS and USFWS on when to implement any Round 1 AMMs.

Effectiveness Testing of Round 1 AMMs - Years 14 and 15

The Licensee shall conduct Round 1 AMM effectiveness testing in Years 14 and 15. The Licensee shall:

- Compare the effectiveness study results to the performance goals in Article B210.
- Provide the effectiveness study report to MDFW, NMFS, and USFWS by February 1 of Years 15 and 16 for adult American Shad and by April 1 of Years 15 and 16 for juvenile American Shad and adult American Eel.
- Consult MDFW, NMFS, and USFWS to determine what, if any AMMs may be implemented from the table below.
- File the effectiveness study report and documentation of any AMMs with the Commission.

If warranted, the Licensee shall consult MDFW, NMFS and USFWS on when to implement any Round 2 AMMs.

Effectiveness Testing of Round 2 AMMs - Years 17 and 18

The Licensee shall conduct Round 2 AMM effectiveness testing in Years 17 and 18. The Licensee shall follow the same consultations steps bulleted above; however, the Licensee shall provide the effectiveness study report to MDFW, NMFS, and USFWS by February 1 of Years 18 and 19 for adult American Shad and by April 1 of Years 18 and 19 for juvenile American Shad and adult American Eel.

MDFW, NMFS, and USFWS have agreed, consistent with the terms of the Flows and Fish Passage Settlement Agreement (March 2023), not to exercise any reserved or other regulatory authority regarding passage to request or require any AMMs other than those listed in the table below for the first 25 years of the license. In addition, they have agreed, consistent with the settlement agreement, not to request or require pumping restrictions at any time over the life of the license.

Downstream Adaptive Management Measures

Adaptive Management Measure (if needed)	Timing
<u>Northfield Mountain Intake/Tailrace</u> <ul style="list-style-type: none"> Alter the arrangement and size of the net panels (e.g. extend depth of the smaller panels). Improve maintenance measures for the net. 	<p>Initial Effectiveness Testing of Barrier Net: Years 10-11.</p> <p>Round 1 AMM Effectiveness Testing (if needed): Years 14-15</p> <p>Round 2 AMM Effectiveness Testing (if needed): Years 17-18</p>

Article B230. Fishway Operating Periods¹

The Licensee shall operate the barrier net for downstream passage from June 1 to November 15.

¹Future refinement of the timing may be made by the MDFW, NMFS, and USFWS based on new information and after consultation with the Licensee.

Article B240. Fish Passage Facility Operation and Maintenance Plan for Barrier Net

The Licensee shall develop and implement a Fish Passage Facilities Operations and Maintenance Plan (FOMP) for the barrier net. The FOMP shall detail how and when the barrier net will be operated and describe routine maintenance activities that will occur both during and outside of the downstream fish passage season. The FOMP will include a provision to provide annual fishway Operation and Maintenance (O&M) reports that summarize the status of the barrier net, identify needed repairs or equipment replacement, etc. The O&M report shall be submitted to the MDFW, NMFS, and USFWS by January 31 annually. The FOMP shall be developed in consultation with and require approval by the MDFW, NMFS, and USFWS prior to submitting the final FOMP to the FERC for approval.

The FOMP shall be completed no later than 6 months prior to the barrier net being placed into service, as outlined in the schedule in Article B200. Thereafter, the same FOMP shall be amended by the Licensee within 6 months prior to the following:

- Any AMM's are placed into service, as outlined in Articles B220; and,
- Any operational or facility modifications resulting from new information obtained from operation of the barrier net pursuant to the annual O&M reports.

5.3 Recreation

As noted above the Recreation Settlement included a single RMP for both Projects. In addition to maintaining and operating the existing recreation amenities at both locations (as described in [Section 4.3](#)), the agreement includes enhanced or proposed recreational features, which are summarized below for each Project which supplements the existing recreation facilities.

5.3.1 *Turners Falls Project*

- Construct Pocket Park: Construct a pocket park (viewing location, picnic table) at the Pauchaug-Schell Bridge Greenway and include signage for historical and cultural interpretation.
- Construct Mallory Brook Campsite: Provide paddle access camping at a new campsite at Mallory Brook (if for some reason that location proves to be problematic, another site will be chosen).
- Construct Formal Access Trail and Put-In at Cabot Camp: Construct 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.
- Construct Car-Top Access at East End of Unity Park and Reconfigure Parking Lot: Add a new car-top access and put-in at the eastern end of Unity Park, provide a means of storing and locking vessels, and reconfigure the Unity Park parking lot to improve vehicle and pedestrian safety.
- Construct River Access and Two Put-Ins Just Below Turners Falls Dam: The new access will start via the existing bridge (aka the “IP Bridge”) spanning the power canal just below the Gatehouse. Once over the power canal, a path will lead recreationists to an elevated bench and opening above the river channel. From this elevated bench there will be two routes to access the river. One route will continue with a path leading further upstream to a put-in closer to the dam and upstream of Peskeomskut Island. This route will be designed to accommodate whitewater rafters. The second route will lead further downstream to a put-in below Peskeomskut Island. The second route currently consists of an uneven path with jagged rocks creating unstable footing. The proposed second route will require clearing and grubbing to create a path with better footing before turning right to the put-in. This route will be designed to accommodate pass-through boaters (canoes and kayaks) that want to avoid Peskeomskut Island.
- Construct Viewing Platform and Picnic Area just Below Turners Falls Dam: Construct a viewing platform and picnic area below the Turners Falls Dam with the best feasible view of Great Falls (the Turners Falls Dam). The exact location of the viewing platform and picnic area are yet to be determined, with one option being forming a platform atop the existing Spillway Ladder as it is elevated and provides a good view of the Turners Falls Dam.
- Construct River Access Trail at Station No. 1: Provide formal access for fishing and non-motorized boats at Station No. 1. It will include a path leading from Power Street to a put-in just upstream of the Station No. 1 tailrace.
- Install Stairs at the Cabot Woods Fishing Access: Historically, there were stairs along the steep topography leading from the picnic area in Cabot Woods to the river’s edge; however, they are no longer in place. New stairs will be installed and maintained at the same location as the previous stairs, which leads to just below Rock Dam.
- Construct Portage Trail Around Rock Dam: The “Rock Dam” is a natural rock feature with a sizeable vertical drop located in the bypass reach of the Connecticut River near the Cabot Woods Fishing Area. With boating opportunities expected to increase under the new flow regime, some boaters may opt to avoid Rock Dam and portage around it for safety reasons. Alternatively, some

boaters may view the vertical drop at Rock Dam as a “play” area and may want to “run” the drop more than once. For these reasons, a portage trail will be constructed around Rock Dam.

- Improve Poplar Street River Access: There is existing cartop access at Poplar Street; however, it is extremely steep. Due to steep topography and land ownership restrictions, the existing gravel parking lot will be used, leading to timber stairs with a boat slide railing leading to a 5-foot-long, 20-foot-wide concrete landing/abutment. A 32-foot-long gangway will be anchored to the concrete abutment and lead to a floating dock in the Connecticut River to accommodate fluctuations in the river elevation.
- Install Interpretive Cultural Signage at Key Locations: Interpretive signage will be installed at Cabot Woods (Rock Dam), and Peskeompskut/Great Falls (Turners Falls Dam).

5.3.2 *Northfield Mountain Project*

- Enhance Existing Bennett Meadow Trails: Enhance existing riverfront trails south of Route 10 off the parking lot at Bennett Meadow, add a bench, and include historical and cultural interpretive signage.
- Construct Riverview Improvements (Docks): The proposed barrier net around the Northfield Mountain tailrace will be in place during a portion of the summer recreation season. The current layout of the barrier net encloses the existing Boat Tour Dock. Given this, the dock will be relocated further upstream of its current location. Moving the dock will entail extending the existing road further north and allowing boaters or users of the area the ability to drop a boat closer to the dock or operate a wheelchair down the access road. An ADA-accessible dock will be provided to support motor boats, canoes/kayaks, and the Riverboat.
- Construct New Mountain Biking Trails at Northfield Mountain: Construct approximately five (5) miles of new trails for mountain biking.
- Construct Barton Cove Campsite: Provide paddle access camping at a new campsite in the Barton Cove area in Gill.
- Establish Rose Ledges as a Project Recreation Facility: Rose Ledges is a rock climbing areas on the eastern side of Northfield Mountain.
- Implement Barton Cove Improvements: Add the ability to lock canoes and kayaks during the day at the Barton Cove Canoe and Kayak rental facility in the picnic area.

5.4 **Northfield Mountain Project- Sediment Management Plan and Periodic Dredging of the Upper Intake Channel**

FirstLight proposes to conduct bathymetric mapping of the Upper Reservoir at least once every two (2) years to help understand the location, volume, and rate of sediment accumulation in the Upper Reservoir. If the results of the bathymetric survey indicate an average sediment depth throughout the middle of the intake channel of five (5) feet or greater, an internal detailed review by an engineering team will be initiated and planning for future sediment removal will commence. The detailed review will include an evaluation as to whether sediment levels have increased to the point where the check dam and/or intake

channel geometry would not be able to prevent an excessive release of sediment to the Connecticut River during an unplanned or planned dewatering. The engineering review team will prepare a report of its findings and recommendations. FirstLight will then notify the appropriate agencies and inform them of the next steps.

Once the five (5) foot threshold has been reached, sediment removal will commence within three (3) years unless there is a technical and engineering basis for a longer period of time, which would be submitted to USEPA, MADEP, and FERC for review and comment. After reaching the five (5) foot threshold, and until sediment removal occurs, FirstLight will perform bathymetric surveys and detailed engineering reviews annually. Further details regarding this dredging is documented in a Sediment Management Plan entitled Upper Reservoir Dewatering Protocols ([Appendix D](#)), which FirstLight previously filed with FERC on June 30, 2017. FirstLight proposes that this Sediment Management Plan can be amended over time, so long as the amended plan provides an equivalent level of protection and is approved by USEPA, MADEP and FERC.

5.5 Turners Falls Impoundment Streambank Stabilization

5.5.1 Background

This section includes essential information and background related to Study No. 3.1.1 *2013 Full River Reconnaissance Survey* and Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Banks* – hereinafter referred to as the FRR and Erosion Causation Study. A chronology of events regarding these two studies are summarized in [Table 5.5.1-1](#) (end of this section), which includes study plans, meeting dates, response to stakeholder comments on study plans, reports, and response to stakeholder comments on reports. These documents can be found on the website or in [Appendix A](#).

A team of industry experts in the fields of fluvial geomorphology, hydraulic engineering, and geotechnical engineering were enlisted to conduct the FRR and Erosion Causation Study. For the Erosion Causation Study, the team of experts included Dr. Andrew Simon, who was the senior developer of the Bank Stability and Toe Erosion Model (BSTEM) while at the U.S. Department of Agriculture, National Sedimentation Laboratory, to lead this study. Prior to starting any field work, FirstLight also provided MDEP with resumes of the experts leading these studies.

FirstLight was methodical along each step of developing, conducting, and reporting on the FRR and the Erosion Causation Study and sought MDEP and stakeholder input throughout the process. FirstLight provided stakeholders, including MDEP, with three rounds of study plans in which it discussed the use of BSTEM, a Transect Selection Report, and a three volume Erosion Causation Report. FirstLight met separately with MDEP, and as part of a larger stakeholder group, to ensure that it was collecting the desired information needed to address the causes of erosion.

While BSTEM was a central tool to assess bank erosion, FirstLight also took a holistic approach that utilized a combination of qualitative geomorphic analysis, quantitative engineering and geomorphic analysis, and computer modeling. This three-level approach ensured a proper understanding of the physical processes governing bank processes along the reach through the hydraulic action, transport of sediment, river form and response, interaction with infrastructure and/or biologic aspects of riverine morphology or habitat. The three-level approach allowed for cumulatively supportive, scientifically justifiable results to be

obtained. Each subsequent level of analysis built on the understanding developed by the previous level. Further information on this holistic approach is included in [Appendix E](#).

Relative to BSTEM, the study included the collection of site-specific information at transects in the TFI including:

- Installation of water level loggers throughout the TFI which were used to calibrate a hydraulic model.
- 15 years (2000-2014) of survey at 25 transects in the TFI.
- Land based assessments at transects.
- Boat wave data collection.
- Site specific data collected at 25 transects including: bore hole shear test to determine effective cohesion, angle of internal friction, pore-water pressure and bulk unit weight.
- Submerged jet test to determine the critical shear stress and erodibility coefficient of the bank materials.
- Collection of riverbank samples for particle-size distribution as it relates to critical shear stress.
- Data collection on woody vegetation, root diameters, structure and density.
- Groundwater data from 1997-1998.

The results of the three-level approach for the Erosion Causation Study, and the related supplemental analyses that have occurred since then, properly quantify the causes of erosion throughout the TFI, including water level fluctuations from Project operations, high flows, and boat waves, among other causes as discussed in the final report for Study 3.1.2. A tightly calibrated hydraulic model of the TFI was developed to produce hourly water surface elevations (WSELs) at each of the detailed study sites over a period of record. The hourly data from the hydraulic model was used in BSTEM, thus it directly incorporated WSEL fluctuations from all sources (i.e., boat waves, Project operations, high flows) into the erosion assessment. In addition, groundwater fluctuations were also accounted for given that groundwater levels in the bank can fluctuate with each time step, thereby accounting for hourly changes in pore-water pressure and apparent cohesion. In this way, BSTEM-Dynamic accounts for both the hourly fluctuations in ground- and surface water elevations to calculate driving, confining, and resisting forces at each time step. While BSTEM quantified an erosion rate, supplemental analyses were conducted to break out the percentage contribution from the various erosion causes. Other potential erosion processes such as seepage were also accounted for during the study.

5.5.2 BSTEM Model Study Findings under Proposed Operations

On March 22, 2024, FirstLight filed with FERC the following report: *Supplemental BSTEM Modeling Report Reflecting Operating Conditions in the Flows and Fish Passage Settlement Agreement*. BSTEM was used to determine the amount of erosion in the TFI under the operating conditions in the F/F Agreement. The results of the BSTEM modeling for riverbank segments within Massachusetts have found that ([Figure 5.5.2-1](#)):

- The dominant cause of erosion throughout the TFI is high flows or, in the case of Barton Cove, boat waves;
- Project operations are not a **dominant**¹⁰ cause of erosion anywhere in the TFI; and,
- Project operations are a **contributing**¹¹ cause of erosion in Massachusetts in: (1) an approximately 21,600-foot-long reach from the exit of Barton Cove to the French King Gorge (both sides of the river), and (2) an approximately 4,700-foot-long reach on river right upstream of the Northfield Mountain tailrace.

5.5.3 FirstLight Streambank Erosion Proposal

As discussed further in [Appendix E](#), FirstLight's Streambank Erosion Proposal is summarized below.

- As agreed to in the Recreation Settlement Agreement, conservation easements will be established along the TFI's riparian corridor on FirstLight owned land. The goal of the conservation easements will be to conserve the riparian buffers along the TFI, allow for the continued operation of the Bennett Meadow Wildlife Management Area, and conserve the 1.3 mile long portion of the New England National Scenic Trail in the Northfield Mountain Project boundary. Collectively, the conservation easements/restrictions that are part of the Turners Falls and Northfield Mountain Projects equate to 761.4 acres.
- Given that the water quality certification will be issued by the MDEP, the proposal is focused on the Massachusetts portion of the TFI.
- FirstLight will establish a boat wake restriction, in coordination with the MDCR and the Massachusetts Environmental Police, from the Turners Falls Dam extending upstream approximately two miles to where the TFI narrows to mitigate the impact of boat waves in the Barton Cove area.
- FirstLight will implement a shoreline erosion monitoring program for all TFI reaches in Massachusetts where the results of the March 2024 BSTEM modeling showed that proposed Project operations are a contributing cause of erosion ([Figure 5.5.3-1](#)).
- The shoreline erosion monitoring program would consist of the following:
 - Within one year of license issuance, FirstLight will develop a Shoreline Erosion Monitoring Plan in consultation with MDEP. MDEP must approve the monitoring plan prior to FirstLight initiating any shoreline erosion surveys.
 - FirstLight will conduct an initial shoreline erosion survey within two years of license issuance.

¹⁰ For a cause to be considered dominant, it needed to have been responsible for at least 50% of the bank erosion at a site.

¹¹ For a cause to be considered contributing, it had to contribute to >5%, but less than 50%, of the erosion at the site.

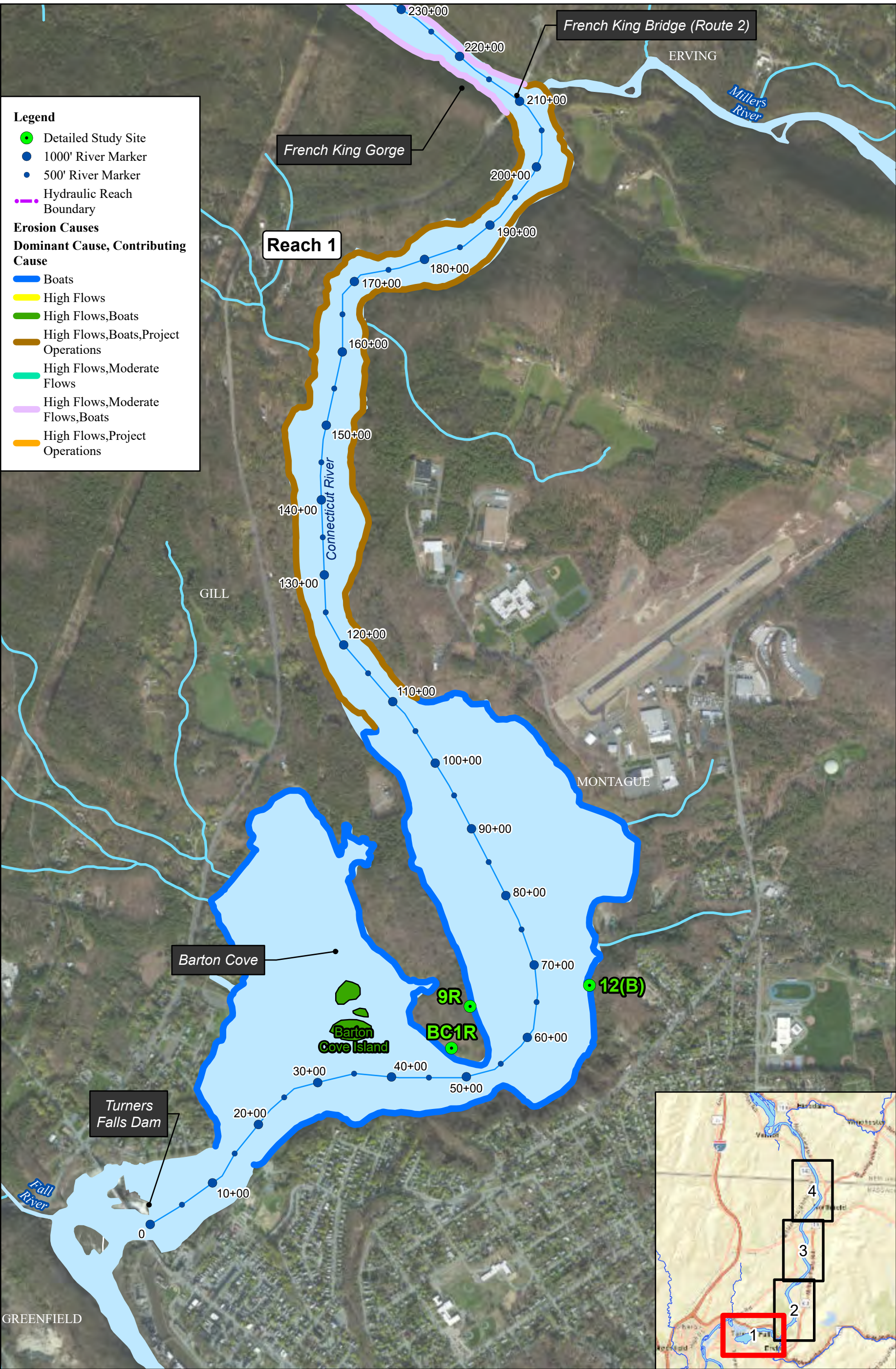
- FirstLight will conduct additional shoreline erosion surveys in Year 10, 20, 30, and 40 of the new license.
- Each erosion survey will consist of:
 - A reconnaissance survey of each TFI riverbank segment in Massachusetts where proposed Project operations were identified by BSTEM to be a contributing cause of erosion ([Figure 5.5.3-1](#)). The reconnaissance survey will characterize the riverbank characteristics and erosion conditions of each segment.
 - Cross-sectional surveys at existing detailed study sites within each TFI riverbank segment in Massachusetts where proposed Project operations were identified by BSTEM as a contributing cause of erosion ([Figure 5.5.3-1](#)). If a detailed study site does not currently exist in such a reach (e.g., the reach from the Barton Cove exit to the French King Gorge), FirstLight will establish a representative detailed study site within that reach during the first erosion survey following license issuance. Newly established detailed study sites will be re-surveyed during subsequent surveys.
- Following completion of each erosion survey, FirstLight will prepare a report summarizing the survey methods and results. The report will also identify surveyed riverbank segments that require stabilization or, in the event of a previously repaired bank segment, repair, if any. The report will be submitted to MDEP for approval.
- Upon MDEP approval, FirstLight will complete the stabilization or repair measures identified in the final report, if any, within 5 years. Following completion of remediation activities, FirstLight will file as-built documentation (plans/photos) of the stabilization/repair efforts with MDEP.

Table 5.5.1-1. Consultation Record on FRR and Erosion Causation Study and Correspondence Record with Massachusetts Department of Environmental Protection

Date	Mtg Location	Summary
01/08/2013		FirstLight filed two reports entitled: <i>Analysis of Erosion in Vicinity of Route 10 Bridge Spanning the Connecticut River</i> and <i>Riverbank Erosion Comparison along the Connecticut River</i> .
01/30-31/2013	Montague	FERC scoping meetings
03/01/2013		MDEP issued its study request letter requesting two studies- Northfield Mountain/Turners Falls Operations Impact on Sediment Transport and Water Quality Monitoring. FirstLight received over 200 comment letters.
03/26/2013	Springfield	FirstLight met with MDEP to discuss the FRR, Hydraulic and Geomorphic Analysis of Erosion in the TFI and Water Quality Study
04/15/2013		FirstLight filed its Proposed Study Plan (PSP.)
05/15/2013	Northfield	FirstLight met with MDEP and other stakeholders to review the FRR and Erosion Causation Study PSPs.
06/14/2013	Northfield	FirstLight met with MDEP and other stakeholders on the FRR and Erosion Causation Study PSPs.
06/28/2013		FirstLight filed its Updated PSP (UPSP).
07/12/2013		MDEP issued its comments on the FRR and Erosion Causation Study. Other stakeholder filed comments on these same studies.
08/04/2014	Northfield	FirstLight met with MDEP and other stakeholders on the Erosion Causation Study. FirstLight provided a presentation on Detailed Study Site Selection for the Erosion Causation Study.
08/14/2013		FirstLight filed its Revised Study Plan (RSP)
08/19/2013		FirstLight met with a subset of stakeholders on the Erosion Causation Study.
08/26/2013	Springfield	FirstLight met with MDEP on the FRR and Erosion Causation Study.
09/20/2013		Following the 08/26/2013 MDEP meeting, FirstLight sent MDEP a letter with the resumes for the consultants that would lead the FRR and Erosion Causation including Dr. Kit Choi, Dr. Robert Simons and Dr. Andrew Simon.
11/05/2013	Northfield	FirstLight met with MDEP regarding the FRR and Erosion Causation Study, which included a PowerPoint presentation.
05/12/2014		FirstLight sent MDEP a draft version of the Selection of Detailed Study Sites Report for the Erosion Causation Study.
06/04/2014	Springfield	FirstLight met with MDEP to discuss the draft version of the Selection of Detailed Study Sites Report for the Erosion Causation Study.
06/06/2014		FirstLight sent MDEP and stakeholders the Selection of Detailed Study Sites Report for the Erosion Causation Study.
06/24/2014	Northfield	FirstLight met with MDEP and other stakeholders on the Detailed Study Sites Report for the Erosion Causation. FirstLight presented the Selection of Detailed Study Sites Report.
07/03/2014-07/15/2014		Comments on the Detailed Study Sites Report were provided from MDEP and other stakeholders.

Date	Mtg Location	Summary
07/23/2014		FirstLight submitted responses to the comments received on the Selection of Detailed Study Sites Report.
08/04/2014	Northfield	FirstLight met with MDEP and other stakeholders to discuss FirstLight's response to comments on the Detailed Study Sites Report and to finalize the location of detailed study sites.
08/12/2014		FirstLight emailed MDEP and other stakeholders on an addendum to the Erosion Causation Study to address ice issues, which were raised in FERC's 12/13/13 Determination Letter.
09/16/2014		FirstLight filed Initial Study Report Summary for the Erosion Causation Study including the Detailed Study Sites Report along with consultation record described above. Also filed the FRR Report and Quality Assurance Project Plan.
09/30-10/01/2014		FirstLight held its Initial Study Report Meeting. The FRR and Erosion Causation Studies were discussed on 10/01/2014.
10/15/2014		FirstLight filed meeting minutes from 9/30-10/01/14 meetings.
10/15/2014	Northfield	FirstLight met with MDEP and other stakeholders on FRR and Erosion Causation Study.
11/04/2014		FirstLight provided all stakeholders, including MDEP, with responses to comments received on the FRR.
11/14/2014		Comments on the FRR and Erosion Causation Study were due. No comments were filed by MDEP. Comments received from CRWC, FRCOG (including Letter from Univ of Illinois), and Northfield (11/4).
12/15/2014		FirstLight files responds to comments raised on the FRR and Erosion Causation Study.
01/22/2015		FERC issued its Determination Letter on the FRR. FirstLight was required to meet with stakeholders and file an addendum to the FRR by 04/22/2015. The only comment on the Erosion Causation study was that FERC required FirstLight to file progress reports.
02/24/2015		FirstLight sent MDEP and stakeholders a copy of the FRR addendum
03/04/2015	Greenfield	FirstLight met with MDEP and stakeholders on the FRR addendum. At the end of the meeting, FirstLight requested comments on the FRR addendum by 04/03/2015. MDEP did not provide comments
03/31/2015		FirstLight emailed stakeholders, including MDEP, information on groundwater data, boat wave data, TFI and flow data, and Project Boundary maps regarding the Erosion Causation Study.
04/22/2015		FirstLight filed the FRR addendum, its response to comments, and the full consultation record with FERC
05/26/2015		FirstLight filed its 2015 Q1 data deliverable report on the Erosion Causation Study. Filing included information on groundwater data, boat wave data, TFI and flow data, and Project Boundary maps.
08/18/2015		FirstLight filed progress report on the Erosion Causation Study.
09/14/2015		FirstLight filed its Updated Study Report Summary for the Erosion Causation Study. Filing included all of the 2015 correspondence log on the Erosion Causation Study.

Date	Mtg Location	Summary
09/30/2015	Northfield	FirstLight held its 2015 USR meeting. The FRR and Erosion Causation Studies were discussed on 09/30. MDEP attended the meeting.
10/15/2015		FirstLight filed meeting minutes from 09/30/2015 USR meeting
10/22/2015		FirstLight filed information on the Erosion Causation Study regarding the Exhibit K drawings.
12/14/2015		FirstLight filed its response to comments received on the Erosion Causation Study. No comments were filed by MDEP.
01/15/2015		FERC issued its Determination Letter on the Erosion Causation Study. FERC did not adopt any proposed changes to the study.
10/14/2016		FirstLight filed the Erosion Causation Study- Vol I-III.
11/01/2016	Northfield	FirstLight met with stakeholders, including MDEP on the Erosion Causation Study.
11/15/2016		FirstLight filed meeting minutes from 11/01/2016 meeting.
12/14/2016		MDEP filed comments on Erosion Causation Study.
01/17/2017		FirstLight filed response to comments on the Erosion Causation Study. This filing includes all comment letters.
02/17/2017		FERC issued its Determination Letter on the Erosion Causation Study. FERC did not adopt any proposed changes to the study.
04/03/2017		FirstLight filed updated Erosion Causation Study- Vol I-III and Report on the Expanded Use of the Upper Reservoir. Regarding the Erosion Causation Study it was essentially the same report as filed on 10/14/2016, however, FirstLight discovered two sites used the incorrect bank geometry, which was addressed in this filing.
10/09/2018	Northfield	FirstLight met with stakeholders, including MDEP, on the Erosion Causation Study, which was a summary of the activities between 10/14/2016 and 04/03/2017.
10/24/2018		FirstLight filed meeting minutes on the 10/09 meeting.
12/21/2018		FirstLight filed response to comments raised on the Erosion Causation Study and Expanded Use of the Upper Reservoir. No comments were filed by MDEP.
03/22/2024		FirstLight filed report entitled Supplemental BSTEM Model Report Reflecting Operating Conditions in the F/F Agreement.

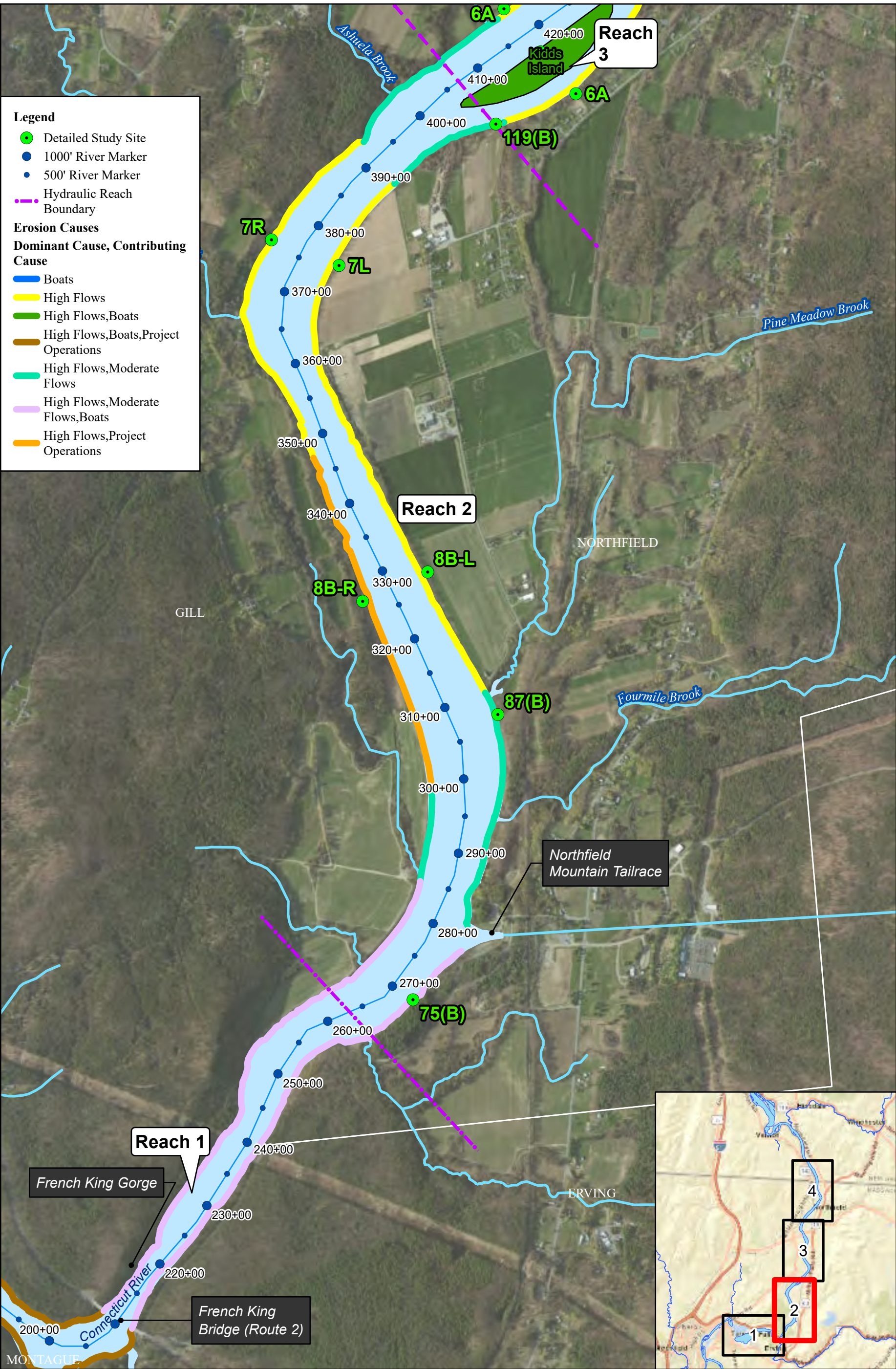


FIRSTLIGHT MA HYDRO LLC
NORTHFIELD MOUNTAIN LLC
Northfield Mountain Pumped Storage Project (No. 2485)
Turners Falls Hydroelectric Project (No. 1889)
401 Water Quality Certification Application

Figure 5.5.2-1:
Causes of Erosion for TFI Bank Segments
within Massachusetts
Map 1



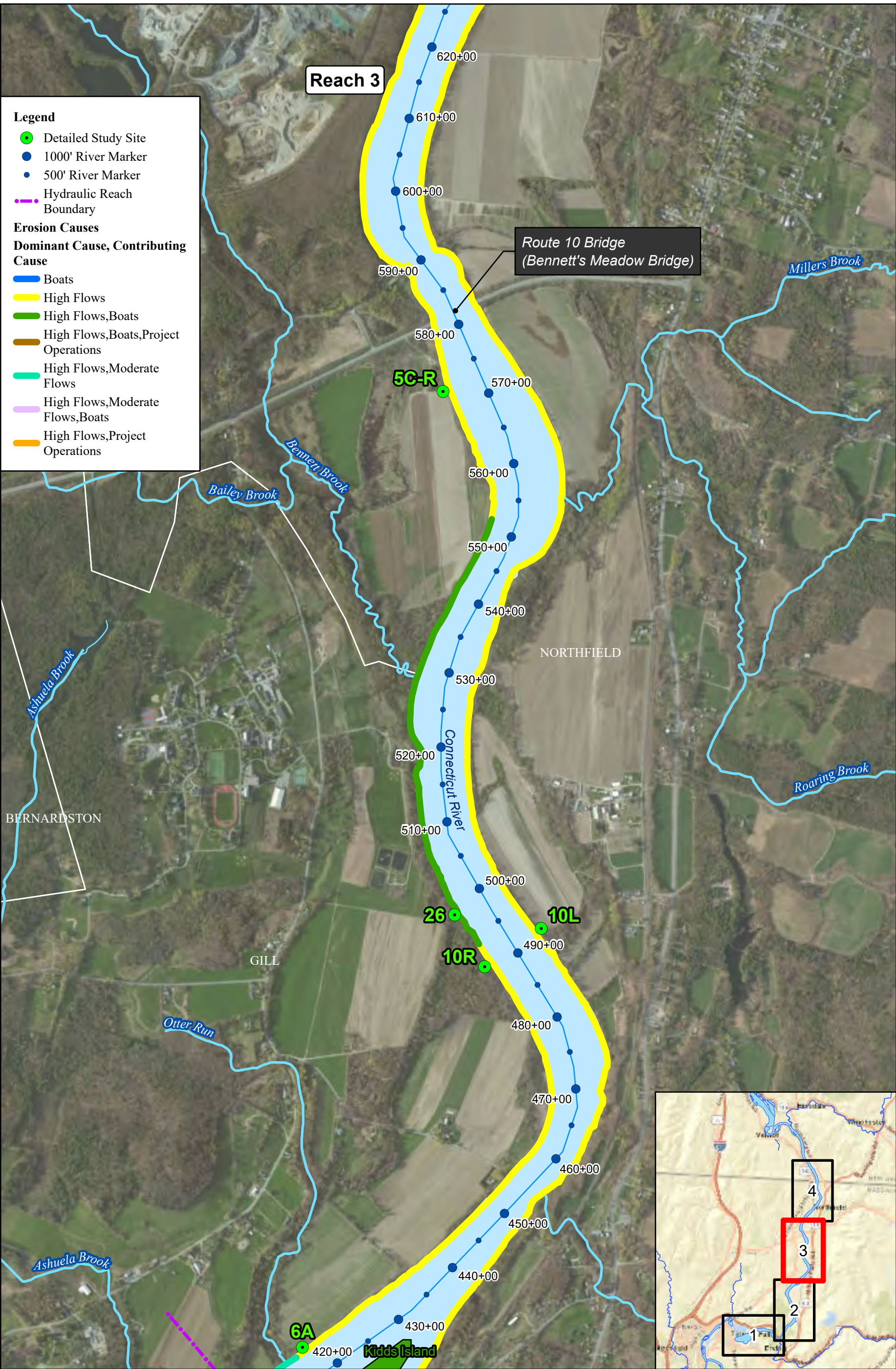
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Geographics, IGN, and the GIS User Community
World Esri Street Basemap: Esri, HERE, Garmin, NGA, USGS, NPS



FIRSTLIGHT MA HYDRO LLC
NORTHFIELD MOUNTAIN LLC
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Figure 5.5.2-1:
Causes of Erosion for TFI Bank Segments
within Massachusetts
Map 2

Service Layer Credits: World Esri Imagery (Clarity) Basemap: Source: Esri, Maxar, Earthstar
Geographics, IGN, and the GIS User Community
World Esri Street Basemap: Esri, HERE, Garmin, NGA, USGS, NPS



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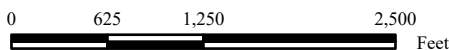


Figure 5.5.2-1:
Causes of Erosion for TFI Bank Segments
within Massachusetts
Map 3

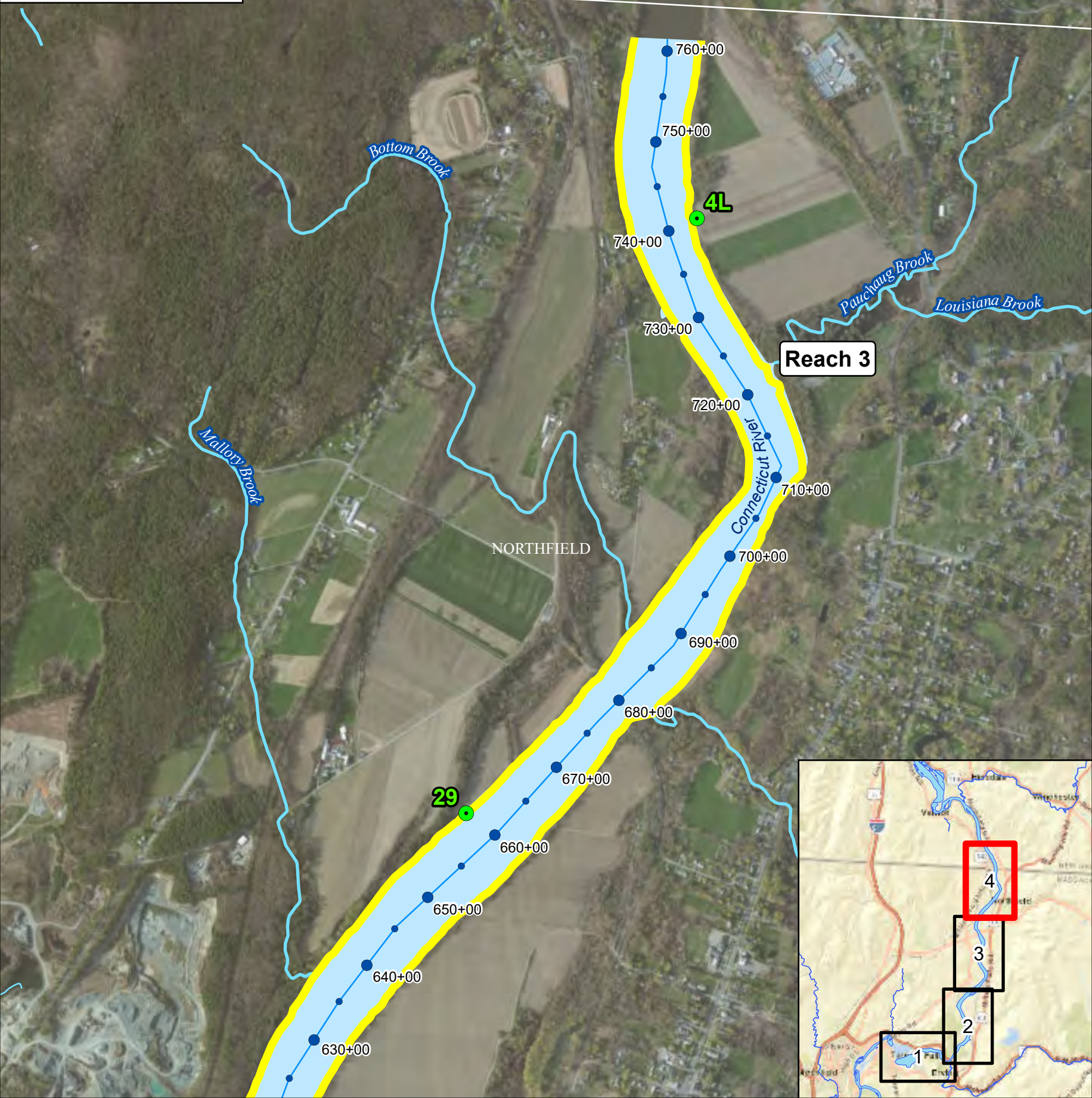
Service Layer Credits: World Esri Imagery (Clarity) Basemap: Source: Esri, Maxar, Earthstar
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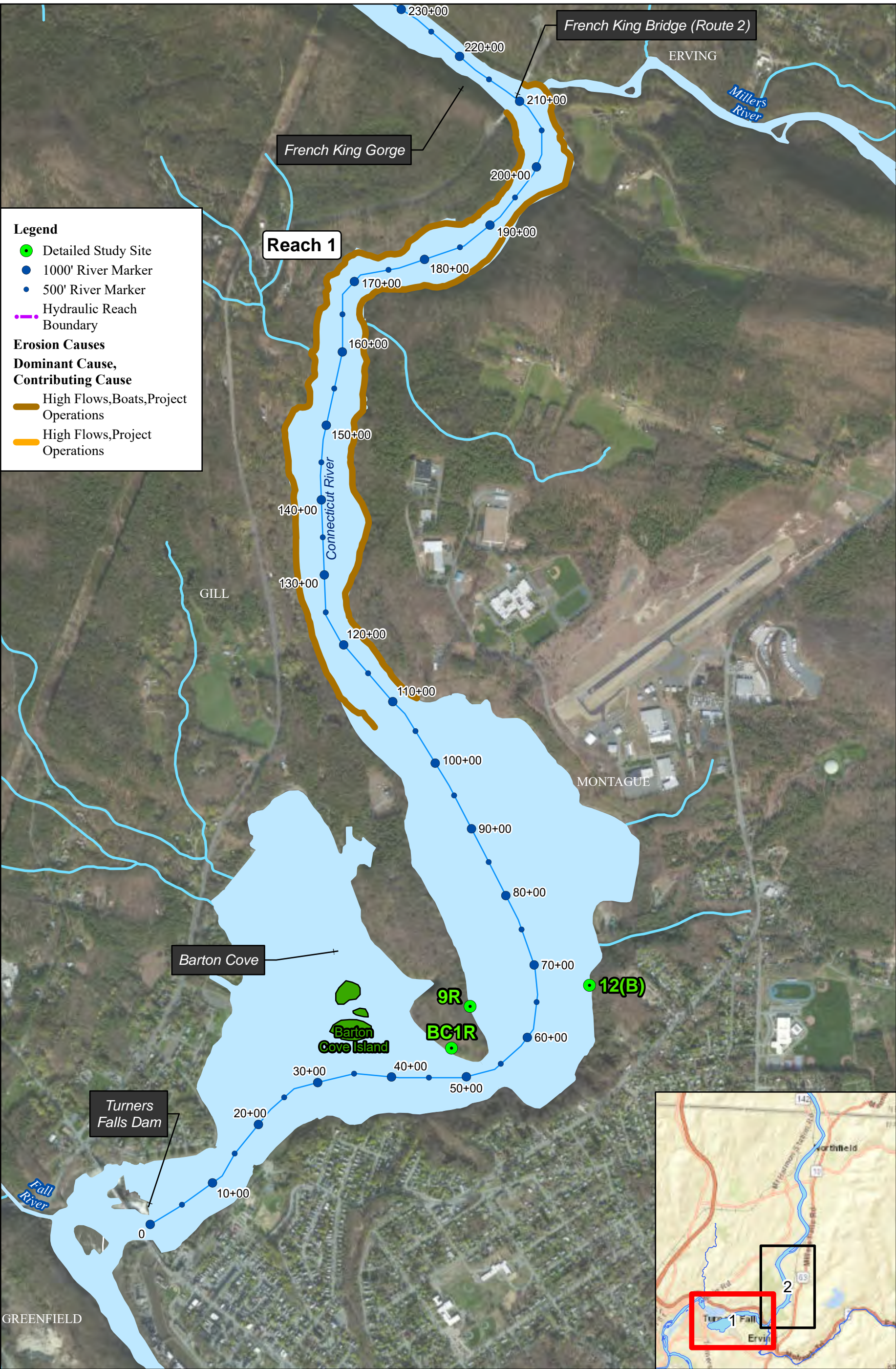
Legend

- Detailed Study Site
- 1000' River Marker
- 500' River Marker
- Hydraulic Reach Boundary

Erosion Causes**Dominant Cause, Contributing Cause**

- Boats
- High Flows
- High Flows,Boats
- High Flows,Boats,Project Operations
- High Flows,Moderate Flows
- High Flows,Moderate Flows,Boats
- High Flows,Project Operations



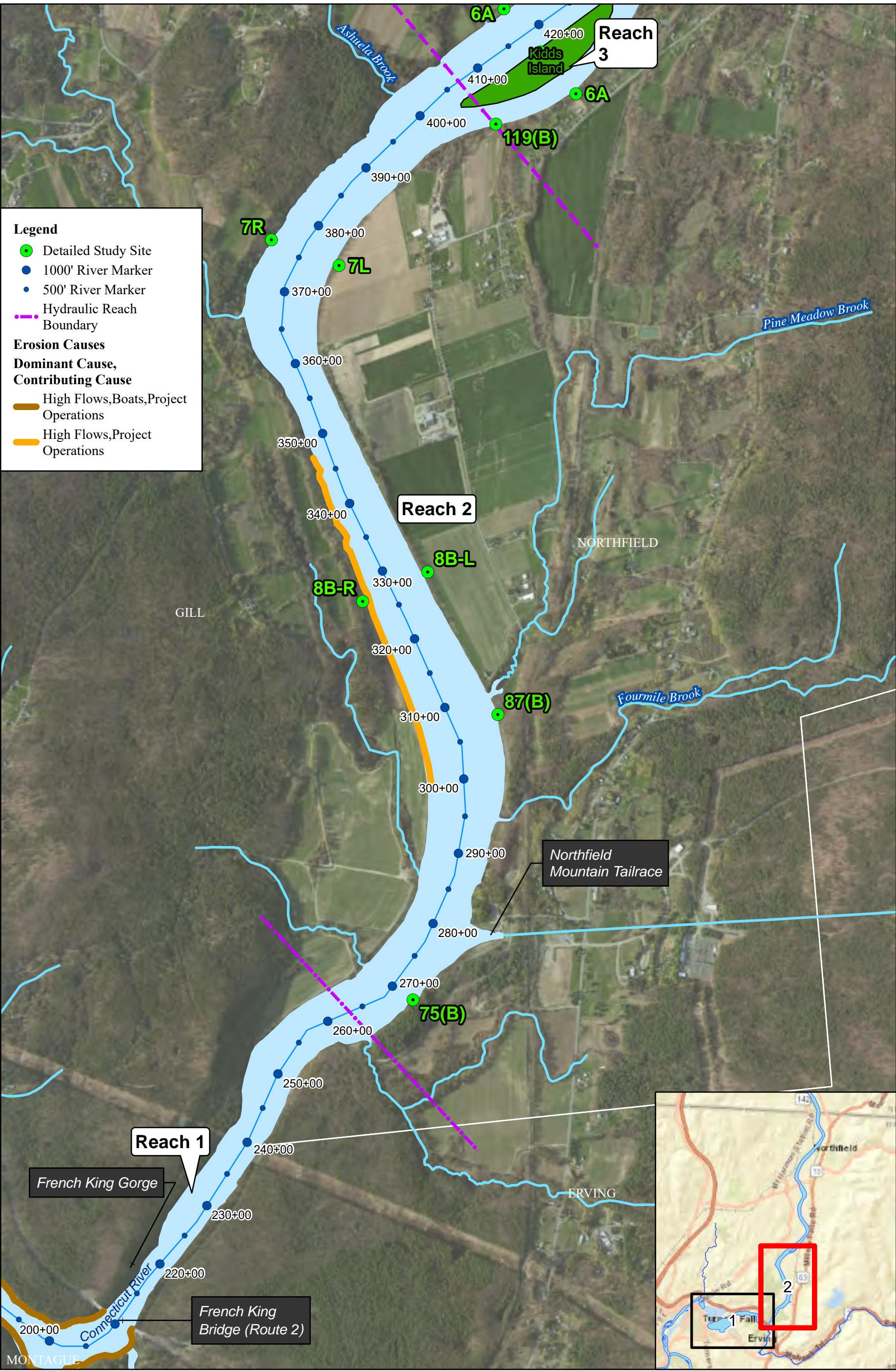


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NORTHFIELD MOUNTAIN LLC
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Figure 5.5.3-1: TFI Riverbank Segments Subject to Future Erosion Monitoring Map 1



Service Layer Credits: World Esri Imagery (Clarity) Basemap: Source: Esri, Maxar, Earthstar
Geographics, IGN, and the GIS User Community
World Esri Street Basemap: Esri, HERE, Garmin, NGA, USGS, NPS



Legend

- Detailed Study Site
- 1000' River Marker
- 500' River Marker
- Hydraulic Reach Boundary

Erosion Causes

**Dominant Cause,
Contributing Cause**

- High Flows, Boats, Project Operations
- High Flows, Project Operations

FIRSTLIGHT MA HYDRO LLC
NORTHFIELD MOUNTAIN LLC
Northfield Mountain Pumped Storage Project (No. 2485)
Turners Falls Hydroelectric Project (No. 1889)
401 Water Quality Certification Application

Figure 5.5.3-1: TFI Riverbank Segments Subject to Future Erosion Monitoring
Map 2



0 625 1,250 2,500
Feet

Service Layer Credits: World Esri Imagery (Clarity) Basemap: Source: Esri, Maxar, Earthstar
Geographics, IGN, and the GIS User Community
World Esri Street Basemap: Esri, HERE, Garmin, NGA, USGS, NPS

5.6 Bald Eagle Protection Plan

A Bald Eagle Protection Plan was developed for the Turners Falls and Northfield Mountain Projects and was filed with the F/F Agreement. Draft License **Article A400. Bald Eagle Protection Plan** of the Turners Falls Project and Draft **License Article B200. Bald Eagle Protection Plan** of the Northfield Mountain Project both state the following: “The Licensee shall implement the Bald Eagle Protection Plan.” The Bald Eagle Protection Plan is included below.

Bald Eagle Protection Plan

The purpose of this plan is to guide the Licensee’s management and maintenance of lands at the Turners Falls Project and Northfield Mountain Project over the new license term for the protection of bald eagles.

Although bald eagles have been removed from the endangered species list, bald and golden eagles are still protected under multiple federal laws and regulations including the Bald and Golden Eagle Protection Act and the Migratory Bird Treaty Act.

Bald eagles winter along the Connecticut River in the Project area. Bald eagles are known to perch in riverbank trees and forage over the Connecticut River in the Project vicinity. As part of licensing, several bald eagles, adults and juveniles, have been observed perching or foraging in the Turners Falls Impoundment (TFI) and Northfield Mountain in both 2014 and 2015, and two occupied bald eagle nests were located within the study area. These nests were found downstream on Third Island (below Cabot Station), near Smead Island, Barton Island in Barton Cove, and along the east bank of the TFI across from Stebbins Island in the upper reaches of the TFI. Since the study, the Licensees staff at the Northfield Mountain Visitor Center have provided anecdotal information on two additional eagle nests located within the TFI. One is located in the vicinity of Kidd’s Island either on the Island or the eastern shore in the Town of Northfield and one in Turners Falls, on the hillside in the general vicinity of the Turners Falls Airport runway.

Protection Measures

Given the nature and scope of Project operations, no adverse effects on bald eagles are anticipated. In the event that tree removal or construction activities are necessary at the Project, the Licensee shall implement the conservation measures described below to avoid effects to bald eagles.

Prior to any tree clearing within the Project boundary or areas immediately adjacent to the Project boundary by the Licensee or its contractors, the area to be cleared will be observed for bald eagle nests by the Licensee. If practicable, the Licensee should also survey for nests within 660 feet of the proposed clearing because nests adjacent to clearing may also be indirectly affected. If such nests are discovered, the Licensee shall consult the Massachusetts Division of Fisheries and Wildlife (MDFW) and the United States Fish and Wildlife Service (USFWS) prior to tree-clearing activities and the tree-clearing activities shall be performed in accordance with the applicable regulations and guidance (i.e., the National Bald Eagle Management Guidelines, USFWS 2007, or as amended).

During the nesting season (January 1 through September 30), no tree clearing will occur within 330 feet of, and no construction activities will occur within 660 feet of, any known bald eagle nests by the Licensee or its contractors. The National Bald Eagle Management Guidelines advise against conducting external construction and land clearing activities within 660 feet of bald eagle nests during the breeding season.

Additionally, the Guidelines recommend maintaining a year-round buffer between nests and tree clearing of at least 330 feet and a year-round buffer between external construction and nests of either 330 or 660 feet, depending on the construction's size, visibility, and local precedence. For any project-related construction activities, work that requires blasting or other activities that produce extremely loud noises within 1/2 mile of active nests will be avoided. The Licensee shall consult with the MDFW and USFWS regarding tree clearing or construction activities that cannot meet these conditions.

5.7 Bat Protection Measures

5.7.1 *Turners Falls Project*

The following Draft License Article was included in the F/F Agreement.

Article A410. Bat Protection Measures

The Licensee shall implement the following measures to protect state or federally listed bat habitat: (1) avoid cutting trees equal to or greater than 3 inches in diameter at breast height within the Turners Falls Project boundary from April 1 through October 31, unless they pose an immediate threat to human life or property (hazard trees); and (2) where non-hazard trees need to be removed, only remove non-hazard trees between November 1 and March 31.

5.7.2 *Northfield Mountain Project*

The following Draft License Article was included in the F/F Agreement.

Article B310. Bat Protection Measures

The Licensee shall implement the following measures to protect state or federally listed bat habitat: (1) avoid cutting trees equal to or greater than 3 inches in diameter at breast height within the Northfield Mountain Pumped Storage Project boundary from April 1 through October 31, unless they pose an immediate threat to human life or property (hazard trees); and (2) where non-hazard trees need to be removed, only remove non-hazard trees between November 1 and March 31.

5.8 Invasive Plant Species Management Plan

Included in [Appendix B](#) and [Appendix C](#) are the Turners Falls and Northfield Mountain Invasive Plant Species Management Plans, respectively. These plans replace those filed with the AFLA.

Attachment A. Turners Falls Hydroelectric Project Form BRP WW28

BRP WW28- Application for Hydroelectric Power Generation Project 401 Water Quality Certification
(MDEP version dated 07/27/2023)



Massachusetts Department of Environmental Protection
Bureau of Water Resources – 401 Water Quality Certification

Transmittal Number _____

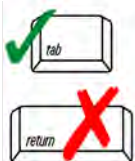
BRP WW28 - Application for Hydroelectric Power Generation
Project 401 Water Quality Certification

Date _____

A. Project Information

Important:

When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.



1. FERC License Type

For what type of Federal Energy Regulatory Commission license are you requesting certification?

☐ Surrender

☒ Re-License

☐ Amendment

☐ Exemption

02/22/2024

Date of issuance of FERC's Ready for Env. Analysis

03/26/2024

Date of Pre-Filing Meeting Request to MassDEP
(must be submitted 30 days prior to filing this application)

2. Applicant / Licensee Information

FirstLight MA Hydro LLC

Company Name

100 District Avenue, Suite 102

Street Address

Burlington

City/Town

MA

State

01083

Zip Code

Justin Trudell

Contact Person Name

justin.trudell@firstlight.energy

Contact Person Email Address

781-653-4247

Contact Person Phone Number

3. Authorized Agent / Representative Information

Foley Hoag LLP

Company Name

155 Seaport Blvd

Street Address

Boston

City/Town

MA

State

02210

Zip Code

Adam Kahn

Contact Person Name

akahn@foleyhoag.com

Contact Person Email Address

617-285-7634

Contact Person Phone Number

4. FERC Project Information

FERC Project Name

Turners Falls Hydroelectric Project

FERC Docket No.

1889

15 Cabot Street

Project Street Address

Montague

City/Town

MA

State

01376

Zip Code

Receiving Waterbody
Segments and
CWA § 303(d)
Impairment Status

see Attachment 1



Massachusetts Department of Environmental Protection
Bureau of Water Resources – 401 Water Quality Certification

Transmittal Number _____

**BRP WW28 - Application for Hydroelectric Power Generation
Project 401 Water Quality Certification**

Date _____

A. Project Information (cont.)

5. MEPA Information

Attach
documentation
of MEPA
jurisdictional
status

Is the project subject to MEPA? ☐ Yes ☒ No

If yes, MEPA Project Name See attached July 6, 2012 and July 12, 2012 letters

EOEEA Number _____

Date of MEPA Certificate _____

6. List all other federal, interstate, tribal, state, territorial, or local agency authorizations required for the proposed project, including all approvals or denials already received.

The Project is being relicensed with the Federal Energy Regulatory Commission, which also requires a 401 WQC. Once MDEP issues the final 401 WQC and FERC issues the new license, then the Licensee will be required to implement the license conditions. At that point, approvals and permitting will be required to construct new project features such as fish passage or recreation facilities. It is expected that MEPA, federal and other permitting will be required.

7. Documentation Required

Attach one complete copy of the following documents:

- a. The license application, and any amendments thereto, filed with FERC for the project.
- b. An annotated table or compendium organized according to subject with hyperlinks to all reports relevant to this application, including any related data and quality assurance project plans, documenting the results of all related studies, including those requested by MassDEP, state and federal fish, wildlife and natural resource agencies, tribes, and other groups or individuals, regardless whether the reports are or are not on file in the above referenced FERC Docket.
- c. Draft Water Quality Mitigation and Enhancement Plan with hyperlinks to relevant reports provided above describing measures to improve water quality and demonstrate that the project will meet the Massachusetts Surface Water Quality Standards (SWQS, 314 CMR 4.00) after accounting for dam and all other project-related impacts to, and any currently associated impairments of, the relevant water body segments.
- d. Draft Long-Term Sampling and Analysis Plan for post-certification physical, chemical, and biological monitoring, including the proposed monitoring objectives, types, methodologies, and schedules, in order to provide quality-controlled information and data necessary for MassDEP's assessment of all designated uses in affected segments, per MassDEP's Consolidated Assessment and Listing Methodology Guidance. See <https://www.mass.gov/service-details/water-quality-assessments>
- e. A summary of stakeholder outreach conducted prior to filing this 401 WQC application, including any specific outreach to Environmental Justice Populations affected by the project.



Massachusetts Department of Environmental Protection
Bureau of Water Resources – 401 Water Quality Certification

Transmittal Number _____

BRP WW28 - Application for Hydroelectric Power Generation
Project 401 Water Quality Certification

Date _____

A. Project Information (cont.)

8. Public Notice

Timing of notice: Within ten days of submitting the application, the applicant shall publish a notice of the application that has been pre-approved by the Massachusetts Department of Environmental Protection.

Means of publication: The notice must be published in the Environmental Monitor and in a local or regional newspaper with the largest readership distribution both online and in hardcopy, if hardcopy exists, within the area that may be affected by the project. The applicant shall also send a copy of the notice to the chief municipal elected official and the conservation commission for the municipalities that may be affected. The applicant shall request that those municipalities publish the notice in the local town or city hall and on the website of the community or communities that may be affected. In municipalities with Environmental Justice Populations where the preceding method for publishing public notice does not specifically serve the Environmental Justice Population(s), public notice shall be provided to at least one additional news organization that primarily serves the Environmental Justice Population(s) within the area that may be affected by the designation. The public notice shall be translated into other languages that are prevalent in areas with persons of limited English proficiency. The Department will publish the notice on its website.

Content of notice: The notice must specify how comments may be submitted; the expiration date of the public comment period; the date, time, and location of public hearing(s) and an internet link if the hearing is remote (if a public hearing will be held); and, if applicable, the applicant's and Department's websites where additional information may be obtained. The notice shall identify the location and the type of project for which the application is filed; a point of contact for information requests to the applicant; and a statement that any ten persons of the Commonwealth, any aggrieved person, or any governmental body or private organization with a mandate to protect the environment that has submitted written comments on the DRAFT Water Quality Certification may appeal MassDEP's Certification pursuant to 310 CMR 1.01 and that failure to submit comments on the DRAFT Water Quality Certification before the end of the public comment period may result in the waiver of any right to an adjudicatory hearing.

B. Applicant's Certification

I hereby certify under the penalties of perjury that I am authorized by the project proponent to provide the following statements:

- (1) The project proponent acknowledges that it is responsible for submitting any site-specific data or other information required to facilitate MassDEP's review of this Application;
- (2) The project proponent acknowledges that any failure to submit in a timely manner such data or information may serve as a basis for denial of this Application;
- (3) The project proponent hereby certifies that all information contained herein is true, accurate, and complete to the best of its knowledge and belief; and
- (4) The project proponent hereby requests that the certifying authority review and take action on this CWA 401 certification Application within the applicable reasonable period of time.

Authorized Agent / Representative Signature

Justin Trudell, President and CEO

Printed Name

4/22/2024

Date

This Application must be filed with FERC at the same time it is filed with MassDEP

Attachment 1 to Attachment A- Turners Falls Hydroelectric Project, BRP WW28 Application for Hydroelectric Generation Project 401 Water Quality Certificate

Question 4: Waterbody: Connecticut River- Category 5 Waters, 303(d) List- “Waters requiring a TMDL”

Assessment Unit ID	Description	Length (miles)	Impairment	Source**
MA34122	Gill (cove of Connecticut River upstream of Turners Falls Dams)	160 acres	(Curly-leaf Pondweed*) (Eurasian Water Milfoil*) (Fanwort*) (Water Chestnut*)	Introduction of Non-Native Organisms (Accidental or Intentional)
			Escherichia Coli (E.coli)	Unknown
MA34-01	New Hampshire/Massachusetts state line to Route 10 Bridge in Northfield	3.5	(Alteration in Stream-side or Littoral Vegetative Covers*)	Streambank Modifications/ Destabilization
			(Flow Regime Modification*)	Impacts from Hydrostructure Flow Regulation/ Modification
			PCBs in Fish Tissue	Unknown
MA34-02	Route 10 Bridge, Northfield to Turners Falls Dams (NATID: MA00848 and MA00849) Gill/ Montague (excluding the delineated segment; Barton Cove MA34019)	11.4	(Alteration in Stream-side or Littoral Vegetative Covers*)	Streambank Modifications/ Destabilization
			(Flow Regime Modification*)	Impacts from Hydrostructure Flow Regulation/ Modification
			(Water Chestnut*)	Introduction of Non-Native Organisms (Accidental or Intentional)
			PCBs in Fish Tissue	Unknown
MA34-03	Turners Falls Dams (NATID: MA00848 and MA00849), Gill/Montague to confluence with Deerfield River, Greenfield/Montague	3.7	(Dewatering*)	Impacts from Hydrostructure Flow Regulation/ Modification
			(Flow Regime Modification*)	Impacts from Hydrostructure Flow Regulation/ Modification
			Escherichia Coli (E. Coli)	Combined Sewer Overflows
			PCBs in Fish Tissue	Unknown
			Total Suspended Solids (TSS)	Unknown

*TMDL not required (Non-pollutant)

**The sources were obtained from [Water Quality Data Viewer - MassDEP](#)

Source: [download \(mass.gov\)](#), Massachusetts Integrated List of Waters for the Clean Water Act 2022 Reporting Cycle, May 2023, page 167-168.

Attachment B. Northfield Mountain Pumped Storage Project Form BRP WW28

BRP WW28- Application for Hydroelectric Power Generation Project 401 Water Quality Certification
(MDEP version dated 07/27/2023)



Massachusetts Department of Environmental Protection
Bureau of Water Resources – 401 Water Quality Certification

Transmittal Number _____

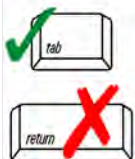
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Project 401 Water Quality Certification**

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☒ Re-License

☐ Amendment

☐ Exemption

02/22/2024

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03/26/2024

Date of Pre-Filing Meeting Request to MassDEP
(must be submitted 30 days prior to filing this application)

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100 District Avenue, Suite 102

Street Address

Burlington

City/Town

MA

State

01083

Zip Code

Justin Trudell

Contact Person Name

justin.trudell@firstlight.energy

Contact Person Email Address

781-653-4247

Contact Person Phone Number

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155 Seaport Blvd

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Boston

City/Town

MA

State

02210

Zip Code

Adam Kahn

Contact Person Name

akahn@foleyhoag.com

Contact Person Email Address

617-285-7634

Contact Person Phone Number

4. FERC Project Information

FERC Project Name

Northfield Mountain Pumped Storage Project

FERC Docket No.

2485

99 Millers Falls Road

Project Street Address

Northfield

City/Town

MA

State

01360

Zip Code

Receiving Waterbody
Segments and
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Impairment Status

See Attachment 1



Massachusetts Department of Environmental Protection
Bureau of Water Resources – 401 Water Quality Certification

Transmittal Number _____

**BRP WW28 - Application for Hydroelectric Power Generation
Project 401 Water Quality Certification**

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A. Project Information (cont.)

5. MEPA Information

Attach
documentation
of MEPA
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status

Is the project subject to MEPA? ☐ Yes ☒ No

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Date

This Application must be filed with FERC at the same time it is filed with MassDEP

**Attachment 1 to Attachment B- Northfield Mountain Pumped Storage Project, BRP WW28 Application for Hydroelectric Generation Project
401 Water Quality Certificate**

Question 4: Waterbody: Connecticut River- Category 5 Waters, 303(d) List- “Waters requiring a TMDL”

Assessment Unit ID	Description	Length (miles)	Impairment	Source**
MA34122	Gill (cove of Connecticut River upstream of Turners Falls Dams)	160 acres	(Curly-leaf Pondweed*) (Eurasian Water Milfoil*) (Fanwort*) (Water Chestnut*)	Introduction of Non-Native Organisms (Accidental or Intentional)
			Escherichia Coli (E.coli)	Unknown
MA34-01	New Hampshire/Massachusetts state line to Route 10 Bridge in Northfield	3.5	(Alteration in Stream-side or Littoral Vegetative Covers*)	Streambank Modifications/ Destabilization
			(Flow Regime Modification*)	Impacts from Hydrostructure Flow Regulation/ Modification
			PCBs in Fish Tissue	Unknown
MA34-02	Route 10 Bridge, Northfield to Turners Falls Dams (NATID: MA00848 and MA00849) Gill/ Montague (excluding the delineated segment; Barton Cove MA34019)	11.4	(Alteration in Stream-side or Littoral Vegetative Covers*)	Streambank Modifications/ Destabilization
			(Flow Regime Modification*)	Impacts from Hydrostructure Flow Regulation/ Modification
			(Water Chestnut*)	Introduction of Non-Native Organisms (Accidental or Intentional)
			PCBs in Fish Tissue	Unknown
MA34-03	Turners Falls Dams (NATID: MA00848 and MA00849), Gill/Montague to confluence with Deerfield River, Greenfield/Montague	3.7	(Dewatering*)	Impacts from Hydrostructure Flow Regulation/ Modification
			(Flow Regime Modification*)	Impacts from Hydrostructure Flow Regulation/ Modification
			Escherichia Coli (E. Coli)	Combined Sewer Overflows
			PCBs in Fish Tissue	Unknown
			Total Suspended Solids (TSS)	Unknown

*TMDL not required (Non-pollutant)

**The sources were obtained from [Water Quality Data Viewer - MassDEP](#)

Source: [download \(mass.gov\)](#), Massachusetts Integrated List of Waters for the Clean Water Act 2022 Reporting Cycle, May 2023, page 167-168.

Attachment C. Draft Water Quality Mitigation and Enhancement Plan

Question 7c. of the BRP WW28 Application for Hydroelectric Power Generation Project 401 Water Quality Certification states the following:

7c. Draft Water Quality Mitigation and Enhancement Plan with hyperlinks to relevant reports provided above describing measures to improve water quality and demonstrate that the project will meet the Massachusetts Surface Water Quality Standards (SWQS, 314 CMR 4.00) after accounting for dam and all other pre-related impacts to, and any currently associated impairments of, the relevant water body segments.

The Draft Water Quality and Enhancement Plan focuses on how FirstLight's proposal addresses impairments that have a nexus to Project operations. The specific locations include the Massachusetts portion of the TFI, including Barton Cove, and from the Turners Falls Dam to the Deerfield River confluence. Note that impairments associated with PCBs in fish and Total Suspended Solids are not addressed in this plan as the source is listed as unknown. In addition, the source of the impairment associated with E-coli is combined sewer overflows, thus it is not addressed in this plan.

Common Impairments in Assessment Units MA34-01 and MA34-02

MA34-01 includes 3.5 miles of the TFI from the MA/NH/VT Stateline down to the Route 10 Bridge. MA 34-02 includes the 11.4 miles of the TFI from the Route 10 Bridge to Turners Falls Dam. Common impairments in these two segments include a) alteration of stream-side or littoral vegetative cover, b) flow regime modification, and c) PCBs in fish. The sources of impairments are listed as a) streambank stabilization/modification, b) impacts from hydrostructure flow regulation/modification and c) unknown, respectively. FirstLight addresses the alteration of stream-side or littoral vegetative cover and flow regime modification below.

Alteration of Stream-Side or Littoral Vegetative Cover

To address issues related to the streambank alteration and littoral vegetative cover, FirstLight conducted two relevant studies including:

- Full River Reconnaissance (FRR) Study (Study No. 3.1.1)
- Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability (Study No. 3.1.2) also known as the Erosion Causation Study.

The FRR included a boat and land based survey of the entire TFI to characterize the riverbank conditions and features. The results of this study were used to inform the Erosion Causation Study. The Erosion Causation Study included a comprehensive holistic assessment of erosion processes throughout the TFI which included:

- A qualitative geomorphic analysis was conducted to develop a geomorphic understanding of the Connecticut River and the TFI including (a) geomorphology of alluvial rivers; (b) geomorphic history of the Connecticut River; (c) analysis of historic datasets and publications (e.g., Field

(2007))¹²; (d) geomorphic analysis of tributaries and upland erosion features; and (e) erosion comparison of the TFI and Connecticut River.

- A quantitative engineering and geomorphic analysis including: (a) analysis of the hydrologic and hydraulic characteristics of the TFI based on field collected data and hydraulic model results; (b) sediment transport analysis; (c) analysis of hydraulic shear stress, water level fluctuations, boat waves, and ice as potential primary causes of erosion; and (d) analysis of land-use and land management practices via geospatial analysis.
- As elaborated further below, computer modeling was conducted to understand the complex hydrologic, hydraulic and geotechnical dynamics of the TFI. The key tool in the erosion assessment was the Bank Stability and Toe Erosion Model (BSTEM), which was developed by Dr. Andrew Simon during his time at the U.S. Department of Agriculture National Sedimentation Laboratory, who headed the Erosion Causation Study. A total of 25 detailed study sites were selected in consultation with MDEP and stakeholders for detailed study in the Erosion Causation Study representing the range of riverbank conditions and features observed in the FRR.

Further information on this comprehensive holistic approach is included in [Appendix E](#).

FirstLight conducted the Erosion Causation Study per the approved study plan and quantified the causes and extent of erosion under baseline operating conditions. The primary causes of erosion were categorized as Project operations, high flows/floods, and boat waves. BSTEM relied on the following information:

- The operating conditions were simulated in the operations model of the Project, which provides information on the hourly flow and water elevation at the Turners Falls Dam (see Study No. 3.8.1 for further details on the operations model). The operations model simulated baseline conditions and alternative operating conditions as discussed below.
- The water level and flow data from the operations model was used in a tightly calibrated hydraulic model of the TFI (see Study No. 3.2.1 for further details on the hydraulic model).
- The water level and flow data at each of the 25 detailed study sites, along with the soils data and testing collected at these same sites, were used in BSTEM to quantify the bank erosion rate at each detailed study site. The BSTEM results combined with quantitative analyses were used to determine the causes of erosion at each site, which were then extrapolated to each bank segment within the TFI.

The Erosion Causation Study, reflecting baseline conditions, was filed with FERC in April 2017. In addition to the April 2017 report other BSTEM modeling and associated reports were developed as part of licensing including a) simulating the increased use of the Upper Reservoir Storage, b) simulating the conditions in the AFLA and c) more recently, on March 22, 2024, FirstLight filed a report with FERC simulating the operating conditions in the Flow and Fish Passage Settlement Agreement, which was compared to baseline conditions. The March 2024 report supersedes all of the previous reports.

¹² Field Geology Services (Field). (2007). Fluvial Geomorphology Study of the Turners Falls Pool on the Connecticut River between Turners Falls, MA and Vernon, VT. Farmington, ME: Author.

A consistent finding throughout all of the erosion evaluations conducted during relicensing is that the dominant¹³ causes of erosion in the TFI are high flows/floods and, in the Barton Cove area, boat waves. Project operations is not a dominant cause of erosion at any locations in the TFI but is a contributing¹⁴ cause of erosion in the following locations of the TFI in Massachusetts:

- ~21,600-foot-long reach from the exit of Barton Cove to the French King Gorge (banks along both sides of the river).
- ~4,700-foot-long reach on river right upstream of the Northfield Mountain tailrace.

While the impairment is primarily a function of high flows/floods and boat waves, to address streambank erosion where Project operations is a contributing cause of erosion under the operating conditions in the F/F Agreement, FirstLight is proposing to implement a shoreline erosion monitoring program in the Massachusetts reach of the TFI consisting of the following:

- Within one year of license issuance, FirstLight will develop a Shoreline Erosion Monitoring Plan in consultation with MDEP, which will be approved by MDEP prior to FirstLight initiating any shoreline erosion surveys.
- FirstLight will conduct an initial shoreline erosion survey within two years of license issuance.
- FirstLight will conduct additional shoreline erosion surveys in Year 10, 20, 30, and 40 of the new license.
- Each erosion survey will consist of:
 - A boat-based reconnaissance survey of each TFI riverbank segment in Massachusetts (excluding the Barton Cove area) where proposed Project operations are identified by the March 2024 erosion evaluation to be a contributing cause of erosion. This includes the approximately 21,600-foot-long reach from the exit of Barton Cove to the French King Gorge and the approximately 4,700-foot-long reach on river right upstream of the Northfield Mountain tailrace. The reconnaissance survey will characterize the riverbank characteristics and erosion conditions of these reaches.
 - Cross-sectional surveys at existing detailed study sites within each TFI riverbank segment in Massachusetts (excluding the Barton Cove area) where proposed Project operations are identified by the March 2024 erosion evaluation to be a contributing cause of erosion. If a detailed study site does not currently exist in such a reach (e.g., the reach from the Barton Cove exit to the French King Gorge), FirstLight will establish a representative detailed study site within that reach during the first erosion survey following license issuance. Newly established detailed study sites will be re-surveyed during subsequent surveys.
- Following completion of each erosion survey, FirstLight will prepare a report summarizing the survey methods and results. The report will also identify surveyed riverbank segments that

¹³ For a cause to be considered dominant, it needed to be responsible for at least 50% of the bank erosion at a site.

¹⁴ For a cause to be considered contributing, it had to contribute to >5%, but less than 50%, of the erosion at a site.

require stabilization or, in the event of a previously repaired bank segment, repair, if any. The report will be submitted to MDEP for approval.

- Upon approval from MDEP, FirstLight will complete the stabilization or repair measures identified in the final report, if any, within 5 years. Following completion of remediation activities, FirstLight will file as-built documentation (plans/photos) of the stabilization/repair efforts with MDEP.

Flow Regime Modification

The flow regime in the TFI is influenced by many factors including:

- There are storage reservoirs in the watershed upstream of the TFI that impact the seasonal magnitude and timing of flow on the Connecticut River. The storage projects on the Connecticut River operate to increase low flows in the summer, store flows in the spring, and include First Connecticut Lake, Second Connecticut Lake and Lake Francis. In addition to the mainstem storage reservoir there are other flood control facilities on tributaries to the Connecticut River.
- Closer to the Project, there are flood control storage reservoirs on the Ashuelot and Millers Rivers, tributaries to the TFI that impact the seasonal magnitude and timing of flow.
- Operation of hydroelectric projects on the Connecticut River upstream of the TFI including:
 - The Fifteen Mile Falls Project (FERC No. 2077), owned by Great River Hydro (GRH), consists of three developments; in upstream to downstream order, they include Moore, Comerford and McIndoes. The Moore and Comerford Developments are seasonal storage reservoirs and can operate as peaking facilities. The license for Fifteen Mile Falls expires in 2042.
 - Downstream of the Fifteen Mile Falls Project are three GRH projects located in series immediately upstream of the Turners Falls Project. In upstream to downstream order those projects include the Wilder (FERC No. 1892), Bellows Falls (FERC No. 1855) and Vernon (FERC No. 1904) Hydroelectric Projects. These projects can operate as peaking facilities under their current licenses. However, as part of the next license, an agreement was reached with several agencies regarding future operations that limits peaking to a set number of hours each month- called “flexible operations”. Thus, GRH may implement flexible operations at the Vernon Project resulting in a peaking flow regime entering the TFI.
- Turners Falls and Northfield Mountain Project operations.
 - The Turners Falls Project can operate as a peaking facility under its current license; however, as part of the next license peaking operations will be limited as discussed below.

A central theme of the USFWS, NFMS and MDFW was to reduce peaking on the Connecticut River to reflect a more natural hydrograph downstream of Cabot Station. Per the F/F Agreement, FirstLight must dampen the peaking releases from Vernon, Bellow Falls, and Wilder Stations (as well as the Fifteen Mile

Falls Projects) to maintain a more stabilized flow regime in the Connecticut River below Cabot Station. To maintain the stabilized flow regime, TFI storage must be used as a buffer.

As noted in [Section 5.5](#), on those streambanks within the TFI in Massachusetts where FirstLight operations is a contributing cause to erosion, FirstLight will stabilize any new or previously stabilized sites over the license term.

Also, per the F/F Agreement, FirstLight must maintain an up-ramping rate of 0.90 ft/hour in the TFI, as measured as the Turners Falls dam, from 5/15-8/15 between 8:00 am and 2:00 pm to protect odonates from rapidly rising water levels during their eclosure¹⁵ period.

Common Impairments in Assessment Units MA34122 and MA34-02

MA34122 includes the 160-acre Barton Cove and MA34-02 includes the 11.4 miles of the TFI from the Route 10 Bridge in Northfield to the Turners Falls Dam. A common impairment in both segments includes an invasive aquatic plant, water chestnut. MA34122 has other impairments including three other invasive aquatic plant impairments (curly-leaf pondweed, Eurasian water milfoil and fanwort). For all of the invasive aquatic plants, the source is listed as the introduction of non-native aquatic organisms which could be accidental or intentional.

The original source of invasive aquatic plants in Barton Cove is unknown; however, it was likely introduced from boats, motors, trailers and fishing gear. In addition, a continual seed supply could be transported from tributaries and from the mainstem Connecticut River. There is a boat launch in Gill owned and managed by the MDCR that, to FirstLight's knowledge, is not staffed by personnel, commonly referred to as weed watchers, to inspect boats/trailers being launched or taken out of the water for invasive aquatic plants. Similarly, the Pauchaug Boat Launch is also not staffed with weed watchers.

While FirstLight is not the cause of the impairment, as outlined in the Turners Falls Project Invasive Aquatic Plant Species Management Plan ([Appendix B](#)), FirstLight is proposing to monitor the Turners Falls Impoundment and bypass reach for invasive aquatic plants as follows:

Baseline Survey: In the first full summer following license issuance, FirstLight will conduct an invasive aquatic plant survey of the TFI from the Turners Falls Dam to the base of Vernon Dam, and of the bypass reach from the Turners Falls Dam to Cabot Station. The TFI will be surveyed by boat in the late summer (August/September) to facilitate identification of any invasive aquatic plants by means of floristic attributes. The survey methodology will include semi-quantitatively documenting the invasive aquatic plants found in the TFI to location, size and percent cover by cover class range (i.e., 2-25%; 25-50%; 50-75%; and 75-100%). Estimates of stand width will be made in three meter intervals (1-3, 3-6, 6-9, and >10 m). Estimates of length will be made to the nearest meter.

The location of the invasive aquatic plants will be recorded using a GPS for later upload into a GIS map to define baseline conditions. A baseline map of the TFI will be developed showing the Site ID number, the invasive plant species found and the percent cover.

¹⁵ Eclosure is when dragonfly larvae emerge from the water to undergo metamorphosis and are temporarily immobile and vulnerable to inundation.

The survey of the bypass reach will be conducted by canoe and/or foot and will follow the same methodology as described above.

Annual Surveys: The majority of the invasive aquatic plants occur immediately upstream of the Turners Falls Dam with fewer occurrences upstream of the French King Bridge. Invasive aquatic plants upstream of the French King Bridge are not as widespread and occur at lower densities. Also, the bypass reach has limited invasive aquatic plants. Given this, on an annual basis after the baseline survey, FirstLight will repeat the same study methods as outlined above in the TFI from the Turners Falls Dam to French King Bridge.

5-Year Surveys: FirstLight will repeat the same study methods as outlined above in the entire TFI and bypass reach every 5 years.

Control Measures: After reviewing the annual reports, if the USFWS and NHESP demonstrate that aquatic invasive plant species are significantly affecting fish and wildlife populations in the TFI or bypass reach and that control measures are needed, the Licensee will consult with USFWS and NHESP to undertake reasonable measures, as determined by FERC and the MDEP, to control aquatic invasive plant species in the TFI and bypass reach, commensurate with FirstLight's level of responsibility.

Assessment Unit MA34-03

Assessment Unit MA34-03 extends from the Turners Falls Dam to the confluence with the Deerfield River, thus it includes the bypass reach and a short stretch of the Connecticut River below Cabot Station. The impairments in this reach include dewatering and flow regime modification. Both of these impairments have been addressed in the F/F Agreement, which was signed by MDFW, NMFS, USFWS, TNC, AMC, American Whitewater, and 3 whitewater groups. The F/F Agreement reflects the balancing of multiple designated uses and competing resources in the bypass and below Cabot Station including:

- Providing aquatic habitat for several life stages of target fish species, macroinvertebrates and mussels;
- Providing aquatic habitat throughout the life cycle of the federally endangered Shortnose Sturgeon;
- Providing a zone of passage in the spring for migratory fish to access the new fish lift at the Turners Falls Dam;
- Protecting state-listed plants in the bypass;
- Reducing flow fluctuations below Cabot Station to protect the federally endangered Puritan Tiger Beetle and Shortnose Sturgeon, state listed Cobblestone Tiger Beetles and state listed odonates; and,
- Providing releases from the Turners Falls Dam and Station No. 1 for boating opportunities.

Study No. 3.3.1, the Instream Flow Study, was filed with FERC on 10/14/2016. The Instream Flow Study was the key tool used to evaluate the habitat needs for the target fish species, macroinvertebrates and mussels. Note that there were also seven addendums (Addendums 1-7) supplementing the Instream Flow Study that addressed additional information requests relative to sea lamprey spawning, mussel

assessments, and further evaluations in Reach 5 (Route 116 Bridge to Holyoke Dam). Segment MA34-03 was broken into three separate reaches, as warranted for hydraulic modeling purposes as shown in [Table C-1](#) and in [Figure C-1](#).

Table C-1. Habitat Reach Descriptions and Lengths

Reach No.	Subsegment of Segment 34-03	Subsegment Length
1	Turners Falls Dam to Station No. 1	1.0 mi
2	Station No. 1 to Rawson Island	1.0 mi
3	Rawson Island to the Montague United States Geological Survey Gage	1.75 mi

Reach 1 includes the large plunge pool below the dam, three channels including the Right Channel¹⁶, Center Channel, and Left Channel which flow around Peskeomskut Island and the reach from where the three channels converge to Station No. 1. As agreed to while conducting a site walkover of the bypass reach, which included MDFW, USFWS and NMFS and several other stakeholders, habitat in the plunge pool, Center Channel and Left Channel were not quantified. Habitat in the plunge pool is not highly dependent on flow. The Center Channel cuts through ledge, like a chute, and offers no substrate or cover for fish. The Left Channel is a flat bedrock surface without notable habitat features relative to substrate or cover. The Right Channel is comprised of riffle and run habitat with varying substrates. Habitat in the Right Channel was quantified which is approximately 80-feet-wide and represents roughly 0.1 miles of Reach 1. From the three channel convergence to Station No. 1, the river is approximately 400+ feet-wide and represents approximately 0.5 miles of Reach 1. The lower portion of Reach 1 is also backwatered.

The impairment for dewatering is addressed below relative to the increased flows from the Turners Falls Dam, below Station No. 1 and below Cabot Station.

Minimum Flows from Turners Falls Dam (Reach 1)

Per the F/F Agreement, the minimum flows provided from the Turners Falls Dam are on an or-inflow basis (inflow is the naturally routed flow), whichever is less, and include the following: 500 cfs from 7/1-11/15, 400 cfs from 11/16-3/31, 4,290 cfs from 4/1-5/31, 2,990 cfs from 6/1-15, and 2,280 cfs from 6/16-6/30.

The 500 cfs flow from 7/1-11/15 reflects the balancing of many competing resources including state listed plants, aquatic habitat for a variety of target species including juvenile and adult life stages of fallfish, longnose dace, white sucker, walleye, and tessellated darter, and recreational boating. Even within the list of target fish species and life stages, a balancing of habitat are needed as some target species/life stages may require more or less flow than another target species/life stage.

A Turners Falls Dam minimum flow of 500 cfs from 7/1-11/15 provides approximately¹⁷ 83%, 49%, 83%, 98%, 0%, 98%, 0% and 100% of the peak habitat for juvenile fallfish, adult fallfish, juvenile longnose dace, adult longnose dace, juvenile/adult white sucker, juvenile walleye, adult walleye, and juvenile/adult tessellated darter in the Right Channel, respectively. Note that the Right Channel has no habitat for white

¹⁶ The "Right" Channel assumes one is looking in a downstream direction.

¹⁷ The instream flow study did not include a flow of 500 cfs. The closest flow was 562 cfs, which the percentages above are based upon.

sucker juvenile/adult and walleye adult under any flows up to 4,000 cfs, as these species have a narrow range of suitable velocities (preferring low velocities).

Initially, as part of the Flow and Fish Passage Agreement in Principle, a flow of 250 cfs was proposed from the Turners Falls Dam from 7/1-11/15 for the purpose of protecting rare plants. The 250 cfs flow was subject to an inspection of rare plants under Turners Falls Dam discharges ranging from 250-400 cfs. The opportunity to inspect rare plants was conducted as part of a boating study discussed next.

FirstLight conducted a boating study where different flows were released from the Turners Falls Dam and volunteer canoeists and kayakers paddled from the put-in immediately below the dam and around Peskeomskut Island to the take-out just below Rock Dam. The minimum navigable flow was determined to be approximately 545 cfs, which was released from bascule gate No. 1 at the Turners Falls Dam. This flow was supplemented with 71 cfs from the Fall River, a tributary entering the bypass from the north and adjacent to Peskeomskut Island and 560 cfs from Station No. 1, for a total flow of approximately 616 cfs below Peskeomskut Island. Prior to conducting the boating study, water level loggers were placed in the approximate location of rare plants, such that NHESP could evaluate potential impacts of the various boating releases from the Turners Falls Dam on rare plants.

To help avoid and protect rare plants, and to provide additional access for boaters, FirstLight agreed to a second put-in below Peskeomskut Island (in addition to the existing put-in above Peskeomskut Island). In the end, the minimum flow was increased from 250 cfs to 500 cfs to balance the competing resources of protecting rare plants, providing aquatic habitat, and offering additional access for recreational boaters below Peskeomskut Island.

Section 314 CMR 4.03(b) of the Massachusetts water quality standards states *“In waters where flows are regulated by dams or similar structures, the lowest flow condition at which aquatic life criteria must be applied is the flow equaled or exceeded 99% of the time on a yearly basis, or another equivalent flow agreed upon by the Department and the federal, state or private entity controlling the flow.* In this case the 500 cfs minimum flow represents *an equivalent flow agreed upon* by the USFWS, NMFS, and MDFW reflecting the balancing of aquatic resources and rare plants.

The winter flow of 400 cfs from 11/16-3/31 was evaluated relative to the water depth in the bypass as fish will move to areas of deeper, slower water in the winter. Fish are cold-blooded organisms, and their body temperatures will be equivalent to the temperature of the water they are immersed in; during cold conditions, their metabolism will slow considerably. Alterations to habitat during the winter that result in them expending energy to move to different habitats could result in reduced health and increased mortality. Because fish do not typically feed much during the winter, and because forage for fish is often very limited in availability during the winter, they cannot replenish energy reserves as easily as they would be able to during the warmer months. Initiating feeding could also increase their chances of being preyed upon by mammals that can more easily capture them in the winter. Important components of providing habitat for fish in winter are:

- Stability of conditions – especially ice conditions.
- Presence of pool areas with low velocity, or even areas of no velocity.

- Areas of groundwater influx can be important, but warmer groundwater can also affect downstream areas negatively by causing more dynamic conditions (i.e. more melting/freezing situations).
- Shelter provided by rocks, complex bank habitat, or woody debris. In general, diverse habitats, including side channels and backwaters can increase the probability of survival of fish in the winter

Other than the large plunge pool below the dam, most of Reach 1-3 does not have overwintering pools that are of sufficient depth where fish can conserve energy. Fish would likely seek deeper portions of the Connecticut River further downstream where it is backwatered by the Holyoke Dam.

The Turners Falls Dam minimum flows of 4,290, 2,990 and 2,280 cfs from 4/1-5/31, 6/1-15, and 6/16-30, respectively (6,500, 4,500, and 3,500 cfs below Station No. 1, respectively), provides aquatic habitat for migratory and resident fish, mussels and macroinvertebrates and a zone of passage for migratory fish to following the natural route of the Connecticut River to the new fish lift at the Turners Falls Dam.

Total Minimum Flow below Station No. 1 (portion of Reach 2)

The Turners Falls Dam minimum flows are supplemented with Station No. 1 discharges to maintain a total minimum flow below Station No. 1. Per the F/F Agreement, the total minimum flows below Station No. 1 are on an or-inflow basis (inflow is the naturally routed flow), whichever is less, and include the following: 1,800 cfs from 7/1-8/31, 1,500 cfs from 9/1-3/31, 6,500 cfs from 4/1-5/31, 4,500 cfs from 6/1-15, and 3,500 cfs from 6/16-30. The flows in the upper portion of Reach 2 reflect a substantial increase in aquatic habitat for the various target species and life stages, including mussels and macroinvertebrates. A Turners Falls Dam minimum flow of 1,500 cfs from 7/1-8/31 provides 88%, 94%, 72%, 66%, 99%, 99%, 50% and 73% of the peak habitat for juvenile fallfish, adult fallfish, juvenile longnose dace, adult longnose dace, juvenile/adult white sucker, juvenile walleye, adult walleye, and juvenile/adult tessellated darter in the Reach 2, respectively. A Turners Falls Dam minimum flow of 1,800 cfs from 9/1-3/31 provides 95%, 100%, 89%, 82%, 93%, 99%, 46% and 91% of the peak habitat for juvenile fallfish, adult fallfish, juvenile longnose dace, adult longnose dace, juvenile/adult white sucker, juvenile walleye, adult walleye, and juvenile/adult tessellated darter in the Reach 2, respectively. While the percentage of peak habitat for adult walleye is 50% at 1,500 cfs and 46% at 1,800 cfs, the optimal habitat occurs at a flow of 400 cfs.

Total Minimum Flow below Cabot Station (portion of Reach 2 and Reach 3)

Per the F/F Agreement, the total minimum flows below Cabot Station are on an or-inflow basis (inflow is the naturally routed flow), whichever is less. Cabot Station will be baseloaded, assuming inflow is sufficient, such that approximately 2,300 cfs from a single Cabot Unit will be used to supplement the Total Minimum Flow below Station No. 1 from 12/1-6/30. Baseloading a Cabot unit substantially increases spawning habitat by 76-82%, maintains 30% more habitat for Shortnose Sturgeon larvae which is a critical life stage drifting below Cabot Station from spawning areas near and above Cabot Station.

Cabot Station Ramping Rates and Stabilized Flow Regime

Per the F/F Agreement, Cabot Station will be up- and down-ramped at rate of 2,300 cfs/hour from 4/1-6/30 to protect Shortnose Sturgeon habitat. Cabot Station will be up-ramped at a rate of 2,300 cfs/hour from 7/1-8/15 between 8:00 am and 2:00 pm to protect state-listed odonates emerging from the river shoreline areas during their eclosure process from becoming inundated and lost from the environment

due to rapidly rising water levels. The ramping rate restrictions from 7/1-8/15 will apply during the first three years after license issuance but will be superseded by the Cabot Stabilization requirements discussed next. The Cabot ramping rate restrictions from 7/1-8/31 for odonates will be unnecessary as the flow stabilization requirements will limit the rate of rise in water levels.

FirstLight will maintain a stabilized flow regime below Cabot except during the winter. This protection, mitigation and enhancement measures was the centerpiece of the suite of measures to reduce Cabot Station peaking operations and deliver a more natural river flow regime. The ecological benefits included:

- Maintaining more stable aquatic habitat for fish, mussels and macroinvertebrates between Cabot Station and approximately 32 miles of downstream habitat.
- Protecting state-endangered odonates emerging from the river shoreline areas during their eclosure process from becoming inundated and lost from the system due to rapidly rising water levels.
- Limiting impacts to habitat of the state-endangered Cobblestone Tiger Beetle located on a cobble bar approximately 3,500 feet below Cabot Station.
- Protecting the federally-threatened and state-endangered Puritan Tiger Beetle habitat located at Rainbow Beach approximately 25 miles below Cabot Station from water level fluctuations and inundation.

Summary

Overall, the enhanced flows in the bypass reach and the stabilized flow regime below Cabot Station required the balancing of many competing resources including protecting the federally endangered Shortnose Sturgeon, facilitating upstream passage of American Shad to a new fish lift, enhancing habitat for a variety of native species, and during the summer protecting state-listed rare plants. The balanced flow regime increases spawning habitat for Shortnose Sturgeon 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 and increases spawning habitat for American Shad 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.

In addition to addressing the dewatering impairment, the F/F Agreement also addresses the flow regime modification impairment. Specifically, the F/F Agreement requires Cabot Station to ramp up and down from to protect spawning and rearing habitat for migratory fish and Shortnose Sturgeon and state listed odonates. The stabilized flow regime below Cabot Station protects aquatic habitat, state listed odonates, state listed Cobblestone Tiger Beetle habitat, and the federally endangered Puritan Tiger Beetle habitat.

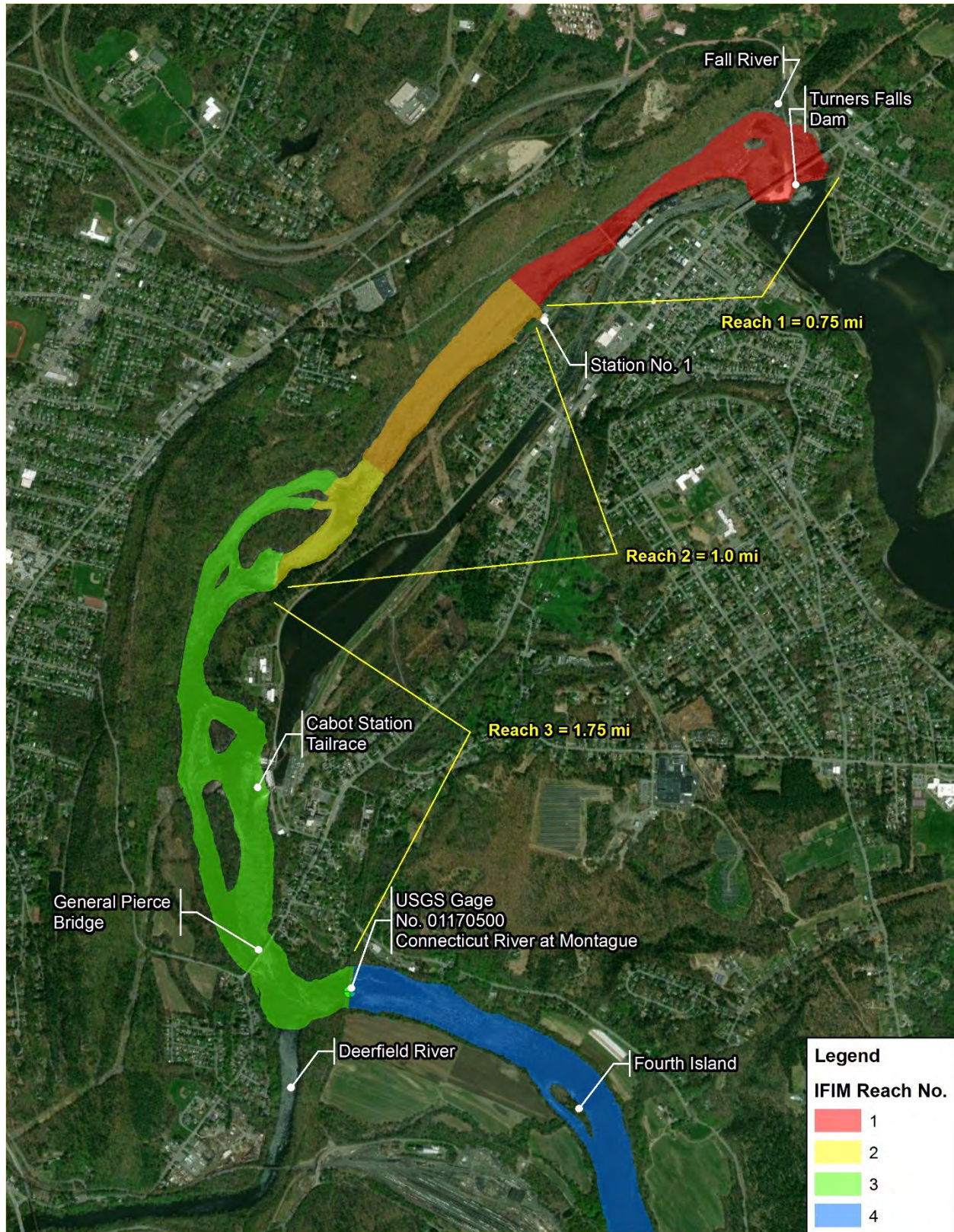


Figure C-1. Reaches 1-4 of the Instream Flow Study

Attachment D. Draft Long-Term Sampling and Analysis Plan

Question 7d. of the BRP WW28 Application for Hydroelectric Power Generation Project 401 Water Quality Certification states the following:

7d. Draft Long-Term Sampling and Analysis Plan for post-certification physical, chemical, and biological monitoring, including the proposed monitoring objections, types, methodologies, and schedules, in order to provide quality-controlled information and data necessary for MassDEP's assessment of all designated uses in affected segments per MassDEP's Consolidated Assessment and Listing methodology Guidance. See: <https://www.mass.gov/service-details/water-quality-assessments>

Background

The MDEP's Watershed Planning Program (WPP) conducts monitoring and assessment activities and reports its findings to the United States Environmental Protection Agency (USEPA) and the public as required by the Clean Water Act (CWA). The CWA requires MDEP to submit reports on the designated-use-support status of Massachusetts waterbodies every two (2) years. MDEP conducts water quality assessments to evaluate the ecological and recreation (fishing/swimming) conditions of all Massachusetts surface waters. More specifically, Sections 305(b), 314, and 303(d) of the CWA requires states to monitor and report on the quality of its surface waters and whether they support designated uses. MDEP's WPP conducts these monitoring and reporting requirements and evaluates the support of uses designated in the state's Surface Water Quality Standards Regulations. In Massachusetts, the designated uses include aquatic life (such as fish, other aquatic life, and wildlife); fish consumption; public water supply; shellfish harvesting; primary (e.g., swimming) and secondary (e.g., boating) contact-recreation; and aesthetics. Assessment and listing decisions are combined in biennial Integrated Reports to the USEPA.

MDEP Water Quality Standards and Designated Uses

The Massachusetts surface water quality standards, 314 CMR 4.00 (MDEP, 1/7/2022¹⁸), assign all inland, coastal and marine waters to classes according to the intended beneficial uses of those waters. The water quality standards designate the most sensitive uses for which the various waters of the Commonwealth shall be enhanced, maintained and protected; which prescribe the minimum water quality criteria required to sustain the Designated Uses, as defined in 314 CMR 4.02; Designated Uses.

The Commonwealth classifies the entire Connecticut River as a Class B, warm water fishery. Class B waters are designated as a habitat for fish, other aquatic life, and wildlife, including for their reproduction, migration, growth and other critical functions, and for primary and secondary contact recreation. These waters shall have consistently good aesthetic value. MA Class B water quality standards for warm waters include the following:

Dissolved Oxygen (DO) [314 CMR 4.05 Classes and Criteria, (3) Inland Water Classes (b) Class B (1) Dissolved Oxygen]

Shall not be less than 6.0 mg/L in cold water fisheries and not less than 5.0 mg/L in warm water fisheries. Where natural background conditions are lower, DO shall not be less than natural background conditions.

¹⁸ [314 CMR 4 \(mass.gov\)](#)

Natural seasonal and daily variations that are necessary to protect existing and designated uses shall be maintained.

Temperature [314 CMR 4.05 Classes and Criteria, (3) Inland Water Classes (b) Class B (2) Temperature]

Shall not exceed 83°F (28.3°C) in warm water fisheries. The rise in temperature due to a discharge shall not exceed 5°F (2.8°C) in rivers and streams designated as warm water fisheries based on the minimum expected flow for the month.

Hydrologic Conditions [314 CMR 4.03 Application of Standards (3) Hydrologic Conditions]

The Department will determine the most severe hydrologic condition at which water quality criteria must be applied. The Department may further stipulate the magnitude, duration and frequency of allowable excursions from the magnitude component of criteria and may determine that criteria should be applied at flows lower than those specified in order to prevent adverse impacts of discharges on existing and designated uses.

(a) For rivers and streams, the lowest flow condition at and above which aquatic life criteria must be applied is the lowest mean flow for seven consecutive days to be expected once in ten years. When records are not sufficient to determine this condition, the flow may be estimated using methods approved by the Department.

(b) In waters where flows are regulated by dams or similar structures, the lowest flow condition at which aquatic life criteria must be applied is the flow equaled or exceeded 99% of the time on a yearly basis, or another equivalent flow agreed upon by the Department and the federal, state or private entity controlling the flow. The minimum flow established in such an agreement will become the critical low flow for those waters covered by the agreement. When the Department issues a 401 Water Quality Certification of an activity subject to licensing by the Federal Energy Regulatory Commission, flows shall be maintained or restored to protect existing and designated uses.

(c) In coastal and marine waters and for lakes and ponds, the Department will establish extreme hydrologic conditions at which aquatic life criteria must be applied on a case-by-case basis. In all cases existing uses shall be protected and the selection shall not interfere with the attainment of designated uses.

(d) For rivers and streams and waters whose flows are regulated by dams or similar structures, human health based criteria may be applied at the harmonic mean flow. For coastal and marine waters and lakes and ponds, human health based criteria may be applied at conditions the Department determines will result in protection at least equivalent to that provided for rivers and stream.

Draft Long Term Sampling and Analysis Plan

MDEP is seeking a Draft Long-Term Sampling and Analysis Plan to monitor physical, chemical, and biological conditions after the license conditions are implemented to assess if the Project is meeting its designated uses.

As part of the FERC licensing process for the Turners Falls and Northfield Mountain Projects, 39 studies were conducted in consultation with federal and state regulatory agencies, including the MDEP, host communities, non-government organizations, and tribes (“stakeholders”). These studies were used to

help inform FirstLight's licensing proposal. Outlined below are the post-certification proposed physical, chemical and biological monitoring.

Chemical Monitoring

As described in the Water Quality Study Report (Study No. 3.2.01), continuous DO and temperature data was collected throughout the Project including DO and temperature profiles in the TFI throughout the 2015 study period and all state water quality standards were met. DO results from within the TFI, the bypass reach, the power canal, and below Cabot Station remained above the water quality standard of 5.0 mg/L minimum for Class B warm water fisheries. The minimum observed DO concentration was 5.8 mg/L (and 71.1% saturation) at Site 11 below Cabot Station.

The water temperatures observed at each location remained below the water quality standard of 28.3°C for Class B warm water fisheries. The maximum instantaneous temperatures observed across all sites ranged from 26.4 °C to 28.1°C.

It is expected that with the proposed higher bypass flows there will be increased aeration of the water and higher DO concentrations in the bypass, which will mix with Station No. 1 and Cabot discharges. Given that the Project met water quality criteria under existing operations, and with the proposed changes in operation likely to improve water quality, FirstLight is not proposing post-certification water quality monitoring.

Biological Monitoring

Aquatic Resources

FirstLight conducted numerous studies to inform its minimum flow releases from the Turners Falls Dam, minimum flows below Station No. 1, variable releases from the Turners Falls Dam, variable releases from Station No. 1, Cabot Station ramping rates, baseloading a Cabot unit, and Cabot Flow Stabilization. A host of studies were used to inform the overall flow proposal; however, the key study was Study 3.3.01 *Conduct Instream Flow Habitat Assessments in the Bypass Reach and below Cabot Station* or Instream Flow Study.

The result of an Instream Flow Study is a relationship between aquatic habitat (square feet) for the various target species and life stages evaluated and flow (cfs). The Instream Flow Study extended from the Turners Falls Dam to just upstream of Holyoke Dam and was broken into five reaches. Reach 1, 2 and 3 extended from the Turners Falls Dam to the Montague USGS gage, Reach 4 extended from the Montague USGS gage to the Route 116 Bridge (~9 miles) and Reach 5 extended from the Route 116 Bridge to a natural hydraulic control in the vicinity of Dinosaur Footprints Reservation (~22 miles).

The Instream Flow Study incorporates the biological habitat needs for the target species and life stages via habitat suitability index (HSI) curves for depth, velocity and substrate. Each target species and life stage has a preferred range of microhabitat (depth, velocity, substrate and cover) conditions. For example, adult smallmouth bass may prefer greater depths and lower velocities than adult American shad. Biologists have conducted studies or used professional judgement to identify the depth, velocity, and substrate preferences for an array of species and life stages. Habitat Suitability Index (HSI) criteria have been developed from these studies for depth, velocity, substrate, and in some cases, cover. HSI criteria rate the species/life stage preference using a 0 to 1 scale. A suitability index value of 0 indicates no habitat value, while a suitability index value of 1 indicates optimal habitat value.

The HSI curves are married with the hydraulic data (depth and velocity) from the river under a range of flows, and observed substrate data, to quantify the amount of habitat over the same range of flows. Ultimately, this results in a relationship between flow and habitat for each target species and life stage. This process was conducted in Reaches 1-5.

The Instream Flow Study findings, including the relationship between flow and habitat, were summarized in various reports and addendums. The study findings were used by FirstLight, USFWS, NFMS, MDFW, TNC and others to reach agreement on flows needed to protect aquatic resources in the bypass reach and downstream of Cabot Station. The IFIM study incorporates the biological needs of the target species and life stages via the HSI curves, which is subsequently reflected in the proposed flow regime in the bypass and below Cabot Station.

Article A200 of the F/F Settlement Agreement entitled *Project Operation, Monitoring and Reporting Plan* requires FirstLight to develop a flow compliance and reporting plan within one year of license issuance. The article specifically requires FirstLight to document compliance with:

- Minimum Flows below the Turners Falls Dam.
- Total minimum Bypass Flows below Station No. 1.
- Minimum Flows below Cabot Station.
- Cabot Station Ramping Rates.
- Variable Releases from Turners Falls Dam and Variable Releases for Station No. 1.
- Flow Stabilization below Cabot Station.

Per the F/F Agreement (Article A190), FirstLight is required to document compliance with the minimum bypass flows, Cabot baseloading, Cabot ramping rates, and Cabot flow stabilization (“flow regime”). Since the flow regime was developed based on the instream flow study findings that quantified habitat, documentation of the operating regime will indirectly document compliance with the habitat needs for fishes, mussels and macroinvertebrates. The proposed flow regime in the bypass reach and below Cabot Station will address two impairments in the Segment MA34-03, which extends from the Turners Falls Dam to the confluence with the Deerfield River. The two impairments include dewatering and flow regime modification.

Fish Passage Effectiveness Testing and Adaptive Management Measures

As discussed in the F/F Agreement, FirstLight is required to install upstream and downstream fish passage facilities. Upstream passage facilities include a lift at Turners Falls Dam (“Spillway Lift”), rehabilitating the Gatehouse trapping facility, installing interim upstream eel passage structures, and eventually installing permanent upstream eel passage structure(s). Downstream passage facilities include a barrier net around the Northfield Project tailrace, a plunge pool below bascule gate 1 at the Turners Falls Dam, a bar rack at Station No. 1 and updates to the Cabot Station downstream fish passage facility.

The F/F Agreement requires that after a facility is constructed and had a shakedown year, 2 years of effectiveness testing is required to evaluate the passage efficiency and time-to-pass. Specifically, effectiveness testing will be implemented at the following constructed facilities: Cabot Station

downstream passage facility, Station No. 1 bar rack, plunge pool, Spillway Lift and for the permanent upstream eel passage structure(s). Per the F/F Agreement after each year of effectiveness testing the results will be compared to the fish passage performance goals relative to passage efficiency and time-to-pass.

The F/F Agreement also lays out adaptive management measures if the fish passage performance goals are not achieved. If an adaptive management measure is implemented, the F/F Agreement also requires subsequent effectiveness testing.

The F/F Agreement also requires FirstLight to consult with the USFWS, NMFS and MDFW regarding the effectiveness testing study plans, reviewing and commenting on effectiveness testing study results, and consulting on what, if any, adaptive management measures will be implemented where performance goals are not achieved. The F/F Agreement also requires reporting the findings to FERC.

Invasive Aquatic Plant Species Management Plan- Monitoring and Management Measures

As outlined in the Turners Falls Project Invasive Aquatic Plant Species Management Plan ([Appendix B](#)), FirstLight is proposing monitoring in the Turners Falls Impoundment and bypass reach for invasive aquatic plants. A high-level summary of the monitoring is below.

Baseline Survey: In the first full summer following license issuance, FirstLight will conduct an invasive aquatic plant survey of the TFI from the Turners Falls Dam to the base of Vernon Dam, and of the bypass reach from the Turners Falls Dam to Cabot Station. The TFI will be surveyed by boat in the late summer (August/September) to facilitate identification of any invasive aquatic plants by means of floristic attributes. The survey methodology will include semi-quantitatively documenting the invasive aquatic plants found in the TFI to location, size and percent cover by cover class range (i.e., 2-25%; 25-50%; 50-75%; and 75-100%). Estimates of stand width will be made in three meter intervals (1-3, 3-6, 6-9, and >10 m). Estimates of length will be made to the nearest meter.

The location of the invasive aquatic plants will be recorded using a GPS for later upload into a GIS map to define baseline conditions. A baseline map of the TFI will be developed showing the Site ID number, the invasive plant species found and the percent cover.

The survey of the bypass reach will be conducted by canoe and/or foot and will follow the same methodology as described above.

Annual Surveys: The majority of the invasive aquatic plants occur immediately upstream of the Turners Falls Dam with fewer occurrences upstream of the French King Bridge. Invasive aquatic plants upstream of the French King Bridge are not as widespread and occur at lower densities. Also, the bypass reach has limited invasive aquatic plants. Given this, on an annual basis after the baseline survey, FirstLight will repeat the same study methods as outlined above in the TFI from the Turners Falls Dam to French King Bridge.

5-Year Surveys: FirstLight will repeat the same study methods as outlined above in the entire TFI and bypass reach every 5 years.

Control Measures: After reviewing the annual reports, if the USFWS and NHESP demonstrate that aquatic invasive plant species are significantly affecting fish and wildlife populations in the TFI or bypass reach

and that control measures are needed, the Licensee will consult with USFWS and NHESP to undertake reasonable measures, as determined by FERC and the MDEP, to control aquatic invasive plant species in the TFI and bypass reach, commensurate with FirstLight's level of responsibility.

Physical Monitoring

Upper Reservoir Sediment

As outlined in the Upper Reservoir Dewatering Protocols ([Appendix D](#)), FirstLight will conduct bathymetric mapping of the Upper Reservoir at least once every two years to understand the location, volume, and rate of sediment accumulation in the Upper Reservoir. The monitoring of sediment accumulation in the Upper Reservoir will inform when sediment removal will occur per the dewatering protocols.

Streambank Stabilization Erosion Monitoring

As discussed in [Section 5.5](#), FirstLight is proposing to implement a shoreline erosion monitoring program in those reaches where Project operations has a nexus to shoreline erosion. FirstLight used the BSTEM model to identify those streambanks in the TFI in Massachusetts where it was demonstrated that proposed Project operations are a contributing cause of erosion, excluding the Barton Cove area. The Barton Cove area is defined as the TFI from the Turners Falls Dam to approximately two miles upstream where the TFI narrows.

The shoreline erosion monitoring program would consist of the following:

- Within one year of license issuance, FirstLight will develop a Shoreline Erosion Monitoring Plan in consultation with MDEP. MDEP will be responsible for approving the monitoring plan prior to FirstLight initiating any shoreline erosion surveys.
- FirstLight will conduct an initial shoreline erosion survey within two years of license issuance.
- FirstLight will conduct additional shoreline erosion surveys in Year 10, 20, 30, and 40 of the new license.
- Each erosion survey will consist of:
 - A boat-based reconnaissance survey of each TFI riverbank segment in Massachusetts (excluding the Barton Cove area) where proposed Project operations are identified by BSTEM to be a contributing cause of erosion. The reconnaissance survey will characterize the riverbank characteristics and erosion conditions of each segment.
 - Cross-sectional surveys at existing detailed study sites within each TFI riverbank segment in Massachusetts (excluding the Barton Cove area) where proposed Project operations are identified by BSTEM to be a contributing cause of erosion. If a detailed study site does not currently exist in such a reach (e.g., the reach from the Barton Cove exit to the French King Gorge), FirstLight will establish a representative detailed study site within that reach during the first erosion survey following license issuance. Newly established detailed study sites will be re-surveyed during subsequent surveys.
- Following completion of each erosion survey, FirstLight will prepare a report summarizing the survey methods and results. The report will also identify surveyed riverbank segments that

require stabilization or, in the event of a previously repaired bank segment, repair, if any. The report will be submitted to MDEP for approval.

- Upon approval from MDEP, FirstLight will complete the stabilization or repair measures identified in the final report, if any. Following completion of remediation activities, FirstLight will file as-built documentation (plans/photos) of the stabilization/repair efforts with MADEP.

Attachment E. Stakeholder Outreach

Question 7e of the BRP-WW28 Form states: ***A summary of stakeholder outreach conducted prior to filing this 401 WQC application, including any specific outreach to Environmental Justice Populations affected by the project.***

FirstLight is providing a single response for the Turners Falls and Northfield Projects relative to Question 7e.

Environmental Justice Communities

FirstLight reviewed the “*Updated Massachusetts 2020 Environmental Justice Populations*” GIS mapping in Massachusetts to identify any Environmental Justice (EJ) Populations within the Project area. The Massachusetts interactive GIS map website¹⁹ was used. That website states: “*This map is based on the US Census Bureau data released in October 2021 and March 2022, and was updated on November 12, 2022.*”

Massachusetts Environmental Policy Act (MEPA) rules define “designated geographic area” with respect to a project as the area within one mile of the project. Although MEPA does not apply to this 401 Application, FirstLight identified all EJ communities within one mile of the Project Boundary. Shown in [Table E-1](#) are the EJ communities within one mile of the Project Boundary, which are located in the town of Montague and City of Greenfield. [Figure E-1](#) shows the tract numbers that are listed in [Table E-1](#). Note that portions of Montague are in the FERC Project Boundary for both Projects, but Greenfield has no lands within either Project Boundary.

In Massachusetts, an EJ population is a neighborhood where one or more of the following criteria are true:

1. The annual median household income is 65% or less of the Massachusetts annual median household income (MHHI).
2. Minorities comprise 40% or more of the population.
3. 25% or more of households identify as speaking English less than "very well"
4. Minorities comprise 25% or more of the population and the annual median household income of the municipality in which the neighborhood is located does not exceed 150% of the MHHI.

Based on the above criteria, all the communities in [Table E-1](#) have median household incomes that are 65% or less than the MHHI. In addition, two communities have minority populations representing more than 40% of the population.

¹⁹ The website is accessible here: [Massachusetts 2020 Environmental Justice Populations \(arcgis.com\)](https://arcgis.com/mass/2020-environmental-justice-populations)

Table E-1. Environmental Justice Communities within one mile of the Project Boundary

Town	Block Group No.	Census Tract	Minority Population	Median Household Income	% of MA Household Income	Households with Language Isolation
Montague	1	407.02	7%	\$40,000	47%	2%
	4	407.01	16%	\$54,696	65%	0%
	2	407.01	23%	\$25,339	30%	1%
	1	407.01	18%	\$40,191	48%	0%
Montague as a whole has a median household income of \$59,364 which is 70% of the MHHI.						
Greenfield	1	411	9%	\$52,315	62%	2%
	3	412	12%	\$51,435	61%	5%
	3	413.01	18%	\$43,472	52%	0%
	1	413.02	15%	\$21,792	26%	0%
	2	413.02	16%	\$41,146	49%	2%
	2	414	25%	\$47,404	56%	9%
	2	413.01	20%	\$44,091	52%	4%
	1	412	13%	\$54,432	65%	0%
Greenfield as a whole has a median household income of \$46,250 which is 55% of the MHHI.						
	<u>Income</u> : at least 25% of households have a median income 65% or less than the MHHI.					
	<u>Income</u> : at least 25% of households have a median income 65% or less than the MHHI. <u>Minority</u> : the block group minority population is ≥40%, or the block group minority population is ≥25% and the median HHI of the municipality the block group is in is <150% of the MHHI.					

The towns of Montague, Gill and Northfield participated in the licensing process from the beginning, filing letters with FERC in February 2013, when initial study requests were due. These three towns, and Erving, participated in settlement discussions. The Greenfield and Erving town clerks were notified of the site tours in August 2012 and of the publication of the Pre-Application Document in 2013; however, Greenfield did not participate in the licensing process, and Erving participated later in the process during settlement. Some residents of Greenfield participated in the FERC scoping meetings. Note that public notices of the site tours and of the FERC scoping meetings were included in the Greenfield Recorder newspaper, the primary newspaper serving all of the towns around the Projects.

In addition to FirstLight's outreach to the towns and residents, it held extensive conversations with representatives from several local, state, and federal Native American tribes to engage them in the licensing settlement process. Several organizations actively participated, including representatives of the Elnu Abenaki, the Chaubunagungamaug Band of Nipmuck Indians, and the Nolumbeka Project. FirstLight invited participation from representatives of the federally recognized tribes including the Wampanoag Tribe of Gay Head, Mashpee Wampanoag Tribe and Narragansett Tribe. FirstLight also engaged with Greenfield-based organizations throughout the licensing process, including FRCOG and CRC.

Stakeholder Outreach Prior to Filing the 401 Application

FirstLight opted to use FERC's ILP, whereby FERC is involved from the beginning of the licensing process starting with study scoping. The ILP regulations require considerable consultation with stakeholders throughout the licensing process particularly during the study plan development and study reporting phases.

FERC was involved in the study plan development process, which in this case included three rounds of study plans- Proposed Study Plan, Updated Study Plan and Revised Study Plan and numerous meetings to discuss the study plans. After stakeholder comments were filed on the study plans, and FirstLight responded to the comments, FERC then issued a determination letter in which it approved the study plan as-is or required modifications to the study plan based on stakeholders comments. FERC also weighed in on whether any new stakeholders studies were approved or denied.

While FERC conducted this process during the study planning phase, it was repeated multiple times after reports were filed with FERC. Over 200 public comment letters were received as part of the study planning process, and over a dozen meetings with stakeholders occurred. Per the ILP regulations, the following steps occurred relative to reports:

- File Study Reports, which included a transmittal letter notifying stakeholders of upcoming meeting dates
- Meeting to Discuss Study Reports
- FirstLight filed Meeting Minutes
- Stakeholders filed comments on the studies which could include requesting further evaluation or data collection and/or a request for new study(ies).
- FirstLight responded to stakeholder comments.
- FERC would issue its Determination Letter

In all, this comprehensive stakeholder engagement process resulted in outreach to over 325 stakeholders, more than 39 scientific studies with multiple opportunities for public comment and engagement, hundreds of stakeholder meetings, thousands of public comments collected, and consultation with more than 20 state and federal agencies, organizations, and towns.

[Table E-2](#) includes a summary of the stakeholder outreach prior to filing the 401 Application which generally includes the following:

- Any correspondence with the MDEP and EEA²⁰.
- Any cultural resources consultation with FERC, FirstLight, or Native American tribes.
- All FERC meeting dates and meeting notices.

²⁰ Note that in addition to MDEP and EEA, FirstLight had considerable correspondence with MDFW and NHESP which is documented in the appendices of the various study plans.

- For the Proposed Study Plan, Updated Study Plan and Revised Study Plan stakeholder comments on studies and FirstLight responses.
- For all reports, stakeholder comments and FirstLight responses.

Table E-2. Summary of Stakeholder Outreach Prior to Filing the 401 Water Quality Certificate Application (Meeting Dates shown in Green)

FERC Filing Date (if applicable)	Document Description
7/6/2012	FirstLight letter to EEA relative to MEPA (not filed with FERC)
7/12/2012	EEA response to FirstLight relative to MEPA (not filed with FERC)
8/29/2012	FirstLight letter notifying parties of 10/4-5/2012 site tours (includes contact list)
9/25/2012	Proof of Notice placed in Keene Sentinel Newspaper re: Site Tour of the Turners Falls and Northfield Mountain Projects on 10/4-5/2012
9/25/2012	Proof of Notice placed in Greenfield Recorder Newspaper re: Site Tour of the Turners Falls and Northfield Mountain Projects on 10/4-5/2012
10/4/2012	FirstLight hosts site tour of Turners Falls and Northfield Mountain Projects
10/5/2012	FirstLight hosts site tour of Turners Falls and Northfield Mountain Projects
10/12/2012	FirstLight hosts site tour of Turners Falls and Northfield Mountain Projects
11/8/2012	FERC sent letter to consult with Mashpee Wampanoag Tribe
11/14/2012	FERC sent letter to consult with Wampanoag Tribe of Gay Head
12/21/2012	FERC issues Notice of Scoping Meetings on 1/30-31/2013
1/17/2013	FERC staff notes on attempts to engage the Wampanoag Tribe of Gay Head, Mashpee Wampanoag Tribe and Narragansett Tribe
1/30/2013	FERC hosts public scoping meeting in Montague, MA
1/31/2013	FERC hosts public scoping meeting in Montague, MA
2/5/2013	FERC letter to Narragansett Tribe
3/1/2013	MDEP Study Request Letter- requests two studies- sediment transport and water quality
4/15/2013	FirstLight files Proposed Study Plan. Appendix A of the submittal included all of the Study Request Letters
5/14/2013	Study Plan Meeting to discuss all studies and Meeting of Working Group 1: Geology/Soils, Water Resources and Development Resources
5/15/2013	Study Plan Meeting of Working Group 1: Geology/Soils, Water Resources and Development Resources (MDEP attended)
5/21/2013	Study Plan Meeting of Working Group 2: Aquatic Resources, Terrestrial, Wetlands, Riparian Resources
5/22/2013	Study Plan Meeting of Working Group 2: Aquatic Resources, Terrestrial, Wetlands, Riparian Resources
6/4/2013	Study Plan Meeting of Working Group 2: Aquatic Resources, Terrestrial, Wetlands, Riparian Resources
6/5/2013	Study Plan Meeting of Working Group 2: Aquatic Resources, Terrestrial, Wetlands, Riparian Resources

FERC Filing Date (if applicable)	Document Description
6/11/2013	Study Plan Meeting of Working Group 3: Recreation and Land Use Resources, Aesthetic Resources, Cultural Resources
6/12/2013	Study Plan Meeting of Working Group 3: Recreation and Land Use Resources, Aesthetic Resources, Cultural Resources
6/13/2013	Study Plan Meeting of Working Group 3: Recreation and Land Use Resources, Aesthetic Resources, Cultural Resources
6/14/2013	Meeting with MDEP, CRSEC, FRCOG, FCD, CRWC, LCCLC, and FERC to Discuss Study 3.1.1 Full River Reconnaissance Study
6/28/2013	FirstLight files Updated Proposed Study Plan. Appendix A of the submittal included all of the Study Request Letters.
7/12/2013	MDEP files comments on Updated Proposed Study Plan.
8/14/2013	FirstLight files Revised Study Plan- Appendix A- Study Request Letters.
8/14/2013	FirstLight files Revised Study Plan- Appendix B- Stakeholder Comments on the Updated Proposed Study Plan and FirstLight Responses. Comment letters provided by USFWS, NMFS, USEPA, MDEP, MDFW, NHDES, VANR, NPS, American Whitewater, New England FLOW, Appalachian Mountain Club, Connecticut River Watershed Council, The Nature Conservancy, Trout Unlimited, Franklin Regional Council of Governments, Franklin Conservation District, Landowners and Concerned Citizens for License Compliance, Town of Northfield, Karl Meyer, The Nolumbeka Project, Inc., Lisa McLoughlin and Warren Ondras, Town of Montague Fire Chief, and Vermont Division of Historic Preservation.
8/26/2013	Meeting with MDEP to discuss Study 3.1.1 Full River Reconnaissance Study in Springfield, MA
8/28/2013	MDEP files comments on Revised Study Plan
10/30/2013	Meeting with CRSEC to discuss Study 3.1.1 Full River Reconnaissance Study in Greenfield, MA
11/5/2013	Meeting with MDEP to discuss Study 3.1.1 Full River Reconnaissance Study in Northfield, MA
2/13/2014	FirstLight letter to Narragansett Tribe and Nolumbeka Project- request to consult on TCP and ethnographer
5/12/2014	FirstLight emailed MDEP a draft version of the Selection of Detailed Study Sites Report for Study 3.1.2 Erosion Causation.
6/4/2014	Meeting with MDEP to discuss Study 3.1.2 Erosion Causation and specifically Selection of Detailed Study Sites Report.
6/6/2014	FirstLight emailed MDEP, CRWC, FRCOG, and NHDES Selection of Detailed Study Sites Report. Comment letters were provided by CRWC on 7/3/2014, FRCOG on 7/3/2014. On 7/15/2014, MDEP responded to CRWC and FRCOG comments.
7/15/2014	MDEP comments on Study No. 3.1.2 Erosion Causation and specifically the Selection of Detailed Study Sites Report.
7/23/2014	FirstLight sent letter to CRWC and FRCOG responding to comments on Study 3.1.2 Erosion Causation and specifically the Selection of Detailed Study Sites Report.
6/24/2014	Meeting with MDEP, CRWC, FRCOG, CRSEC, LCCLC, FERC, Massachusetts Riverways, NMFS, FCD, and Karl Meyer to discuss Study 3.1.2 Erosion Causation and specifically the Selection of Detailed Study Sites Report.
8/1/2014	Memo from FRCOG to FirstLight regarding Study 3.1.2 Erosion Causation and Selection of Detailed Study Sites.

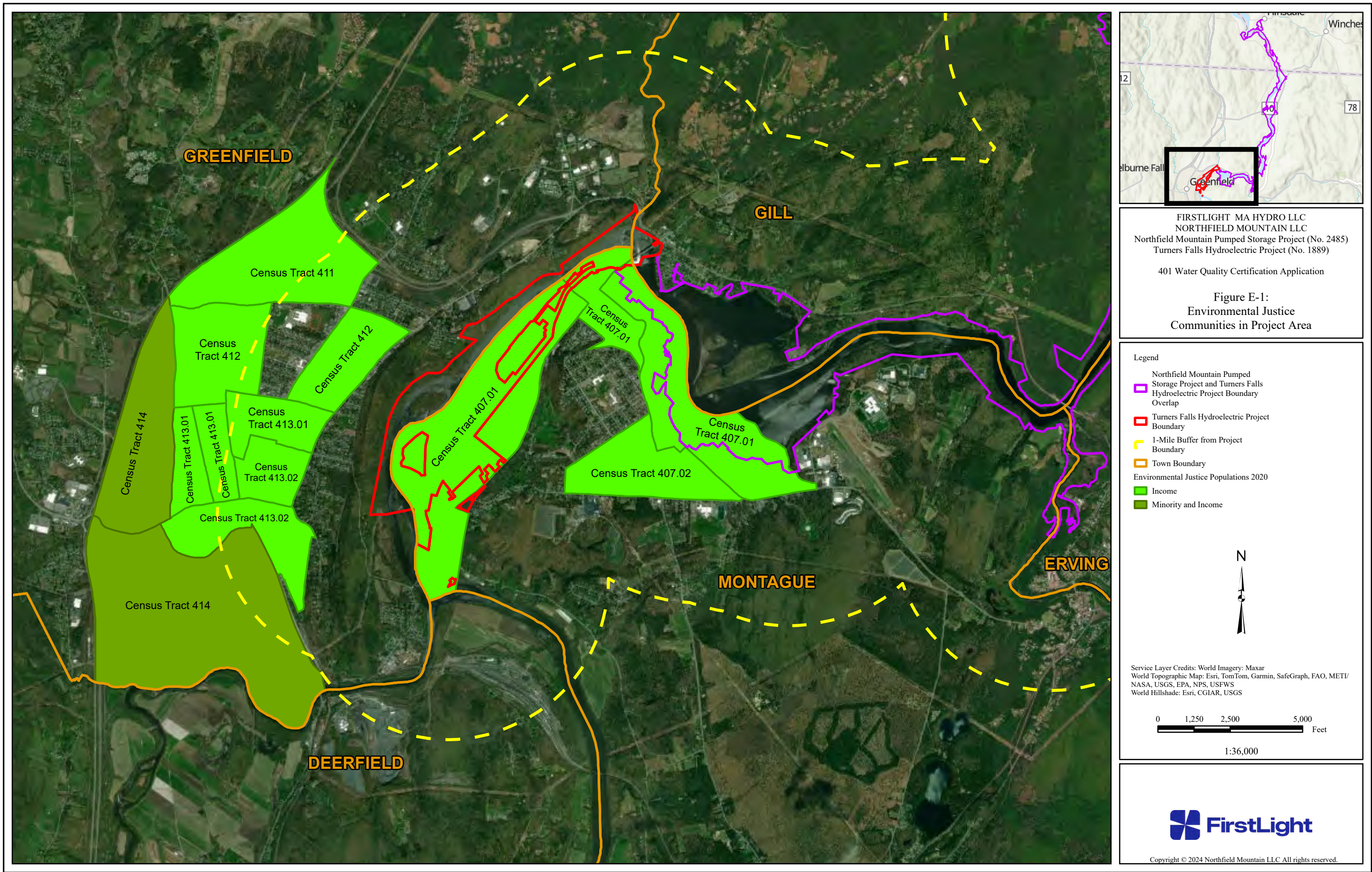
FERC Filing Date (if applicable)	Document Description
8/4/2014	Meeting with MDEP, CRWC, NMFS, FERC, FRCOG, and CRSEC to discuss Study 3.1.2 Erosion Causation and specifically to finalize transect selection.
8/28/2014	Memo from FRCOG to FirstLight regarding Study 3.1.2 Erosion Causation and Selection of Detailed Study Sites.
9/16/2014	FirstLight files Transmittal Letter of Updated Study Report and notifies stakeholders of 9/30 and 10/1/2014 Meetings.
9/16/2014	FirstLight files Study 3.1.1 Full River Reconnaissance and Quality Assurance Project Plan. Appendix A includes the entire consultation record above.
9/16/2014	FirstLight files Study 3.1.2 Erosion Causation, Updated Study Report, includes the entire consultation record noted above.
9/30/2014	Initial Study Report Meeting
10/1/2014	Initial Study Report Meeting
10/15/2014	FirstLight files Initial Study Report Meeting Minutes and Attachments for Study Nos. 3.1.2, 3.3.3, 3.3.11, 3.3.12, and 3.3.16.
10/15/2014	Meeting with MDEP, FRCOG, CRWC, FCD, MA Riverways, LCCLC, NMFS, FERC on Study 3.1.1 Full River Reconnaissance
11/4/2014	FirstLight files Meetings Minutes regarding Study No. 3.1.1 Full River Reconnaissance.
12/15/2014	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments were from USFWS, NMFS, NPS, MDFW, FRCOG, Town of Northfield, AMC, NE FLOW, AMC, CRSEC, CRWC, TNC, Don Pugh and Karl Meyer.
2/24/2014	FirstLight sent Addendum to Study 3.1.1 Full River Reconnaissance to CRSEC.
3/3/2015	FRCOG memo to FirstLight on Study 3.1.1 Full River Reconnaissance.
3/4/2015	Meeting with CRSEC regarding the Addendum to Study 3.1.1 Full River Reconnaissance.
3/9/2015	FirstLight response to FRCOG Letter of 3/3/2015 on Study 3.1.1 Full River Reconnaissance.
3/31/2015	FirstLight notifies stakeholders of where reports are posted on FirstLight's website.
4/2/2015	FRCOG memo to FirstLight on Addendum to Study 3.1.1 Full River Reconnaissance.
4/22/2015	FirstLight files Addendum to Study 3.1.1 Full River Reconnaissance includes all consultation records noted above, FirstLight's response to comments, and meeting minutes.
5/1/2015	Nolumbeka files comments on Study 3.7.3 Traditional Cultural Properties
5/26/2015	FirstLight files 2015 Quarter 1 Deliverables for Study 3.1.2 Erosion Causation.
6/9/2015	FirstLight files response to Nolumbeka letter of 4/29/15.
6/30/2015	FirstLight notifies stakeholders of Study Reports 3.3.8, 3.3.9, 3.3.14, 3.4.1, 3.4.2, 3.5.1 and 3.6.7 posted to website

FERC Filing Date (if applicable)	Document Description
7/21/2015	FirstLight notifies stakeholders of Updated Study Report Meeting to be held on 9/29-30/2015
9/15/2015	FirstLight notifies stakeholders of 9/29-9/30/2015 meetings- provides call in number
9/29/2015	Meeting to discuss Study Reports 3.3.1 Instream Flow, 3.3.13 Littoral Zone, 3.3.14 Aquatic Habitat Mapping, 3.3.11 Fish Assemblage, 3.3.17 Tributary Access, 3.3.2 Adult Shad Passage, 3.3.15 Sea Lamprey Spawning, 3.3.4 Upstream Eel Passage, 3.3.3 Downstream Juvenile Shad Passage, 3.3.5 Downstream Eel Passage, 3.3.6 Shad Spawning, 3.3.18 Canal Drawdown, 3.3.19 Ultrasound Array, 3.3.7 Entrainment and Morality, 3.3.20 Northfield Entrainment, 3.3.12 Cabot Emergency Spillway, and 3.2.1 Water Quality
9/30/2015	Meeting to discuss Study Reports 3.3.10 Odonates, 3.3.16 Mussels, 3.4.1 Terrestrial, 3.4.2 Project Impacts on Recreation at Northfield, 3.5.1 Wetlands and RTE, 3.2.2 Hydraulic Model, 3.3.8 CFD of Fish Passage Structures, 3.3.9 River 2D Northfield tailrace, 3.8.1 Energy Generation, 3.1.1 Full River Reconnaissance, 3.1.2 Erosion Causation, 3.1.3 Sediment Management Plan, 3.6.1 Recreation Use, 3.6.2 Recreation Facility Inventory, 3.6.3 Whitewater Boating, 3.6.4 Day/Night Use, 3.6.5 Land Use, 3.6.6 Project Effects on Recreation, 3.6.74 Recreation Study of Trails, 3.7.2 Historic Structures, 3.7.3 Traditional Cultural Properties, 3.7.1 Archaeology
10/14/2015	FirstLight files Updated Study Report Meeting Summary and PowerPoint presentation from 9/29-30/2015 meetings
10/22/2015	FirstLight files information regarding Study 3.1.2 Erosion Causation
12/14/2015	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments filed by USFWS, NMFS, NPS, AMC, CRSEC, NE FLOW, AW, AMC, Crab Apple Whitewater, Zoar Outdoor, CRWC, TNC and Karl Meyer.
1/19/2016	FERC letter to Narragansett Indian Tribe- request Tribe to work with FirstLight on identifying properties of cultural significance
1/19/2016	FERC memo to file of telephone call with Narragansett Indian Tribe and Nolumbeka Project
2/12/2016	FirstLight notifies stakeholders of Study Report Meeting to be held on 3/16/2016
3/1/2016	FirstLight files Transmittal letter along with study reports, and proposed schedule and process plan for remaining studies, notifies stakeholders of 3/16/2016 meeting.
3/16/2016	Meeting to discuss Study Reports: 3.3.4 Upstream Eel Passage, 3.3.6 Shad Spawning, 3.3.20 Northfield Entrainment, 3.3.11 Fish Assemblage, 3.2.1 Water Quality, 3.3.12 Cabot Emergency Spillway, 3.3.8 CFD of Fish Passage Structures, 3.3.9 River2D Northfield tailrace, 3.3.10 Odonates, 3.3.16 Mussels, 3.5.1 Wetlands and RTE, 3.4.1 Terrestrial, 3.6.1 Recreation Use, and 3.6.5 Land Use Inventory.
3/31/2016	FirstLight files Meeting Minutes from 3/16/2016 Meeting.

FERC Filing Date (if applicable)	Document Description
5/31/2016	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments filed by USFWS, NMFS, MDFW, CRWC, TNC and Karl Meyer.
6/30/2016	FirstLight notifies stakeholders of posting Study Reports 3.3.13 Littoral Zone and 3.3.15 Sea Lamprey Spawning to relicensing website
10/14/2016	FirstLight files Transmittal Letter along the reports and notifies stakeholders of 10/31 and 11/1/2016 Meetings.
10/31/2016	Meeting to discuss Study Reports: 3.3.1 Instream Flow, 3.3.16 Mussels, 3.3.2 Adult Shad Passage, 3.3.3 Juvenile Downstream Passage, 3.3.7 Entrainment and Mortality, 3.3.15 Sea Lamprey Spawning, and 3.3.13 Littoral Zone
11/1/2016	Meeting to discuss Study Reports: 3.1.3 Sediment Management Plan, 3.1.2 Erosion Causation, and 3.6.6 Project Impacts on Recreation and Land Use
11/15/2016	FirstLight files Meeting Minutes from 10/31 and 11/1/2016 Meetings.
12/14/2016	MDEP comments on Study Report 3.1.2 Erosion Causation, 3.1.3 Sediment Management.
1/17/2017	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments filed by USFWS, NMFS, USEPA, MDEP, MDFW, FRCOG, CRWC, LCCLC, AW, AMC, NE FLOW, Karl Meyer and William Copland.
1/17/2017	Narragansett files letter with FERC.
1/17/2017	Elnu Abenaki files letter with FERC.
2/23/2017	FirstLight notifies stakeholders of 3/16/2017 Meeting.
3/1/2017	FirstLight files Transmittal Letter along with Reports and notifies stakeholders of 3/16/2017 Meeting.
3/1/2017	FirstLight files response to Elnu letter.
3/1/2017	FirstLight files response to Narragansett Letter.
3/16/2017	Meeting to discuss Study Reports: 3.3.10 Odonates, 3.3.20 Northfield Entrainment, 3.3.19 Ultrasound Array, 3.3.5 Downstream Eel Passage, 3.8.1 Energy Generation
3/31/2017	FirstLight files Meeting Minutes from 3/16/2017 Meeting.
4/3/2017	FirstLight files Transmittal Letter along with Study Reports 3.1.2 Erosion Causation (Expanded Use of Upper Reservoir), 3.3.1 Instream Flow, 3.3.16 Mussels, and 3.5.1 Wetland and RTE.
4/3/2017	FirstLight response to MDEP question at meeting on BSTEM.
4/26/2017	Cowasuck Band of Pennacook files comments with FERC.
5/1/2017	FirstLight files Transmittal letter along with Study Reports 3.3.2 Adult Shad Passage and 3.3.3 Juvenile Shad Downstream Passage.

FERC Filing Date (if applicable)	Document Description
5/30/2017	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments provided by MDFW, USFWS, NMFS, and CRC.
6/1/2017	Meeting to discuss Study 3.3.1 Instream Flow Study pertaining to mussels.
11/6/2017	FERC notes to record re: discussion with Cowasuck Band
7/2/2018	Elnu Abenaki files Letter with FERC
9/13/2018	FirstLight notifies stakeholders of 10/9/2018 meeting
9/21/2018	FirstLight notifies stakeholders of 10/9/2018 meeting and provides call in number
10/9/2018	Meeting to discuss Study 3.3.1 Instream Flow Study pertaining to mussels, 3.3.2 Adult Shad Passage, 3.3.15 Sea Lamprey Spawning, 3.3.9- River2D Northfield tailrace, 3.1.2 Erosion Causation, 3.3.20 Northfield Entrainment, 3.5.1 Wetlands and RTE
10/24/2018	FirstLight files Meeting Minutes from 10/9/2018 Meeting
12/21/2018	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments provided by USFWS, NMFS, MDFW/NHESP, and CRC.
3/1/2019	FirstLight files Transmittal letter for Study 3.3.1 Instream Flow Study and 3.3.5 Downstream Eel Passage
3/12/2019	FirstLight files Transmittal letter for Study 3.3.9 River2D Northfield Tailrace, 3.3.19 Ultrasound Array, 3.7.1 Archaeology and notifies stakeholders of 3/29/2019 Meeting
3/30/2019	Meeting to discuss Study Nos: 3.3.9 River2D Northfield Tailrace, 3.3.19 Ultrasound Array, 3.7.1 Archaeology.
4/15/2019	FirstLight files Meeting Minutes from 3/29/2019 Meeting
4/19/2019	FirstLight files Transmittal letter for Study 3.3.1 Instream Flow Study, Addendum 6
5/15/2019	MDFW files comments on Study 3.3.1 Instream Flow Study
5/30/2019	FirstLight response to MDFW comments on Study 3.3.1 Instream Flow Study
6/13/2019	FirstLight response to CRC comments on Study 3.3.9 River2D of Northfield Tailrace and 3.3.19 Ultrasonic Array
9/30/2019	FirstLight files Transmittal letter for Study 3.3.1 Instream Flow Study, Addendum 7 Revised, Yellow Lampmussel
11/29/2019	Elnu Abenaki Letter to FERC commenting on Study 3.7.1 Archaeology, 3.7.2 Historic Structures, 3.7.3 Traditional Cultural Properties
2/3/2020	FirstLight files Transmittal letter for Study 3.7.1, Phase II, Revised
3/16/2020	Elnu Abenaki letter to FERC on 3.7.3 Traditional Cultural Properties
12/4/2020	FirstLight files Transmittal letter for the Amended Final License Application

FERC Filing Date (if applicable)	Document Description
12/21/2020	FirstLight files proof of public of Amended Final License Application
8/3/2021	MDEP files letter requesting deferral of Ready for Environmental Assessment Notice
9/20/2021	Elnu Tribe files letter with FERC
11/22/2021	MDEP files letter supporting FirstLight's request to defer Ready for Environmental Assessment Notice
4/14/2022	FERC Response to Elnu Abenaki 9/20/2021 letter
9/22/2022	MDEP comments on Ready for Environmental Assessment Notice
9/29/2022	FERC sends letter to Stockbridge-Munsee Community
10/31/2022	FirstLight files status update along with an Amended Flows and Fish Passage Agreement-in-Principle- Status Updates were emailed to a longer list of stakeholders
1/4/2023	FirstLight files status update – emailed to long list of stakeholders
2/10/2023	FirstLight files status update – emailed to long list of stakeholders
2/24/2023	FirstLight files status update – emailed to long list of stakeholders
3/10/2023	FirstLight files status update – emailed to long list of stakeholders
3/24/2023	FirstLight files status update and Memorandum of Understanding in Principle on Cultural Issues
5/24/2023	MDFW supplemental comments on Flows and Fish Passage Settlement Agreement
6/12/2023	FirstLight files responses to stakeholder comments on Flows and Fish Passage Settlement Agreement
7/25/2023	FirstLight files responses to stakeholder comments on Recreation Settlement Agreement



Appendix A. List of Documents Included on Public Website and Provided to MDEP

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
4/22/2024	FirstLight 401 Water Quality Certification Application to Mass Dept of Env Protection	Process	FirstLight		Download
3/22/2024	FirstLight files amendments- cover letter	Process	FirstLight		Download
3/22/2024	FirstLight files Streambank Erosion Proposal	Process	FirstLight		Download
3/22/2024	FirstLight files BSTEM Analysis of Flows and Fish Passage Agreement	Process	FirstLight		Download
3/22/2024	FirstLight files Revised Invasive Plant Species Management Plan- Northfield Mountain Project	Process	FirstLight		Download
3/22/2024	FirstLight files Revised Invasive Plant Species Management Plan- Turners Falls Project	Process	FirstLight		Download
3/22/2024	FirstLight files Draft Biological Assessment for Puritan Tiger Beetle	Process	FirstLight		Download
3/22/2024	FirstLight files Draft Biological Assessment for Shortnose Sturgeon	Process	FirstLight		Download
12/11/2023	FirstLight files response to FERC Additional Information Requests	Process	FirstLight		Download
11/9/2023	FERC issues Additional Information Request on Recreation Settlement Agreement	Process	FERC		Download
7/25/2023	FirstLight files responses to stakeholder comments on Recreation Settlement Agreement	Response to Comments	FirstLight		Download
6/20/2023	FERC notices and seeks comments on Recreation Settlement Agreement	Settlement Agreement	FERC		Download
6/12/2023	FirstLight files Recreation Settlement Agreement and Recreation Management Plan	Settlement Agreement	FirstLight		Download
6/12/2023	FirstLight files responses to stakeholder comments on Flows and Fish Passage Settlement Agreement	Response to Comments	FirstLight		Download
5/24/2023	MDFW supplemental comments on Flows and Fish Passage Settlement Agreement	Settlement Agreement	MDFW		Download
5/11/2023	FirstLight files response to FERC Additional Information Requests	Process	FirstLight		Download
5/4/2023	FERC issues updated due date for comments on Flows and Fish Passage Settlement Agreement	Process	FERC		Download
4/26/2023	FERC issues Additional Information Request on Northfield Mountain Project	Process	FERC		Download
4/26/2023	FERC issues Additional Information Request on Turners Falls Project	Process	FERC		Download
4/4/2023	FERC notices and seeks comments on Flows and Fish Passage Settlement Agreement	Process	FERC		Download
3/31/2023	FirstLight files Flows and Fish Passage Settlement Agreement	Settlement Agreement	FirstLight		Download
3/24/2023	FirstLight files status update and Memorandum of Understanding in Principle on Cultural Issues	Agreement in Principle	FirstLight		Download
3/10/2023	FirstLight files status update	Process	FirstLight		Download
2/24/2023	FirstLight files status update	Process	FirstLight		Download
2/10/2023	FirstLight files status update	Process	FirstLight		Download
1/12/2023	FERC response to request for Ready for Environmental Assessment extension	Process	FERC		Download
1/4/2023	FirstLight files status update	Process	FirstLight		Download
10/31/2022	FirstLight files status update along with an Amended Flows and Fish Passage Agreement-in-Principle	Agreement in Principle	FirstLight		Download
9/29/2022	FERC sends letter to Stockbridge-Munsee Community	Cultural	FERC		Download
9/22/2022	MDEP comments on Ready for Environmental Assessment Notice	Process	MDEP		Download
8/18/2022	CRC response to FirstLight's 6/29/2022 response [NOT FILED WITH FERC]	401WQC	CRC		Download
8/9/2022	FirstLight files status update	Process	FirstLight		Download
7/25/2022	FERC requests FirstLight to provide update on the status of Settlement	Process	FERC		Download
6/29/2022	FL response to CRC letter to EOEEA including: Exh 1- AIPs, Exh 2- New England ISO letter, Exh 3- IFIM Map, Exh 4- Burbot and Longnose Dace MDIFW info, and Exh 5- TFI Elevation Duration Curves [NOT FILED WITH FERC]	401WQC	FirstLight		Download
6/13/2022	CRC letter to EOEEA regarding 401 WQC, including: Exh 1- Flow and Fish Passage AIP, Exh 2- memo on min flow below Turners Falls Dam, Exh 3- memo on Turners Falls Impoundment impairments, and Exh 4- decommissioning memo [NOT FILED WITH FERC]	401WQC	CRC		Download
4/14/2022	FERC Response to Elnu Abenaki 9/20/2021 letter	Cultural	FERC		Download
3/18/2022	FirstLight files status update along with Flows and Fish Passage Agreement-in-Principle	Agreement in Principle	FirstLight		Download
2/28/2022	FirstLight files status update along with Whitewater Agreement-in-Principle	Agreement in Principle	FirstLight		Download
1/31/2022	FirstLight files status update	Process	FirstLight		Download
1/4/2022	FirstLight files Ready for Environmental Assessment extension progress report	Process	FirstLight		Download
12/28/2021	FirstLight issues Boating Navigability Study (not filed with FERC)	Boating Study	FirstLight		Download
11/22/2021	MDEP files letter supporting FirstLight's request to defer Ready for Environmental Assessment Notice	Process	MDEP		Download
11/12/2021	FirstLight files letter requesting deferral of Ready for Environmental Assessment Notice	Process	FirstLight		Download
11/9/2021	FirstLight Final Study Plan for Boating Demonstration Flow Study (not filed with FERC)	Boating Study	FirstLight		Download
9/20/2021	Elnu Tribe files letter with FERC	Cultural	Elnu		Download
8/5/2021	FirstLight files letter requesting deferral of Ready for Environmental Assessment Notice	Process	FirstLight		Download
8/4/2021	FirstLight files response to Additional Information Requests	Process	FirstLight		Download
8/3/2021	MDEP files letter requesting deferral of Ready for Environmental Assessment Notice	Process	MDEP		Download
7/2/2021	FirstLight files response to Additional Information Requests- Correction to typos	Process	FirstLight		Download
6/23/2021	FirstLight files response to FERC letter of Deficiency and Additional Information Requests	Process	FirstLight		Download
6/23/2021	FirstLight files response to FERC letter of deficiency and Additional Information Requests of 4/19/2021- Rare Plant Information Privileged	Process	FirstLight		Download
6/18/2021	FirstLight files response to FERC letter of deficiency and Additional Information Requests of 4/19/2021	Process	FirstLight		Download

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
4/19/2021	FERC issues letter of deficiency and Additional Information Requests for Northfield Mountain Project- Round 2	Process	FERC		Download
4/19/2021	FERC issues letter of deficiency and Additional Information Requests for Turners Falls Project- Round 2	Process	FERC		Download
3/25/2021	FirstLight files response to Great River Hydro comment filing of 3/15/2021	Process	FirstLight		Download
3/15/2021	FirstLight files response to FERC letter of deficiency and Additional Information Requests for Turners Falls and Northfield Mountain Projects	Process	FirstLight		Download
3/15/2021	FirstLight files response to FERC letter of deficiency and Additional Information Requests for Turners Falls-Privileged	Process	FirstLight		
2/5/2021	FERC notes regarding call with FirstLight regarding FERC Additional Information Requests	Process	FERC		Download
2/5/2021	FirstLight files Notice to dredge the Northfield Mountain Upper Reservoir	Geology	FirstLight		Download
1/28/2021	FERC notes regarding call with FirstLight regarding FERC Additional Information Requests	Process	FERC		Download
1/14/2021	FERC issues letter of deficiency and Additional Information Requests for Northfield Mountain Project	Process	FERC		Download
1/14/2021	FERC issues letter of deficiency and Additional Information Requests for Turners Falls Project	Process	FERC		Download
12/21/2020	FirstLight files proof of public of Amended Final License Application	Amended FLA	FirstLight		Download
12/16/2020	FERC notice establishing procedural schedule for Northfield	Process	FERC		Download
12/16/2020	FERC notice establishing procedural schedule for Turners Falls	Process	FERC		Download
12/4/2020	FirstLight files Amended Final License Application- Executive Summary	Amended FLA	FirstLight		Download
12/4/2020	FirstLight files Amended Final License Application- NFM and TF Vol 3 of 5 RTE Non Public	Amended FLA	FirstLight		
12/4/2020	FirstLight files Amended Final License Application- NFM and TF Volume 2 of 5, Part 1 of 4	Amended FLA	FirstLight		Download
12/4/2020	FirstLight files Amended Final License Application- NFM and TF Volume 2 of 5, Part 2 of 4	Amended FLA	FirstLight		Download
12/4/2020	FirstLight files Amended Final License Application- NFM and TF Volume 2 of 5, Part 3 of 4	Amended FLA	FirstLight		Download
12/4/2020	FirstLight files Amended Final License Application- NFM and TF Volume 2 of 5, Part 4 of 4	Amended FLA	FirstLight		Download
12/4/2020	FirstLight files Amended Final License Application- NFM Vol 4 of 5 HPMP	Amended FLA	FirstLight		
12/4/2020	FirstLight files Amended Final License Application- NFM Vol 5 of 5 CEII	Amended FLA	FirstLight		
12/4/2020	FirstLight files Amended Final License Application- Northfield Mountain Project, Vol 1 of 5	Amended FLA	FirstLight		Download
12/4/2020	FirstLight files Amended Final License Application- TF Vol 5 of 5 CEII	Amended FLA	FirstLight		
12/4/2020	FirstLight files Amended Final License Application- Turners Falls Project, Volume 1 of 5	Amended FLA	FirstLight		Download
12/4/2020	FirstLight files Amended Final License Application-TF Vol 4 of 5 HPMP	Amended FLA	FirstLight		
12/4/2020	FirstLight files Transmittal letter for the Amended Final License Application	Amended FLA	FirstLight		Download
10/7/2020	FERC request for FirstLight to file Additional information for Northfield	Process	FERC		Download
10/7/2020	FERC request for FirstLight to file Additional information for Turners Falls	Process	FERC		Download
9/1/2020	FirstLight request to adjust Amended Final License Application due date	Amended FLA	FirstLight		Download
3/31/2020	FirstLight files Study Report 3.3.19 Ultrasonic Array	Aquatic	FirstLight	3.3.19	Download
3/31/2020	FirstLight files transmittal letter for Study 3.3.19 Ultrasonic Array	Aquatic	FirstLight	3.3.19	Download
3/16/2020	Elnu Abenaki letter to FERC on 3.7.3 Traditional Cultural Properties	Cultural	Elnu	3.7.03	Download
2/10/2020	FirstLight files request to adjust Amended Final License Application due date	Amended FLA	FirstLight		Download
2/3/2020	FirstLight files Revised Study Report 3.7.1, Phase II, Volume I, Privileged	Cultural	FirstLight	3.7.01	
2/3/2020	FirstLight files Revised Study Report 3.7.1, Phase II, Volume II, Privileged	Cultural	FirstLight	3.7.01	
2/3/2020	FirstLight files Transmittal letter for Study 3.7.1, Phase II, Revised	Cultural	FirstLight	3.7.01	Download
11/29/2019	Elnu Abenaki Letter to FERC commenting on Study 3.7.1 Archaeology, 3.7.2 Historic Structures, 3.7.3 Traditional Cultural Properties	Cultural	Elnu	3.7.01, 3.7.02, 3.7.03	Download
10/18/2019	FirstLight files Study Report 3.7.1, Phase II, Appendices, Privileged	Cultural	FirstLight	3.7.01	
10/18/2019	FirstLight files Study Report 3.7.1, Phase II, Privileged	Cultural	FirstLight	3.7.01	
10/18/2019	FirstLight files Transmittal letter for Study 3.7.1, Phase II	Cultural	FirstLight	3.7.01	Download
10/4/2019	FirstLight file monthly progress report on Study 3.7.1- Phase II	Cultural	FirstLight	3.7.01	Download
9/30/2019	FirstLight files Study 3.3.1 Instream Flow Study, Addendum 7, Revised, Yellow Lampmussel	Aquatic	FirstLight	3.3.01	Download
9/30/2019	FirstLight files Transmittal letter for Study 3.3.1 Instream Flow Study, Addendum 7 Revised, Yellow Lampmussel	Aquatic	FirstLight	3.3.01	Download
8/30/2019	FirstLight file monthly progress report on Study 3.7.1- Phase II	Cultural	FirstLight	3.7.01	Download
8/5/2019	FirstLight file monthly progress report on Study 3.7.1- Phase II	Cultural	FirstLight	3.7.01	Download
7/5/2019	FirstLight file monthly progress report on Study 3.7.1- Phase II	Cultural	FirstLight	3.7.01	Download
7/3/2019	FERC issues letter regarding Study 3.3.1 Instream Flow Study- Yellow Lampmussel	Aquatic	FERC	3.3.01	Download
6/13/2019	FirstLight response to CRC comments on Study 3.3.9 River2D of Northfield Tailrace and 3.3.19 Ultrasonic Array	Aquatic	FirstLight	3.3.09, 3.3.19	Download
6/6/2019	FirstLight files monthly progress report on Study 3.7.1- Phase II	Cultural	FirstLight	3.7.01	Download
6/3/2019	FirstLight files Barrier Net Study	Aquatic	FirstLight		Download
6/3/2019	FirstLight files transmittal letter for Barrier Net Study	Aquatic	FirstLight		Download
5/30/2019	FirstLight response to MDFW comments on Study 3.3.1 Instream Flow Study	Aquatic	FirstLight	3.3.01	Download
5/15/2019	MDFW files comments on Study 3.3.1 Instream Flow Study	Aquatic	MDFW	3.3.01	Download

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
5/13/2019	FERC grants extension of time for Study 3.7.1- Phase II	Cultural	FERC	3.7.01	Download
5/6/2019	FirstLight requests extension of time for Study 3.7.1 - Attachment A- Privileged	Cultural	FirstLight	3.7.01	
5/6/2019	FirstLight requests extension of time for Study 3.7.1 - Phase II	Cultural	FirstLight	3.7.01	Download
4/30/2019	FirstLight files Study Plan for Study 3.3.19 Ultrasonic Array (Updated)	Aquatic	FirstLight	3.3.19	Download
4/30/2019	FirstLight files Transmittal letter for Study Plan for Study 3.3.19 Ultrasonic Array	Aquatic	FirstLight	3.3.19	Download
4/19/2019	FirstLight files Study 3.3.1 Instream Flow Study, Addendum 6	Aquatic	FirstLight	3.3.01	Download
4/19/2019	FirstLight files Transmittal letter for Study 3.3.1 Instream Flow Study, Addendum 6	Aquatic	FirstLight	3.3.01	Download
4/15/2019	FirstLight files Meeting Minutes from 3/29/2019 Meeting	Meeting Minutes	FirstLight	3.7.01, 3.3.19	Download
4/12/2019	FirstLight files proposed Amended Final License Application Schedule	Process	FirstLight		Download
3/12/2019	FirstLight files Phase IB Study 3.7.1 Archaeology- Privileged	Cultural	FirstLight	3.7.01	
3/12/2019	FirstLight files Study Plan for Study 3.3.19 Ultrasonic Array	Aquatic	FirstLight	3.3.19	Download
3/12/2019	FirstLight files Study Report 3.3.19 Ultrasonic Array	Aquatic	FirstLight	3.3.19	Download
3/12/2019	FirstLight files Transmittal letter for Study 3.3.9, 3.3.19, 3.7.1 and notifies stakeholders of 3/29/2019 Meeting	Hydraulic, Aquatic, Cultural	FirstLight	3.3.09, 3.3.19, 3.7.01	Download
3/1/2019	FirstLight files Study Report 3.3.1 Instream Flow Study, Addendum 5, Sea Lamprey Mussels	Aquatic	FirstLight	3.3.01	Download
3/1/2019	FirstLight files Study Report 3.5.1 Wetlands and RTE, Addendum 3, Tiger Beetles	RTE	FirstLight	3.5.01	Download
3/1/2019	FirstLight files Transmittal letter for Study 3.3.1 Instream Flow Study and 3.3.5 Downstream Eel Passage	Aquatic	FirstLight	3.3.01, 3.3.05	Download
1/22/2019	FERC issues Determination Letter on Studies 3.3.1, 3.3.20	FERC Determination	FERC	3.3.01, 3.3.20	Download
1/18/2019	FERC response to extension of time request on Study 3.7.1 Archaeology	Cultural	FERC	3.7.01	Download
12/21/2018	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments provided by USFWS, NMFS, MFW/NHESP, and CRC.	Response to Comments	FirstLight	3.1.02, 3.3.01, 3.3.02, 3.3.09, 3.3.15, 3.3.20	Download
12/14/2018	FirstLight files Phase IB and Phase II Evaluation of Sites 27CH244 and 27CH245- Privileged (Attachment B1 to Transmittal Letter)	Cultural	FirstLight	3.7.01	
12/14/2018	FirstLight files Phase IB and Phase II Reports	Cultural	FirstLight	3.7.01	Download
12/14/2018	FirstLight files Phase IB and Phase II Reports- Privileged Transmittal Letter	Cultural	FirstLight	3.7.01	
12/14/2018	FirstLight files Phase IB End of Fieldwork Report- July 2018 Privileged (Attachment A to Transmittal Letter)	Cultural	FirstLight	3.7.01	
12/14/2018	FirstLight files Phase IB in MA- Privileged (Attachment C to Transmittal Letter)	Cultural	FirstLight	3.7.01	
12/14/2018	FirstLight files Phase IB in NH- Privileged (Attachment B2 to Transmittal Letter)	Cultural	FirstLight	3.7.01	
11/8/2018	FirstLight files eDNA results for Shortnose Sturgeon in Turners Falls Impoundment	Aquatic	FirstLight		Download
10/24/2018	FirstLight files Meeting Minutes from 10/9/2018 Meeting	Geology, Aquatic, Hydraulic, RTE	FirstLight	3.1.02, 3.3.01, 3.3.02, 3.3.09, 3.3.15, 3.3.20, 3.5.01	Download
9/21/2018	FirstLight notifies stakeholders of 10/9/2018 meeting and provides call in number	Notice	FirstLight	3.1.02, 3.3.01, 3.3.02, 3.3.09, 3.3.15, 3.3.20, 3.5.01	Download
9/13/2018	FirstLight notifies stakeholders of 10/9/2018 meeting	Notice	FirstLight	3.1.02, 3.3.01, 3.3.02, 3.3.09, 3.3.15, 3.3.20, 3.5.01	Download
8/10/2018	FERC issues revised Process Plan and Schedule	Notice	FERC		Download
8/8/2018	FERC denies waiver request, grants extension of time on Study 3.7.1 Archaeology	Cultural	FERC	3.7.01	Download
7/17/2018	FirstLight files request for an extension of time for Study 3.7.1 Archaeology and 3.7.3 Traditional Cultural Properties	Cultural	FirstLight	3.7.01, 3.7.03	Download
7/16/2018	FirstLight files response to FERC Additional Information Request on Study 3.7.1	Cultural	FirstLight	3.7.01	Download
7/16/2018	FirstLight response on FERC AIRs on Study 3.7.1 Archaeology- Privileged	Cultural	FirstLight	3.7.01	
7/2/2018	Elnu Abenaki files Letter to FERC	Cultural	Elnu	3.7.01, 3.7.03	Download
6/28/2018	FirstLight files response to Juvenile American Shad Assessment	Aquatic	FirstLight	3.3.03	Download
6/21/2018	FERC issues Additional Information Request on Study 3.7.1 Archaeology	Cultural	FERC	3.7.01	Download
6/20/2018	FirstLight seeks waiver to conduct archaeology studies on Great River Hydro Lands	Cultural	FirstLight	3.7.01	Download
5/31/2018	FERC Determination Letter on Study 3.3.3 Juvenile Shad Passage	FERC Determination	FERC	3.3.03	Download
5/10/2018	FirstLight files cover letter and three attachments (CFD modeling, barrier net study, memo responding to comments on barrier net)	Aquatic	FirstLight		Download
5/1/2018	FirstLight files Study 3.3.1 Instream Flow Study, Addendum 3, Reach 3, Mussels	Aquatic	FirstLight	3.3.01	Download
5/1/2018	FirstLight files Study 3.3.1 Instream Flow Study, Addendum 2, Reach 5	Aquatic	FirstLight	3.3.01	Download
5/1/2018	FirstLight files Study 3.3.1 Instream Flow Study, Addendum 2, Reach 5	Aquatic	FirstLight	3.3.01	Download
5/1/2018	FirstLight files Study 3.3.1 Instream Flow Study, Addendum 4, Sea Lamprey	Aquatic	FirstLight	3.3.01	Download
5/1/2018	FirstLight files Study 3.3.15 Sea Lamprey Spawning, Addendum 1	Aquatic	FirstLight	3.3.15	Download
5/1/2018	FirstLight files Transmittal letter of Study 3.3.1 Instream Flow Study and 3.3.15 Sea Lamprey Spawning	Aquatic	FirstLight	3.3.01, 3.3.15	Download
4/19/2018	FirstLight transmittal letter and RMC Report, Emigration of Juvenile Clupeids and Their Responses to Light Conditions at Cabot Station, Fall 1993	Aquatic	FirstLight		Download
4/13/2018	FirstLight files response to stakeholder comments on Study 3.3.19 Ultrasonic Array	Response to Comments	FirstLight	3.3.19	Download
4/6/2018	FirstLight files report: Harza RMC 1992 Report, Downstream Passage of Juvenile Clupeids, 1991	Aquatic	FirstLight		Download
4/6/2018	FirstLight files report: Harza RMC 1993 Report, Downstream Passage of Juvenile Clupeids, 1992	Aquatic	FirstLight		Download

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
4/6/2018	FirstLight files report: RMC 1994 Report, Downstream Passage of Atlantic Salmon Smolts at Cabot Station	Aquatic	FirstLight		Download
4/6/2018	FirstLight files report: RMC 1995 Report, Log Sluice Passage Survival of Juvenile Clupeids at Cabot	Aquatic	FirstLight		Download
4/6/2018	FirstLight files response to Study 3.3.3 Juvenile Shad Passage	Aquatic	FirstLight	3.3.03	Download
3/16/2018	FERC Additional Information Request on Study 3.3.3 Juvenile Shad Passage	Aquatic	FERC	3.3.03	Download
3/15/2018	FERC rehearing denial on Study 3.7.1 Archaeology	Cultural	FERC	3.7.01	Download
2/28/2018	FirstLight files letter seeking delay of Study 3.3.3 Juvenile Shad Passage with MDFW support	Aquatic	FirstLight	3.3.03	Download
2/26/2018	FirstLight files update on Study 3.7.1 Archaeology	Cultural	FirstLight	3.7.01	Download
2/23/2018	FirstLight files status update on licensing	Status Update	FirstLight		Download
11/6/2017	FERC notes to record re: discussion with Cowasuck Band	Cultural	FERC		Download
8/23/2017	FirstLight files Study Report 3.3.1 Instream Flow Study in Reach 5	Aquatic	FirstLight	3.3.01	Download
8/23/2017	FirstLight files Transmittal Letter for Study 3.3.1 Instream Flow Study	Aquatic	FirstLight	3.3.01	Download
7/28/2017	FirstLight files Study Report 3.3.20 Northfield Entrainment, Addendum 1	Aquatic	FirstLight	3.3.20	Download
7/28/2017	FirstLight files Transmittal letter for Study 3.3.20 Northfield Entrainment	Aquatic	FirstLight	3.3.20	Download
6/30/2017	FirstLight files Dewatering Protocols at Upper Reservoir	Geology	FirstLight	3.1.03	Download
6/30/2017	FirstLight files Transmittal letter of Upper Reservoir dewatering protocols	Geology	FirstLight	3.1.03	Download
6/27/2017	FERC issues Determination Letter on Studies 3.3.10, 3.8.1	FERC Determination	FERC	3.3.10, 3.8.01	Download
5/30/2017	FirstLight files response to stakeholder comments on 5/1/2017 reports	Response to Comments	FirstLight	3.3.01, 3.3.02, 3.3.03	Download
5/11/2017	FirstLight files Additional data for Study 3.3.1 Instream Flow Study and 3.3.15 Sea Lamprey Spawning	Aquatic	FirstLight	3.3.01, 3.3.15	Download
5/1/2017	FirstLight files Study Report 3.3.1 Instream Flow Study, Addendum Attachment E2 Errata	Aquatic	FirstLight	3.3.01	Download
5/1/2017	FirstLight files Study Report 3.3.2 American Shad Passage, Addendum 1	Aquatic	FirstLight	3.3.02	Download
5/1/2017	FirstLight files Study Report 3.3.3 Juvenile Shad Passage, Addendum 1	Aquatic	FirstLight	3.3.03	Download
5/1/2017	FirstLight files Transmittal letter along with reports	Aquatic	FirstLight	3.3.01, 3.3.02, 3.3.03	Download
4/26/2017	Cowasuck Band of Pennacook files comments with FERC	Cultural	Cowasuck		Download
4/3/2017	FirstLight Files Study Report 3.1.2 Erosion Causation- Expanded Use of Upper Reservoir	Geology	FirstLight	3.1.02	Download
4/3/2017	FirstLight Files Study Report 3.1.2 Erosion Causation, Volume I	Geology	FirstLight	3.1.02	Download
4/3/2017	FirstLight Files Study Report 3.1.2 Erosion Causation, Volume II, Sections 1-5	Geology	FirstLight	3.1.02	Download
4/3/2017	FirstLight Files Study Report 3.1.2 Erosion Causation, Volume II, Sections 6-9	Geology	FirstLight	3.1.02	Download
4/3/2017	FirstLight Files Study Report 3.1.2 Erosion Causation, Volume III	Geology	FirstLight	3.1.02	Download
4/3/2017	FirstLight Files Study Report 3.1.2 Erosion Causation, Volume III Appendix J-II	Geology	FirstLight	3.1.02	Download
4/3/2017	FirstLight files Study Report 3.3.1 Instream Flow Study, Addendum 1	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.3.1 Instream Flow Study, Addendum Attachment D1	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.3.1 Instream Flow Study, Addendum Attachment D2	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.3.1 Instream Flow Study, Addendum Attachment D3	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.3.1 Instream Flow Study, Addendum Attachment D4	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.3.1 Instream Flow Study, Addendum Attachment D5	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.3.1 Instream Flow Study, Addendum Attachment D6	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.3.1 Instream Flow Study, Addendum Attachment D7	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.3.1 Instream Flow Study, Addendum Attachment E1	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.3.1 Instream Flow Study, Addendum Attachment E2	Aquatic	FirstLight	3.3.01	Download
4/3/2017	FirstLight Files Study Report 3.5.1 Wetlands and RTE, Attachment MADFW 11A Public	RTE	FirstLight	3.5.01	Download
4/3/2017	FirstLight Files Study Report 3.5.1 Wetlands and RTE, Addendum 2 Privileged	RTE	FirstLight	3.5.01	
4/3/2017	FirstLight Files Study Report 3.5.1 Wetlands and RTE, Addendum 2 Public	RTE	FirstLight	3.5.01	Download
4/3/2017	FirstLight Files Study Report 3.5.1 Wetlands and RTE, Attachment MADFW 11A Privileged	RTE	FirstLight	3.5.01	
4/3/2017	FirstLight Files Study Report 3.5.1 Wetlands and RTE, Attachment MADFW 11B	RTE	FirstLight	3.5.01	Download
4/3/2017	FirstLight files Transmittal Letter along with Reports	Geology, Aquatic, RTE	FirstLight	3.1.02, 3.3.01, 3.3.16, 3.5.01	Download
4/3/2017	FirstLight response to MDEP question at meeting on BSTEM	Geology	FirstLight	3.1.02	Download
3/31/2017	FirstLight files Meeting Minutes from 3/16/2017 Meeting	Aquatic, Hydro	FirstLight	3.3.05, 3.3.10, 3.3.19, 3.3.20, 3.8.01	Download
3/20/2017	FirstLight files request for rehearing on Phase IB and Phase II Studies	Cultural	FirstLight	3.7.01	Download
3/1/2017	FirstLight files response to Elnu letter	Cultural	FirstLight	3.7.03	Download
3/1/2017	FirstLight files response to Narragansett Letter	Cultural	FirstLight	3.7.03	Download
3/1/2017	FirstLight files Study Report 3.3.19 Ultrasonic Array	Aquatic	FirstLight	3.3.19	Download
3/1/2017	FirstLight files Study Report 3.3.5 Downstream Eel Passage	Aquatic	FirstLight	3.3.05	Download
3/1/2017	FirstLight files Study Report 3.8.1 Energy Generation	Hydro	FirstLight	3.8.01	Download
3/1/2017	FirstLight files Transmittal Letter along with Reports and notifies stakeholders of 3/16/2017 Meeting	Aquatic, Hydro	FirstLight	3.3.10, 3.3.19, 3.3.05, 3.8.01	Download
2/23/2017	FirstLight notifies stakeholders of 3/16/2017 Meeting	Notice	FirstLight		Download
2/17/2017	FERC Determination Letter on Studies 3.1.2, 3.1.3, 3.3.1, 3.3.2, 3.3.3, 3.3.7, 3.3.13, 3.3.15, 3.3.16, 3.6.6	FERC Determination	FERC	3.1.02, 3.3.01, 3.3.02, 3.3.03, 3.3.07, 3.3.12, 3.3.15, 3.5.01	Download
2/7/2017	FirstLight files response to USFWS comments	Aquatic	FirstLight	3.3.03	Download
1/17/2017	Elnu Abenaki files letter with FERC	Cultural	Elnu	3.7.03	Download

401 Water Quality Certificate Documents

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
1/17/2017	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments filed by USFWS, NMFS, USEPA, MDEP, MDFW, FRCOG, CRWC, LCCLC, AW, AMC, NE FLOW, Karl Meyer and William Copland.	Geology, Aquatic, Recreation	FirstLight	3.1.02, 3.1.03, 3.3.01, 3.3.02, 3.3.03, 3.3.07, 3.3.13, 3.3.15, 3.3.16, 3.6.06	Download
1/17/2017	Narragansett files letter with FERC	Cultural	Narragansett	3.7.03	Download
12/28/2016	FirstLight files Study Reports 3.3.10 Odonates, 3.3.20 Northfield Entrainment	Aquatic	FirstLight	3.3.10, 3.3.20	Download
12/14/2016	MDEP comments on Study Report 3.1.2 Erosion Causation, 3.1.3 Sediment Management	Geology	MDEP	3.1.02, 3.1.3	Download
11/29/2016	FirstLight files Study Report 3.3.1 Instream Flow Study, Errata Notice	Aquatic	FirstLight	3.3.01	Download
11/15/2016	FirstLight files Meeting Minutes from 10/31 and 11/1/2016 Meetings	Geology, Aquatic, Recreation	FirstLight	3.1.03, 3.1.02, 3.3.01, 3.3.02, 3.3.03, 3.3.06, 3.3.07, 3.3.08, 3.3.13, 3.3.15, 3.3.16, 3.5.01, 3.6.06	Download
10/17/2016	FirstLight files Study Report 3.3.6 American Shad Spawning, Addendum, Appendix A	Aquatic	FirstLight	3.3.06	Download
10/14/2016	FirstLight files Study Report 3.1.2 Erosion Causation, Volumes I-III (Part 1)	Geology	FirstLight	3.1.02	Download
10/14/2016	FirstLight files Study Report 3.1.2 Erosion Causation, Volumes I-III (Part 2)	Geology	FirstLight	3.1.02	Download
10/14/2016	FirstLight files Study Report 3.1.2 Erosion Causation, Volumes I-III (Part 3)	Geology	FirstLight	3.1.02	Download
10/14/2016	FirstLight files Study Report 3.1.3 Sediment Management	Geology	FirstLight	3.1.03	Download
10/14/2016	FirstLight files Study Report 3.3.1 Instream Flow Study	Aquatic	FirstLight	3.3.01	Download
10/14/2016	FirstLight files Study Report 3.3.13 Littoral Zone	Aquatic	FirstLight	3.3.13	Download
10/14/2016	FirstLight files Study Report 3.3.15 Sea Lamprey Spawning	Aquatic	FirstLight	3.3.15	Download
10/14/2016	FirstLight files Study Report 3.3.16 Mussels	Aquatic	FirstLight	3.3.16	Download
10/14/2016	FirstLight files Study Report 3.3.2 American Shad Passage, Addendum 1	Aquatic	FirstLight	3.3.02	Download
10/14/2016	FirstLight files Study Report 3.3.3 Juvenile Shad Passage	Aquatic	FirstLight	3.3.03	Download
10/14/2016	FirstLight files Study Report 3.3.6 American Shad Passage, Addendum	Aquatic	FirstLight	3.3.06	Download
10/14/2016	FirstLight files Study Report 3.3.7 Entrainment and Mortality	Aquatic	FirstLight	3.3.07	Download
10/14/2016	FirstLight files Study Report 3.3.8 CFD Modeling for Fish Passage, Addendum 1	Aquatic	FirstLight	3.3.08	Download
10/14/2016	FirstLight files Study Report 3.5.1 Wetlands and RTE, Addendum 1	Terrestrial	FirstLight	3.5.01	Download
10/14/2016	FirstLight files Study Report 3.6.6 Project Impacts on Recreation	Recreation	FirstLight	3.6.06	Download
10/14/2016	FirstLight files Transmittal Letter along the reports and notifies stakeholders of 10/31 and 11/1/2016 Meetings	Geology, Aquatic, Terrestrial, RTE, Recreation	FirstLight	3.1.02, 3.1.03, 3.3.01, 3.3.02, 3.3.03, 3.3.06, 3.3.07, 3.3.08, 3.3.13, 3.3.15, 3.3.16, 3.5.01, 3.6.06	Download
6/30/2016	FirstLight notifies stakeholders of posting Study Reports 3.3.13 Littoral Zone and 3.3.15 Sea Lamprey Spawning to relicensing website	Notice	FirstLight	3.3.13, 3.3.15	Download
6/29/2016	FERC issues Determination Letter on Study 3.3.6, 3.3.8, 3.3.9, 3.3.20, 3.5.1	Aquatic, Hydraulic, RTE	FERC	3.3.06, 3.3.08, 3.3.09, 3.3.20, 3.5.01	Download
5/31/2016	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments filed by USFWS, NMFS, MDFW, CRWC, TNC and Karl Meyer.	Response to Comments	FirstLight	3.2.01, 3.2.02, 3.3.04, 3.3.06, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.18, 3.3.20, 3.4.01, 3.5.01, 3.6.01, 3.6.05	Download
5/5/2016	FERC issues revised Process Plan and Schedule	Process	FERC		Download
4/29/2016	FirstLight files Draft Historic Properties Management Plan- Privileged	Cultural	FirstLight	3.7.01, 3.7.02	
4/29/2016	FirstLight files Final License Application (Part 1)	Final License Application	FirstLight		Download
4/29/2016	FirstLight files Final License Application (Part 2)	Final License Application	FirstLight		Download
4/29/2016	FirstLight files Transmittal letter for HPMPs	Cultural	FirstLight	3.7.01, 3.7.02	Download
4/22/2016	FirstLight files response to CRWC and Meyer comments on Study 3.3.6, 3.3.18 Addendum 1, 3.3.20, 3.6.1, 3.6.5	Aquatic, Recreation	FirstLight	3.3.06, 3.3.18, 3.3.20, 3.6.01, 3.6.05	Download
3/31/2016	FirstLight files Meeting Minutes from 3/16/2016 Meeting	Meeting Minutes	FirstLight	3.2.01, 3.2.02, 3.3.04, 3.3.06, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.18, 3.3.20, 3.4.01, 3.5.01, 3.6.01, 3.6.05	Download
3/1/2016	FirstLight files Study Report 3.2.1 Water Quality	Water Quality	FirstLight	3.2.01	Download
3/1/2016	FirstLight files Study Report 3.2.2 Water Quality, Addendum 1	Hydraulic	FirstLight	3.2.02	Download
3/1/2016	FirstLight files Study Report 3.3.10 Odonates	Aquatic	FirstLight	3.3.10	Download
3/1/2016	FirstLight files Study Report 3.3.11 Fish Assemblage	Aquatic	FirstLight	3.3.11	Download
3/1/2016	FirstLight files Study Report 3.3.12 Cabot Emergency Gates	Aquatic	FirstLight	3.3.12	Download
3/1/2016	FirstLight files Study Report 3.3.18 Canal Drawdown, Addendum 1	Aquatic	FirstLight	3.3.18	Download
3/1/2016	FirstLight files Study Report 3.3.20 Northfield Entrainment	Aquatic	FirstLight	3.3.20	Download
3/1/2016	FirstLight files Study Report 3.3.4 Upstream Eel Passage	Aquatic	FirstLight	3.3.04	Download
3/1/2016	FirstLight files Study Report 3.3.6 American Shad Spawning	Aquatic	FirstLight	3.3.06	Download
3/1/2016	FirstLight files Study Report 3.3.8 CFD Modeling for Fish Passage	Hydraulic	FirstLight	3.3.08	Download
3/1/2016	FirstLight files Study Report 3.3.9 River2D modeling of Northfield Tailrace	Hydraulic	FirstLight	3.3.09	Download
3/1/2016	FirstLight files Study Report 3.3.9 River2D modeling of Northfield Tailrace, Appendix B	Hydraulic	FirstLight	3.3.09	Download
3/1/2016	FirstLight files Study Report 3.4.1 Terrestrial	Terrestrial	FirstLight	3.4.01	Download
3/1/2016	FirstLight files Study Report 3.5.1 Wetlands and RTE	RTE	FirstLight	3.5.01	Download

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
3/1/2016	FirstLight files Study Report 3.6.1 Recreation User Survey	Recreation	FirstLight	3.6.01	Download
3/1/2016	FirstLight files Study Report 3.6.5 Land Use Inventory	Recreation	FirstLight	3.6.05	Download
3/1/2016	FirstLight files Transmittal letter along with study reports, and proposed schedule and process plan for remaining studies, notifies stakeholders of 3/16/2016 meeting.	Water Quality, Aquatic, Terrestrial, RTE, Recreation	FirstLight	3.2.01, 3.3.04, 3.3.06, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.20, 3.4.01, 3.5.01, 3.6.01, 3.6.05	Download
2/25/2016	FERC response to revised Study Plan for Study 3.3.19 Ultrasonic Array	Aquatic	FERC	3.3.19	Download
2/18/2016	FirstLight files Revised Study Plan for Study 3.3.19 Ultrasonic Array	Aquatic	FirstLight	3.3.19	Download
2/12/2016	FirstLight notifies stakeholders of Study Report Meeting to be held on 3/16/2016	Notice	FirstLight		Download
1/19/2016	FERC letter to Narragansett Indian Tribe- request Tribe to work with FirstLight on identifying properties of cultural significance	Cultural	FERC	3.7.03	Download
1/19/2016	FERC memo to file of telephone call with Narragansett Indian Tribe and Nolumbeka Project	Cultural	FERC	3.7.01, 3.7.02, 3.7.03	Download
1/15/2016	FERC issues Determination Letter on Studies 3.1.2, 3.2.2, 3.3.3, 3.3.5, 3.3.7, 3.3.17, 3.3.18, 3.6.3, 3.6.4	Geology, Water Quality, Aquatic, Recreation	FERC	3.1.02, 3.2.02, 3.3.03, 3.3.05, 3.3.07, 3.3.17, 3.3.18, 3.6.03, 3.6.04	Download
12/14/2015	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments filed by USFWS, NMFS, NPS, AMC, CRSEC, NE FLOW, AW, AMC, Crab Apple Whitewater, Zoar Outdoor, CRWC, TNC and Karl Meyer.	Response to Comments	FirstLight	3.1.02, 3.2.02, 3.3.03, 3.3.05, 3.3.07, 3.3.11, 3.3.17, 3.3.18, 3.4.01, 3.6.03, 3.6.04	Download
12/2/2015	FirstLight files Draft License Application (Part 1)	Draft License Application	FirstLight		Download
12/2/2015	FirstLight files Draft License Application (Part 2)	Draft License Application	FirstLight		Download
12/1/2015	FirstLight files Summary Report on 2015 Activities under the Sediment Management Plan for the Northfield Mountain Project	Geology	FirstLight	3.1.03	Download
11/16/2015	FirstLight files Study 3.7.2 Historic Structures, Addendum	Cultural	FirstLight	3.7.02	Download
11/10/2015	FirstLight files supplemental information on Study 3.6.3 Whitewater Boating, 3.6.7 Northfield Mountain Trails	Recreation	FirstLight	3.6.03, 3.6.07	Download
10/29/2015	FirstLight files supplemental information on Study 3.6.3 Whitewater Boating	Recreation	FirstLight	3.6.03	Download
10/22/2015	FirstLight files information regarding Study 3.1.2 Erosion Causation	Geology	FirstLight	3.1.02	Download
10/14/2015	FirstLight files Updated Study Report Meeting Summary and PowerPoint presentation from 9/29-30/2015 meetings	Meeting Minutes	FirstLight	3.1.01, 3.1.02, 3.1.03, 3.2.01, 3.3.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.3.20, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.7.03, 3.8.01	Download
9/15/2015	FirstLight notifies stakeholders of 9/29-9/30/2015 meetings- provides call in number	Notice	FirstLight	3.1.01, 3.1.02, 3.1.03, 3.2.01, 3.3.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.12, 3.3.11, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.3.20, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.7.03, 3.8.01	Download
9/14/2015	FirstLight files Transmittal Letter along with Reports and notifies stakeholders of 9/29-30/2015 meetings	Geology, Water Quality, Aquatic, Terrestrial, RTE, Recreation, Cultural, Hydro	FirstLight	3.1.02, 3.2.01, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.15, 3.3.16, 3.3.19, 3.3.20, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.05, 3.6.06, 3.7.01, 3.7.02, 3.8.01	Download
9/14/2015	FirstLight files Updated Study Report 3.1.2 Erosion Causation	Geology	FirstLight	3.1.02	Download
9/14/2015	FirstLight files Updated Study Report 3.2.1 Water Quality Monitoring	Water Quality	FirstLight	3.2.01	Download
9/14/2015	FirstLight files Updated Study Report 3.3.1 Instream Flow Study	Aquatic	FirstLight	3.3.01	Download
9/14/2015	FirstLight files Updated Study Report 3.3.10 Odonates	Aquatic	FirstLight	3.3.10	Download
9/14/2015	FirstLight files Updated Study Report 3.3.11 Fish Assemblage	Aquatic	FirstLight	3.3.11	Download
9/14/2015	FirstLight files Updated Study Report 3.3.12 Cabot Emergency Gates	Aquatic	FirstLight	3.3.12	Download
9/14/2015	FirstLight files Updated Study Report 3.3.13 Littoral Zone	Aquatic	FirstLight	3.3.13	Download
9/14/2015	FirstLight files Updated Study Report 3.3.15 Sea Lamprey Spawning	Aquatic	FirstLight	3.3.15	Download
9/14/2015	FirstLight files Updated Study Report 3.3.16 Mussels	Aquatic	FirstLight	3.3.16	Download
9/14/2015	FirstLight files Updated Study Report 3.3.19 Ultrasonic Array	Aquatic	FirstLight	3.3.19	Download
9/14/2015	FirstLight files Updated Study Report 3.3.2 American Shad Passage	Aquatic	FirstLight	3.3.02	Download
9/14/2015	FirstLight files Updated Study Report 3.3.20 Northfield Entrainment	Aquatic	FirstLight	3.3.20	Download
9/14/2015	FirstLight files Updated Study Report 3.3.3 Juvenile Shad Passage	Aquatic	FirstLight	3.3.03	Download
9/14/2015	FirstLight files Updated Study Report 3.3.4 Upstream Eel Passage	Aquatic	FirstLight	3.3.04	Download
9/14/2015	FirstLight files Updated Study Report 3.3.5 Downstream Eel Passage	Aquatic	FirstLight	3.3.05	Download

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
9/14/2015	FirstLight files Updated Study Report 3.3.6 American Shad Spawning	Aquatic	FirstLight	3.3.06	Download
9/14/2015	FirstLight files Updated Study Report 3.3.7 Entrainment and Mortality	Aquatic	FirstLight	3.3.07	Download
9/14/2015	FirstLight files Updated Study Report 3.3.8 CFD Modeling for Fish Passage	Hydraulic	FirstLight	3.3.08	Download
9/14/2015	FirstLight files Updated Study Report 3.3.9 River2D Modeling of Northfield Tailrace	Hydraulic	FirstLight	3.3.09	Download
9/14/2015	FirstLight files Updated Study Report 3.4.1 Terrestrial	Terrestrial	FirstLight	3.4.01	Download
9/14/2015	FirstLight files Updated Study Report 3.5.1 Wetlands and RTE	RTE	FirstLight	3.5.01	Download
9/14/2015	FirstLight files Updated Study Report 3.6.1 Recreation User Survey	Recreation	FirstLight	3.6.01	Download
9/14/2015	FirstLight files Updated Study Report 3.6.5 Land Use Inventory	Recreation	FirstLight	3.6.05	Download
9/14/2015	FirstLight files Updated Study Report 3.6.6 Project Impacts on Recreation	Recreation	FirstLight	3.6.06	Download
9/14/2015	FirstLight files Updated Study Report 3.7.1 Archaeology	Cultural	FirstLight	3.7.01	Download
9/14/2015	FirstLight files Updated Study Report 3.7.2 Historic Structures	Cultural	FirstLight	3.7.02	Download
9/14/2015	FirstLight files Updated Study Report 3.8.1 Energy Generation	Hydro	FirstLight	3.8.01	Download
9/14/2015	FirstLight Study Report 3.1.3 Sediment Management	Geology	FirstLight	3.1.03	Download
9/14/2015	FirstLight Study Report 3.2.2 TFI Hydraulic Model	Hydraulic	FirstLight	3.2.02	Download
9/14/2015	FirstLight Study Report 3.3.14 Aquatic Habitat Mapping	Aquatic	FirstLight	3.3.14	Download
9/14/2015	FirstLight Study Report 3.3.17 Tributary Access	Aquatic	FirstLight	3.3.17	Download
9/14/2015	FirstLight Study Report 3.3.18 Canal Drawdown	Aquatic	FirstLight	3.3.18	Download
9/14/2015	FirstLight Study Report 3.4.2 Northfield Project Effects on Recreation	Terrestrial	FirstLight	3.4.02	Download
9/14/2015	FirstLight Study Report 3.6.3 Whitewater Boating	Recreation	FirstLight	3.6.03	Download
9/14/2015	FirstLight Study Report 3.6.4 Day and Night Use Recreation	Recreation	FirstLight	3.6.04	Download
9/14/2015	FirstLight Study Report 3.6.7 Northfield Mountain Trails	Recreation	FirstLight	3.6.07	Download
9/14/2015	FirstLight Study Report 3.7.3 Traditional Cultural Properties	Cultural	FirstLight	3.7.03	Download
8/18/2015	FirstLight files Progress Report 1 on Study 3.1.2 Erosion Study	Geology	FirstLight	3.1.02	Download
7/21/2015	FirstLight notifies stakeholders of Updated Study Report Meeting to be held on 9/29-30/2015	Notice	FirstLight	3.1.02, 3.2.01, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.15, 3.3.16, 3.3.19, 3.3.20, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.05, 3.6.06, 3.7.01, 3.7.02, 3.8.01	Download
6/30/2015	FirstLight notifies stakeholders of Study Reports 3.3.8, 3.3.9, 3.3.14, 3.4.1, 3.4.2, 3.5.1 and 3.6.7 posted to website	Notice	FirstLight	3.3.08, 3.3.09, 3.3.14, 3.4.01, 3.4.02, 3.5.01, 3.6.07	Download
6/24/2015	FirstLight files update on Suspended Sediment Monitoring Equipment	Geology	FirstLight	3.1.03	Download
6/15/2015	FirstLight files addendum to Study 3.6.2 Recreation Facilities Inventory	Recreation	FirstLight	3.6.02	Download
6/9/2015	FirstLight files response to Nolumbeka letter of 4/29/15	Cultural	FirstLight	3.7.03	Download
5/26/2015	FirstLight files 2015 Quarter 1 Deliverables for Study 3.1.2 Erosion Causation	Geology	FirstLight	3.1.02	Download
5/15/2015	FirstLight files Study 3.7.1 (Phase IA Reconnaissance) as Privileged (Massachusetts)- Revised Report	Cultural	FirstLight	3.7.01	
5/15/2015	FirstLight files transmittal letter for Study 3.7.1 Phase IA Reconnaissance	Cultural	FirstLight	3.7.01	Download
5/1/2015	Nolumbeka files comments on Study 3.7.3 Traditional Cultural Properties	Cultural	Nolumbeka	3.7.03	Download
4/22/2015	FirstLight files Addendum to Study 3.1.1 includes all consultation records, FirstLight's response to comments, and meeting minutes (Part 1)	Geology	FirstLight	3.1.01	Download
4/22/2015	FirstLight files Addendum to Study 3.1.1 includes all consultation records, FirstLight's response to comments, and meeting minutes (Part 2)	Geology	FirstLight	3.1.01	Download
4/7/2015	FERC letter approving pilot dredge program in Upper Reservoir	Geology	FERC		Download
4/3/2015	Letter from Stockbridge-Munsee Tribal Historic Preservation on Phase IA Archaeology Study	Cultural	Stockbridge Munsee	3.7.01	Download
3/31/2015	FirstLight files response to USEPA comments on 2014 Summary Annual Monitoring	Geology	FirstLight	3.1.03	Download
3/31/2015	FirstLight notifies stakeholders of where reports are posted on FirstLight's website	Notice	FirstLight		Download
3/10/2015	USEPA files comments on FirstLight's 2014 Summary of Annual Monitoring	Geology	USEPA	3.1.03	Download
3/9/2015	FirstLight response to FRCOG Letter of 3/3/2015 on Study 3.1.1	Geology	FirstLight	3.1.01	Download
3/3/2015	FRCOG's letter to FirstLight on Study 3.1.1	Geology	FRCOG	3.1.01	Download
1/24/2015	FirstLight files letter on Pilot Dredge of Upper Reservoir	Geology	FirstLight		Download
1/22/2015	FERC issues Determination Letter on Study Nos. 3.1.1, 3.1.2, 3.2.1, 3.3.1, 3.3.2, 3.3.4, 3.3.5, 3.3.6, 3.3.9, 3.3.11, 3.3.12, 3.3.14, 3.3.18, 3.3.20, 3.6.1, 3.6.2.	FERC Determination	FERC	3.1.01, 3.1.02, 3.2.01, 3.3.01, 3.3.02, 3.3.04, 3.3.05, 3.3.06, 3.3.09, 3.3.11, 3.3.12, 3.3.14, 3.3.18, 3.3.20, 3.6.01, 3.6.02.	Download
1/21/2015	FirstLight files Study No. 3.7.2 Historic Structures Report	Cultural	FirstLight	3.7.02	
12/31/2014	FirstLight files Study 3.7.1 (Phase IA Reconnaissance) as Privileged (Massachusetts)	Cultural	FirstLight	3.7.01	
12/31/2014	FirstLight files Study 3.7.1 (Phase IA Reconnaissance) as Privileged (Vermont and New Hampshire)	Cultural	FirstLight	3.7.01	
12/31/2014	FirstLight files Study 3.7.2 Historic Structures Report as Privileged	Cultural	FirstLight	3.7.02	
12/31/2014	FirstLight files transmittal letter for Study 3.7.1 and 3.7.2	Cultural	FirstLight	3.7.01, 3.7.02	Download

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
12/15/2014	FirstLight files response to stakeholder comments on requests for study modifications and new studies. Comments were from USFWS, NMFS, NPS, MDFW, FRCOG, Town of Northfield, AMC, NE FLOW, AMC, CRSEC, CRWC, TNC, Don Pugh and Karl Meyer.	Initial Study Report	FirstLight	3.1.02, 3.3.03, 3.3.11, 3.3.12, 3.3.16	Download
12/1/2014	FirstLight files Summary Report on 2014 Activities under the Sediment Management Plan for the Northfield Mountain Project	Geology	FirstLight	3.1.03	Download
11/4/2014	FirstLight files Meetings Minutes regarding Study No. 3.1.1	Geology	FirstLight	3.1.01	Download
10/16/2014	FirstLight files Revised Study Plan for Entrainment of American Shad Ichthyoplankton at Northfield Mountain Project	Aquatic	FirstLight	3.3.20	Download
10/15/2014	FirstLight files Initial Study Report Meeting Minutes and Attachments for Study Nos. 3.1.2, 3.3.3, 3.3.11, 3.3.12, and 3.3.16.	Initial Study Report	FirstLight	3.2.01, 3.2.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.7.03, 3.8.01	Download
9/16/2014	FirstLight files Study 3.1.1 Full River Reconnaissance	Geology	FirstLight	3.1.01	Download
9/16/2014	FirstLight files Study 3.1.2 Updated Study Report, includes consultation record	Geology	FirstLight	3.1.02	Download
9/16/2014	FirstLight files Transmittal Letter of Updated Study Report and notifies stakeholders of 9/30 and 10/1/2014 Meetings	Geology, Water Quality, Hydraulic, Aquatic, Terrestrial, RTE, Recreation, Cultural, Hydro	FirstLight	3.2.01, 3.2.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.7.03, 3.8.01	Download
9/16/2014	FirstLight files Updated Study Report Summaries	Geology, Water Quality, Hydraulic, Aquatic, Terrestrial, RTE, Recreation, Cultural, Hydro	FirstLight	3.2.01, 3.2.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.7.03, 3.8.01	Download
4/3/2014	FirstLight files Northfield Mountain Pumped Storage Project 1990 Field Sampling Program and Impact of Northfield Mountain Pumped Storage Facility on Atlantic Salmon and American Shad	Aquatic	FirstLight		Download
2/21/2014	FERC issues Study Plan Determination Letter on Aquatic Studies	FERC Determination	FirstLight	3.2.01, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19	Download
2/13/2014	FirstLight letter to Narragansett Tribe and Nolumbeka Project- request to consult on TCP and ethnographer	Cultural	FirstLight	3.7.03	Download
12/21/2013	FERC issues Scoping Document 1	Scoping Document 1	FERC		Download
12/2/2013	FirstLight files Summary Report on 2013 Activities under the Sediment Management Plan for the Northfield Mountain Project	Geology	FirstLight	3.1.03	Download
9/13/2013	FERC issues Study Plan Determination Letter on Non-Aquatic Studies	FERC Determination	FERC	3.1.01, 3.1.02, 3.1.03, 3.2.02, 3.3.08, 3.3.09, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.7.03, 3.8.01	Download
8/28/2013	MDEP files comments on Revised Study Plan	Geology, Water Quality	MDEP	3.1.01, 3.1.02, 3.2.01	Download
8/14/2013	FirstLight files Revised Study Plan	Revised Study Plan	FirstLight	3.1.01, 3.1.02, 3.2.01, 3.2.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.7.03, 3.8.01	Download
8/14/2013	FirstLight files Revised Study Plan- Appendix A- Study Request Letters	Revised Study Plan	FirstLight		Download
8/14/2013	FirstLight files Revised Study Plan- Appendix B- Stakeholder Comments and FirstLight Responses	Revised Study Plan	FirstLight		Download
8/14/2013	FirstLight files Revised Study Plan- Appendix C- NRCS Chemical and Physical Soil Properties	Revised Study Plan	FirstLight		Download
8/14/2013	FirstLight files Revised Study Plan- Appendix D- 2013 Full River Reconnaissance Study and Quality Assurance Project Plan	Revised Study Plan	FirstLight		Download
8/14/2013	FirstLight files Revised Study Plan- Appendix E- Previous Data and Information on Adult American Shad	Revised Study Plan	FirstLight		Download
8/14/2013	FirstLight files Revised Study Plan- Appendix F- Turners Falls Upstream Fish Passage CFD Modeling of Gatehouse Entrance	Revised Study Plan	FirstLight		Download

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
8/14/2013	FirstLight files Revised Study Plan- Appendix G- 2011 Cabot Station Drawdown Juvenile American Shad Stranding Study	Revised Study Plan	FirstLight		Download
8/14/2013	FirstLight files Revised Study Plan- Appendix H- Stakeholder Comments on Updated Proposed Study Plan	Revised Study Plan	FirstLight		Download
8/14/2013	FirstLight files Revised Study Plan- Appendix I- Quality Assurance Project Plan for Sediment Monitoring Study- Revision 2	Revised Study Plan	FirstLight	3.1.03	Download
8/14/2013	FirstLight files Transmittal letter for Revised Study Plan	Revised Study Plan	FirstLight	3.1.01, 3.1.02, 3.2.01, 3.2.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.7.03, 3.8.01	Download
7/12/2013	MDEP files comments on Updated Proposed Study Plan	Geology, Water Quality	MDEP	3.1.01, 3.1.02, 3.2.01	Download
6/28/2013	FirstLight files Updated Proposed Study Plan, which includes: Appendix A: Study Request Letters Appendix B: Resource Comments and Concerns Appendix C: NRCS Chemical and Physical Soil Properties Appendix D: 2013 Full River Reconnaissance Study and Quality Assurance Project Plan Appendix E: Previous Data and Information for Adult American Shad Appendix F: Turners Falls Upstream Fish Passage CFD Modeling of Gatehouse Entrance	Updated Proposed Study Plan	FirstLight	3.1.01, 3.1.02, 3.2.01, 3.2.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.8.01	Download
4/15/2013	FERC issues Scoping Document 2	Scoping Document 2	FERC		Download
4/15/2013	FirstLight files Proposed Study Plan (Part 1), which includes: Appendix A: Study Request Letters; Appendix B: Resource Comments and Concerns; Appendix C: NRCS Chemical and Physical Soil Properties; Appendix D: 2013 Full River Reconnaissance Study and Quality Assurance Project Plan; Appendix E: Previous Data and Information for Adult American Shad; Appendix F: Turners Falls Upstream Fish Passage CFD Modeling of Gatehouse Entrance; Appendix G: 2011 Cabot Station Drawdown Juvenile American Shad Stranding Survey	Proposed Study Plan	FirstLight	3.1.01, 3.1.02, 3.2.01, 3.2.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.8.01	Download
4/15/2013	FirstLight files Proposed Study Plan (Part 2), which includes: Appendix A: Study Request Letters; Appendix B: Resource Comments and Concerns; Appendix C: NRCS Chemical and Physical Soil Properties; Appendix D: 2013 Full River Reconnaissance Study and Quality Assurance Project Plan; Appendix E: Previous Data and Information for Adult American Shad; Appendix F: Turners Falls Upstream Fish Passage CFD Modeling of Gatehouse Entrance; Appendix G: 2011 Cabot Station Drawdown Juvenile American Shad Stranding Survey	Proposed Study Plan	FirstLight	3.1.01, 3.1.02, 3.2.01, 3.2.02, 3.3.01, 3.3.02, 3.3.03, 3.3.04, 3.3.05, 3.3.06, 3.3.07, 3.3.08, 3.3.09, 3.3.10, 3.3.11, 3.3.12, 3.3.13, 3.3.14, 3.3.15, 3.3.16, 3.3.17, 3.3.18, 3.3.19, 3.4.01, 3.4.02, 3.5.01, 3.6.01, 3.6.02, 3.6.03, 3.6.04, 3.6.05, 3.6.06, 3.6.07, 3.7.01, 3.7.02, 3.8.01	Download
3/1/2013	MDEP Study Request Letter- requests two studies- sediment transport and water quality	Geology, Water Quality	MDEP		Download
2/28/2013	Transcript of 1/30/2013 Morning Scoping Meeting	Scoping Meeting	FERC		Download
2/28/2013	Transcript of 1/31/2013 Cumulative Effects Scoping Meeting	Scoping Meeting	FERC		Download
2/28/2013	Transcript of 1/31/2013 Evening Scoping Meeting	Scoping Meeting	FERC		Download
2/22/2013	FirstLight files Draft Study Plan to Conduct Instream Flow Habitat Assessments in the Bypass Reach and below Cabot Station	Aquatic	FirstLight		Download
2/5/2013	FERC letter to Narragansett Tribe	Cultural	FERC		Download
1/25/2013	FERC response to Summary Report on 2012 Activities under the Sediment Management Plan for the Northfield Mountain Project	Geology	FERC		Download
1/22/2013	FirstLight files Long Term Monitoring Transects in Turners Falls Impoundment	Geology	FirstLight		Download
1/17/2013	FERC staff notes on attempts to engage the Wampanoag Tribe of Gay Head, Mashpee Wampanoag Tribe and Narragansett Tribe	Cultural	FERC		Download
1/8/2013	FirstLight files report: Analysis of Erosion in Vicinity of Route 10 Bridge Spanning Connecticut River	Geology	FirstLight		Download
1/8/2013	FirstLight files report: Aquatic Mesohabitat Assessment and Mapping	Aquatic	FirstLight		Download
1/8/2013	FirstLight files report: Freshwater Mussel Survey in Connecticut River for the Turners Falls and Northfield Mountain Projects	Aquatic	FirstLight		Download
1/8/2013	FirstLight files report: Riverbank Erosion Comparison along the Connecticut River	Geology	FirstLight		Download
1/8/2013	FirstLight files transmittal letter of four reports	Transmittal Letter	FirstLight		Download
12/21/2012	FERC Notice of Scoping Meetings on 1/30-31/2013	Notice	FERC		Download
11/30/2012	FirstLight files Summary Report on 2012 Activities under the Sediment Management Plan for the Northfield Mountain Project	Geology	FirstLight		Download
11/14/2012	FERC sent letter to consult with Wampanoag Tribe of Gay Head	Cultural	FERC		Download
11/8/2012	FERC sent letter to consult with Mashpee Wampanoag Tribe	Cultural	FERC		Download
11/5/2012	FirstLight files Notice of Intent and Pre-Application Document	NOI/PAD	FirstLight		Download
9/25/2012	Proof of Notice placed in Greenfield Recorder Newspaper re: Site Tour of the Turners Falls and Northfield Mountain Projects on 10/4-5/2012	Notice	FirstLight		Download

FERC Filing Date	Document Description	Category (Resource Area)	Document Author	Study No. (if applicable)	Download Link
9/25/2012	Proof of Notice placed in Keene Sentinel Newspaper re: Site Tour of the Turners Falls and Northfield Mountain Projects on 10/4-5/2012	Notice	FirstLight		Download
8/29/2012	FirstLight letter notifying parties of 10/4-5/2012 site tours (includes contact list)	Notice	FirstLight		Download
7/12/2012	EOEEA response to FirstLight relative to MEPA (not filed with FERC)	MEPA	EOEEA		Download
7/6/2012	FirstLight letter to EOEEA relative to MEPA (not filed with FERC)	MEPA	FirstLight		Download
3/28/2012	FERC Order Approving Revised Sediment Management Plan	Geology	FERC		Download
3/14/2012	FirstLight Response to USEPA comments on Revised Sediment Management Plan for Northfield Mountain Project	Geology	FirstLight		Download
2/15/2012	FirstLight files Revised Sediment Management Plan for Northfield Mountain Project	Geology	FirstLight		Download

Appendix B. Turners Falls Hydroelectric Project Invasive Aquatic Species Management Plan

Turners Falls Hydroelectric Project (FERC Project Number 1889)

Invasive Plant Species Management Plan



MARCH 2024

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LIST OF ACRONYMS

BMP	best management practices
FERC	Federal Energy Regulatory Commission
FirstLight or Licensee	FirstLight MA Hydro LLC
MA	Massachusetts
MDFW	Massachusetts Department of Fish and Wildlife
MIPAG	Massachusetts Invasive Plant Advisory Group
NH	New Hampshire
NHESP	Massachusetts Endangered Species Program
Plan	Invasive Plant Species Management Plan
Project	Turners Falls Hydroelectric Project (FERC No. 1889)
SAV	submerged aquatic vegetation
TFI	Turners Falls Impoundment
USDA	United States Department of Agriculture
USFWS	United States Fish and Wildlife Service
VT	Vermont

1 BACKGROUND

1.1 Project Ownership and Layout

FirstLight MA Hydro LLC (FirstLight or the Licensee) is the owner and operator of the Turners Falls Hydroelectric Project (Project, FERC No. 1889). The Project is located on the Connecticut River in the Commonwealth of Massachusetts (MA), as well as in the states of New Hampshire (NH), and Vermont (VT). The greater portion of the Project, including developed facilities and most of the lands within the FERC Project boundary, is located in Franklin County, MA; specifically, in the towns of Erving, Gill, Greenfield, Montague and Northfield. The Turners Falls Dam is located at approximately river mile 122 (above Long Island Sound) on the Connecticut River in the towns of Gill and Montague, MA. The Project Boundary is shown on [Figure 1.1-1](#). Key features of the Project are shown in [Figure 1.1-2](#) and are described below.

The Turners Falls Dam creates the Turners Falls Impoundment (TFI), which is approximately 20-miles-long, and extends upstream to the base of Great River Hydro's Vernon Hydroelectric Project and Dam (FERC No. 1904). Most of the TFI lies in MA, however, approximately 5.7 miles of the northern portion of the TFI lies in NH and VT. The TFI also serves as the lower reservoir for the Northfield Mountain Project.

The Turners Falls Dam is located on a "Z turn" in the river, and is oriented on a northeast-southwest axis, with the impounded area on the east side of the dam and extending north. At the southwest end of the Turners Falls Dam is the gatehouse. Below the dam, originating at the gatehouse, is the Turners Falls power canal. Paralleling this power canal is a bypassed section of the Connecticut River. Associated with this power canal are the two hydroelectric generating facilities owned by FirstLight: Station No. 1 and Cabot Station. Station No. 1 is located approximately one-third of the way down the power canal. Water is conveyed from the power canal to a small branch canal feeding the Station No. 1 turbines, before discharging into the bypassed reach of the Connecticut River. Cabot Station is located at the downstream terminus of the power canal, where it rejoins the main stem of the Connecticut River. Station No. 1 and Cabot Station discharge into the Connecticut River approximately 0.9 miles and 2.5 miles downstream of the Turners Falls Dam, respectively.

1.2 Purpose of Plan

The purpose of this Invasive Plant Species Management Plan (Plan) is to help prevent the introduction and/or spread of terrestrial and aquatic invasive plants within the Project boundary by implementing best management practices and through supporting the education of individuals performing construction, maintenance, and/or operational activities within the Project boundary. The Plan also includes conducting annual invasive aquatic surveys in the TFI and bypass reach, preparing a report, and consulting with the United States Fish and Wildlife Service (USFWS) and the Massachusetts Natural Heritage and Endangered Species Program (NHESP).

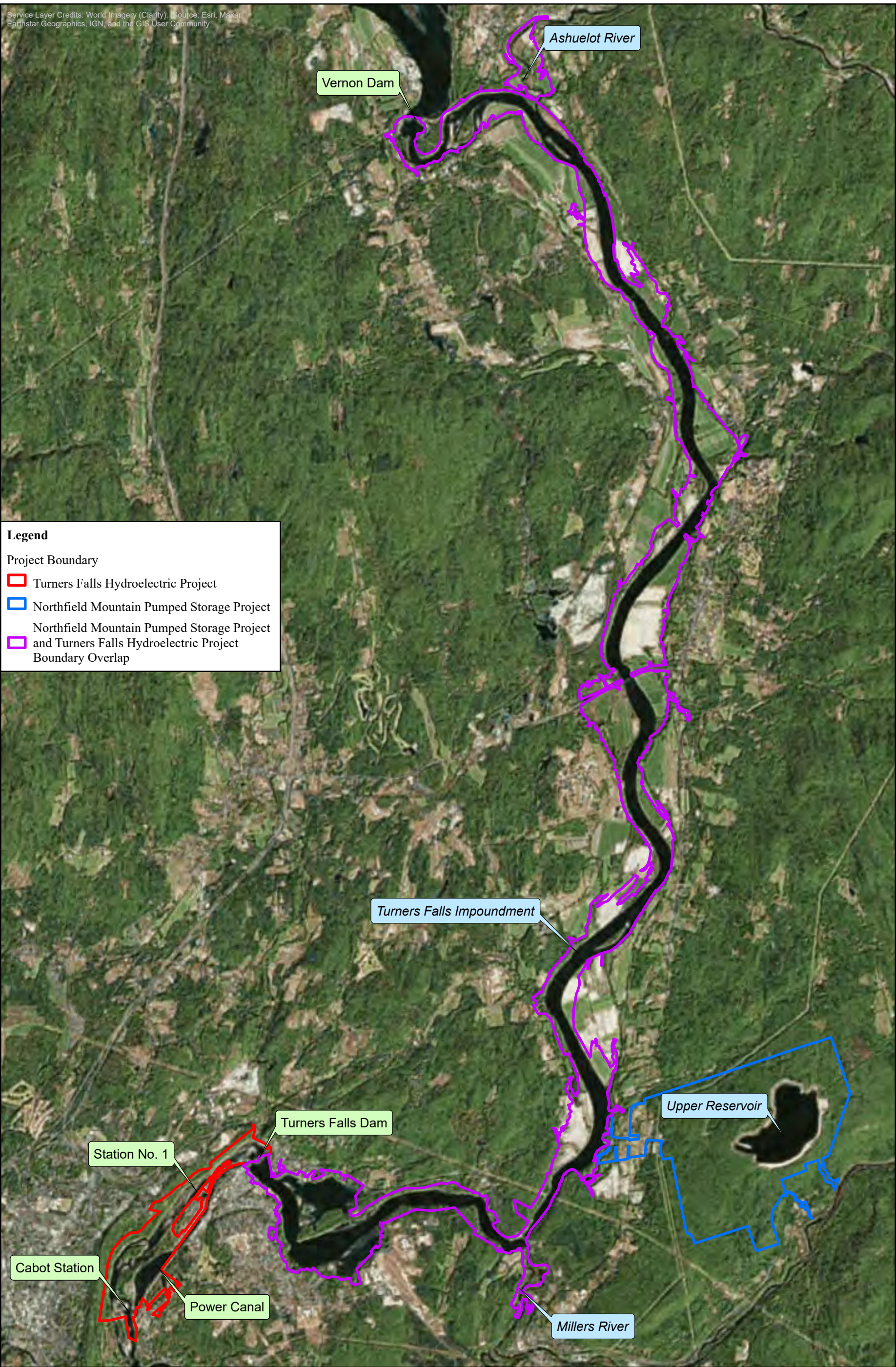
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Project Boundary

Turners Falls Hydroelectric Project

Northfield Mountain Pumped Storage Project

Northfield Mountain Pumped Storage Project and Turners Falls Hydroelectric Project Boundary Overlap



FIRSTLIGHT MA HYDRO LLC

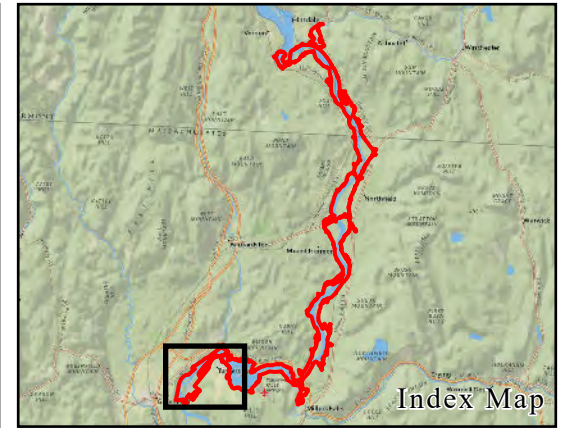
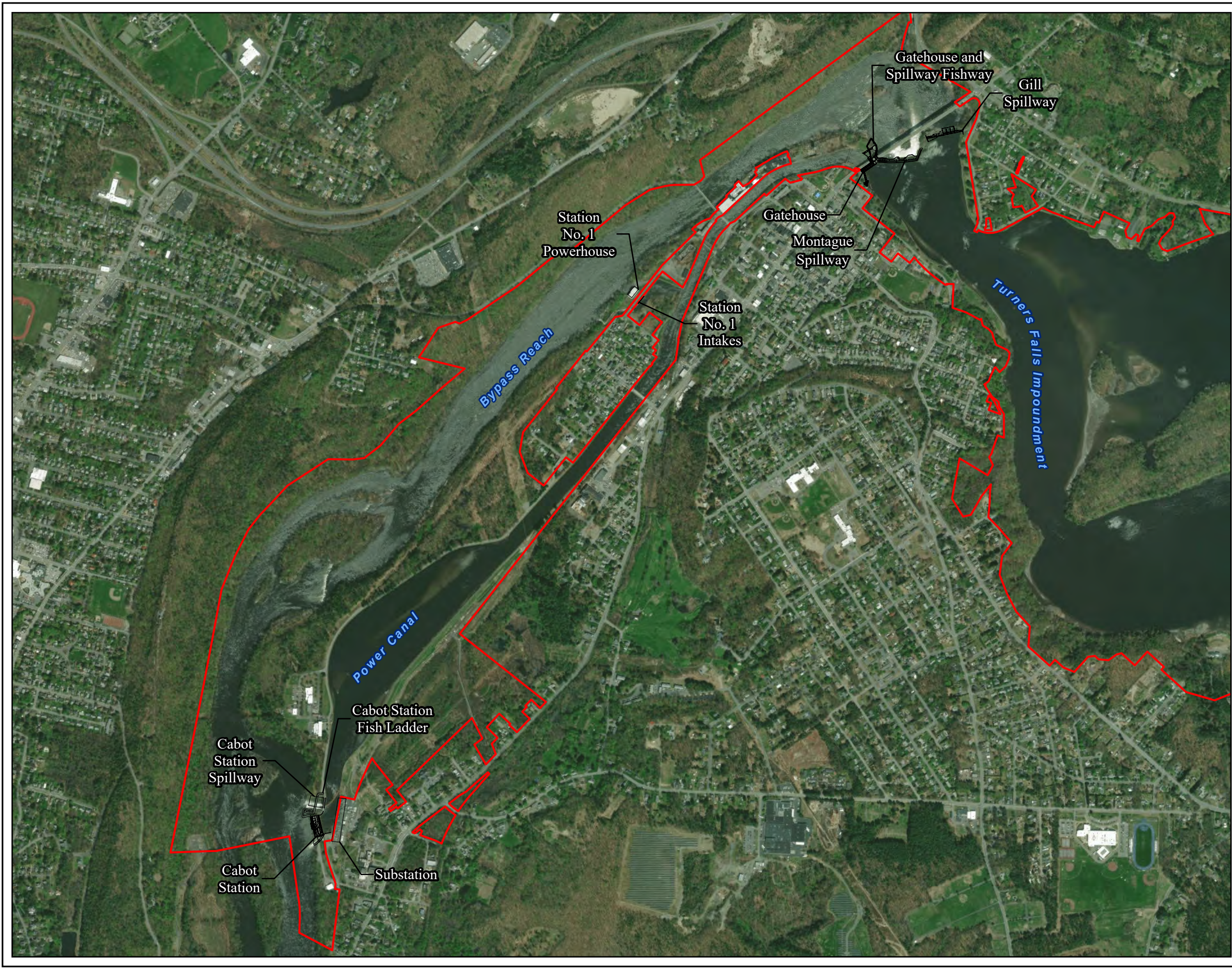
Turners Falls Hydroelectric Project (No. 1889)

Invasive Plant Species Management Plan

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Miles

Figure 1.1-1:
Turners Falls Hydroelectric Project and
Northfield Mountain Pumped Storage Project
Project Boundary




FIRSTLIGHT MA HYDRO LLC
Turners Falls Hydroelectric Project No. 1889

Invasive Plant Species Management Plan

Figure 1.1-2:
Turners Falls Hydroelectric Project
Key Features

Legend

 Project Boundary



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2 EXISTING INFORMATION

As part of the Federal Energy Regulatory Commission (FERC) licensing of the Project, studies were conducted to document the locations of rare, threatened and endangered plants as well as invasive plant species. The two key studies were:

- Study No. 3.4.1. Baseline Study of Terrestrial Wildlife and Botanical Resources at the Turners Falls Impoundment, in the Bypass Reach and below Cabot Station within the Project Boundary.
- Study No. 3.5.1. Baseline Inventory of Wetland, Riparian, and Littoral Habitat in Turners Falls Impoundment, and Assessment of Operational Impacts on Special-Status Species.

The study findings regarding invasive plants are summarized below.

2.1 Invasive Aquatic Plant Species

Methods

During the summer of 2014¹ biologists conducted aquatic plant surveys in the study area including a) the TFI, b) the bypass reach and c) below Cabot Station to the Route 116 Bridge in Sunderland, MA. Aquatic invasive plants were located by use of a boat and on foot, with identification added by the use of look-down buckets. To document an infested area, biologists used a sub-meter GPS to delineate the boundary of the infestation as defined by the dominant canopy cover of the invasive plant. Areas containing only occasional invasive species were characterized with a GPS center point and radius necessary to enclose the population. For areas where invasive plant species were ubiquitous or impractical to map, biologists characterized the invasive species population using estimates of aerial coverage and percent of species present within a delineated polygon. Areas of documented invasive water chestnut beds² in the TFI in the vicinity of Barton Cove were also surveyed.

Findings

The Massachusetts Invasive Plant Advisory Group (MIPAG) maintains a list of invasive plant species occurring in Massachusetts.³ Invasive plants as defined by the MIPAG are, “*non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems.*” Of the 72 plant species listed by MIPAG as “Invasive”, “Likely Invasive” or “Potentially Invasive”, nine (9) invasive species were identified as having the potential to occur in the aquatic habitats associated with the study area.

Several invasive aquatic plant species were found within the study area including variable leaf milfoil, Eurasian milfoil, curly-leaf pondweed, fanwort, and water chestnut. In total, 41 of the mapped 107 SAV beds had some level of infestation by invasive species, which accounted for 38% of the SAV beds. The majority of the invasive aquatic plants occur immediately upstream of the Turners Falls Dam with fewer occurrences upstream of the French King Bridge. In general, invasive species upstream of the French King

¹The Study No. 3.5.1 report was filed with FERC on 3/2/2016.

² Note that in the Massachusetts Integrated List of Waters for the Clean Water Act (2022 Reporting Cycle), Water Chestnut is on the 303(d) list as an impairment in a portion of the TFI.

³ The MIPAG is a voluntary collaborative representing organizations and professionals concerned with the conservation of the Massachusetts landscape. MIPAG was charged by the Massachusetts Executive Office of Environmental Affairs to provide recommendations to the Commonwealth regarding which plants are invasive and what steps should be taken to manage these species. [MIPAG - Massachusetts Invasive Plant Advisory Group \(massnrc.org\)](http://massnrc.org)

Bridge are not as widespread and occur at lower densities. No invasive aquatic plants were identified in mapped SAV beds below the bypass reach.

In the TFI, beds of SAV vegetation, outside of areas near Barton Cove, occur as narrow bands parallel to the shoreline. In some cases, shallow shoals within the TFI, often associated within islands, support large beds of SAV. Native species include wild celery, various pondweeds, muskgrasses, and coontail. [Table 2.1-1](#) lists native and invasive aquatic plants in the TFI.

2.2 Invasive Terrestrial Plant Species

Methods

In 2014 and 2015⁴, biologists conducted plant surveys in the study area defined as including a) uplands adjacent to the TFI, bypass reach, and Connecticut River from Cabot Station to the Route 116 Bridge in Sunderland, MA and b) upland areas in the Turners Falls and Northfield Mountain Project Boundaries.

To document an infested area, biologists used a GPS survey data collector with sub-foot accuracy to delineate the boundary of the infestation as defined by the dominant cover of the invasive plant. Biologists also used field notes, photographs, and field mark-ups of aerial maps to document observations. Areas containing only occasional invasive species were recorded with a GPS center point and radius necessary to enclose the population. For areas where invasive species were ubiquitous or impractical to map, biologists characterized invasive species populations using estimates of areal coverage and percent cover of species present. Along the shoreline, biologists estimated areal coverage using cover classes of 50%.

Findings

Similar to the aquatic plant study, biologists reviewed the MIPAG for a list of invasive terrestrial plant species occurring in Massachusetts.

Biologists identified 21 upland invasive plants in the study area as shown in [Table 2.2-1](#). Because invasive species were widely distributed along the shoreline, the relative abundance and distribution of invasive plants in the study area were mapped using estimated cover classes of 50%. The following five invasive plant species were found to be common within the study area during the 2014 and 2015 field reconnaissance surveys:

- Oriental Bittersweet - found throughout the study area, particularly along the edge of the river where there is abundant sunlight. Highest concentrations were noted in the TFI north of Pauchaug Brook where the TFI transitions to a more dynamic riverine environment. In the upper reaches of the TFI, Oriental bittersweet can be found covering at least 50% of the trees and shrubs along the shoreline.
- Japanese Knotweed - typically confined to discrete patches along the immediate shoreline and, in some instances, in small stands along the edge habitat of previously disturbed areas.
- Multiflora Rose - scattered throughout the study area, particularly along edges of field habitat and along shoreline/transition areas abutting agricultural lands.
- Japanese Barberry - throughout the study area, a common forest understory shrub that forms monoculture thickets. Particularly found in low lying lands and on upland islands within the river.
- Black Swallowwort – found throughout study area, particularly on the banks of the river and the TFI.

Invasive species occurring within the study area are present in areas that have been cleared in the past and are subsequently labeled as disturbed habitat. The forested habitat in the study area along the river has varying amounts of invasive species abundance and distribution. Invasive species cover is between 26-50%

⁴ The Study No. 3.4.1 report was filed with FERC on March 2, 2016.

of the vegetative cover along the shoreline in the TFI from the Route 10 Bridge upstream to Stebbins Island (just below Vernon Dam).

Table 2.1-1: Native and Invasive Aquatic Plant Species within the Turners Falls Impoundment

Scientific Name	Common Name
<i>Cabomba caroliniana</i> *	Fanwort
<i>Ceratophyllum demersum</i>	Coontail
<i>Chara spp.</i>	Muskgrass
<i>Elodea nuttallii</i>	Waterweed
<i>Myriophyllum spicatum</i> *	Eurasian milfoil
<i>Myriophyllum heterophyllum</i> *	Variable leaf milfoil
<i>Myriophyllum spp.</i>	Milfoil
<i>Potamogeton amplifolius</i>	Large-leaf pondweed
<i>Potamogeton perfoliatus</i>	Clasping leaf pondweed
<i>Potamogeton spp.</i>	Pondweed
<i>Potamogeton crispus</i> *	Curly-leaved pondweed
<i>Trapa natans</i> *	Water chestnut
<i>Vallisneria americana</i>	Wild celery (Eelgrass)

*Invasive Species

Table 2.2-1: Upland Invasive Plant List in Study Area

Scientific Name	Common Name	Lifeform Type	Notes	MIPAG Status
<i>Acer platanoides</i>	Norway maple	Tree	Common in woodlands with colluvial soils, grows full sun to full shade dispersed by water, wind and vehicles	MIPAG listed non-native invasive
<i>Alliaria petiolata</i>	Garlic mustard	Biennial Herb	Widespread, grows full sun to full shade, spreads by seed, especially in wooded areas	MIPAG listed non-native invasive
<i>Berberis thunbergii</i>	Japanese barberry	Shrub	Wooded uplands and wetlands, grows in full sun to full shade, spread by birds, forms dense stands	MIPAG listed non-native invasive
<i>Celastrus orbiculatus</i>	Oriental bittersweet	Perennial vine	Grows in full sun to partial shade, berries spread by birds and humans	MIPAG listed non-native invasive
<i>Centaurea maculosa</i>	Spotted knapweed	Perennial herb	Occurs in full sun, spreads rapidly in artificial corridors, agricultural fields, and margins.	Early Detection Species - recorded as potentially invasive in MA by USDA Forest Service
<i>Cynanchum louiseae</i>	Black swallow-wort	Perennial vine	Grows in full sun to partial shade, forms dense stands, deadly to Monarch butterfly larvae	MIPAG listed non-native invasive
<i>Elaeagnus umbellata</i>	Autumn olive	Shrub	Grows in full sun, berries spread by birds, aggressive in open areas	MIPAG listed non-native invasive
<i>Euonymus alatus</i>	Burning bush	Shrub	Capable of germinating in full sun to full shade. Escapes from cultivation and can form dense thickets and dominate the understory	MIPAG listed non-native invasive
<i>Euphorbia esula</i>	Leafy spurge	Perennial herb	Occurs in grasslands	MIPAG listed non-native invasive
<i>Fallopia japonica</i>	Japanese knotweed	Perennial Herb-subshrub	Widespread, grows in full sun to full shade, spreads vegetatively and by seed, forms dense thickets	MIPAG listed non-native invasive
<i>Lonicera japonica</i>	Japanese honeysuckle	Perennial vine	Widespread, grows full sun to full shade, climbs vegetation, seeds dispersed by birds	MIPAG listed non-native invasive
<i>Lonicera morrowii</i>	Morrow's honeysuckle	Shrub	Widespread, grows full sun to full shade, dispersed by birds, can hybridize with other honeysuckle species	MIPAG listed non-native invasive
<i>Lysimachia nummularia</i>	Creeping jenny	Perennial herb	Occurs in uplands and wetlands, grows in full sun to full shade, forms dense mats	MIPAG listed non-native invasive

Scientific Name	Common Name	Lifeform Type	Notes	MIPAG Status
<i>Lythrum salicaria</i>	Purple loosestrife	Perennial herb	Occurs in uplands and wetlands, grows in full sun to partial shade, high seed production, overtakes wetlands	MIPAG listed non-native invasive
<i>Phalaris arundinacea</i>	Reed canary grass	Perennial grass	Occurs in uplands and wetlands, grows full sun to partial shade, can form large colonies, common in agricultural settings	MIPAG listed non-native invasive
<i>Phragmites australis</i>	Common reed	Perennial grass	Grows in uplands and wetlands, full sun to full shade, forms dense stands, flourishes in disturbed areas	MIPAG listed non-native invasive
<i>Polygonum perfoliatum</i>	Mile-a-minute	Perennial vine	Occurs in streamside, fields, and road edges in full sun to partial shade; highly aggressive.	MIPAG listed non-native invasive
<i>Ranunculus ficaria</i>	Lesser celandine	Perennial herb	Occurs in lowland and upland woods, grows in full sun to full shade, spreads vegetatively and by seed, forms dense stands	MIPAG listed non-native invasive
<i>Rhamnus cathartica</i>	Common buckthorn	Shrub-tree	Occurs in uplands and wetlands, grows in full sun to full shade.	MIPAG listed non-native invasive
<i>Robinia pseudoacacia</i>	Black locust	Tree	Occurs in uplands, grows full sun to full shade, aggressive in areas with sandy soils	MIPAG listed non-native invasive
<i>Rosa multiflora</i>	Multiflora rose	Shrub	Widespread, grows in full sun to full shade, forms thorny thickets, dispersed by birds.	MIPAG listed non-native invasive

3 PROPOSED MONITORING MEASURES FOR INVASIVE AQUATIC PLANTS

3.1 Baseline Invasive Aquatic Plant Survey (TFI and Bypass Reach)

The first full summer following license issuance, the Licensee will conduct an invasive aquatic plant survey of the TFI from the Turners Falls Dam to the base of Vernon Dam, and of the bypass reach from the Turners Falls Dam to Cabot Station, totaling approximately 22.5 miles.⁵ The invasive aquatic plant species covered during the survey will include those listed in [Table 2.1-1](#) and any newly identified invasive aquatic plants detected during the survey or included on the list maintained by MIPAG.

The survey of the TFI will be conducted by boat in the late summer (August/September) to facilitate identification of any invasive aquatic plants by means of floristic attributes. The survey methodology will include semi-quantitatively documenting the invasive aquatic plants found in the TFI to location, size, and percent cover by cover class range (i.e., 2-25%; 25-50%; 50-75%; and 75-100%). Estimates of stand width will be made in three-meter intervals (1-3, 3-6, 6-9, and >10 m). Estimates of length will be made to the nearest meter. Each observation of invasive aquatic plants will be assigned a cover descriptor category as follows:

- SC- Small Colony= typically applied to non-woody plants (colonies of herbaceous plants that have been enlarged to the point where they are beginning to coalesce).
- GS- Growing Singly= applied to both woody and herbaceous plants with single stems that appear to be evenly dispersed.
- SP- Small Patch= typically applied to small, isolated clones of herbaceous plants or small patches of shrubs.
- LAP- Large Almost Pure Stand= typically applied to non-woody plants growing in a large monotypic stand covering a large area (cattail).
- SDC- Small Dense Clump= typically applied to wood or herbaceous plants where several aerial stems originate from the roots of a single plant.

The location of the invasive aquatic plants will be recorded using a GPS for later upload onto a GIS map to define baseline conditions. For the survey, a table like that shown below will be developed.

Site ID	Species	Cover	Cover (%)	Width (m)	Length (ft)
Location	Invasive Plant Name	SC, GS, SP, LAP or SDC			

A baseline map of the TFI will be developed showing the Site ID number, the invasive plant species found (color coded in a legend), and the percent cover (which will be represented by 4 distinct size circles including 2-25%, 25-50%, 50-75% and 75-100%).

The survey of the bypass reach will be conducted by canoe and/or foot and will follow the same methodology as described above.

By February 1 of the year after completing the baseline survey, the Licensee will provide a report to the USFWS and NHESP for review and comment (including providing the geospatial data in kml/kmz format). The Licensee will meet with the USFWS and NHESP to discuss study results and will request written comments. The Licensee will update the report (if necessary) and file it with FERC, along with the consultation record, no later than May 1. Potential measures to treat invasive aquatic plant species are discussed in [Section 3.4](#).

⁵ The TFI is approximately 20 miles long and the bypass reach is approximately 2.5 miles long.

3.2 Annual Invasive Aquatic Plant Survey (TFI from Turners Falls Dam to French King Gorge Bridge)

As noted earlier, the majority of the invasive aquatic plants occur immediately upstream of the Turners Falls Dam with fewer occurrences upstream of the French King Bridge. Invasive aquatic plants upstream of the French King Bridge are not as widespread and occur at lower densities. Also, the bypass reach has limited invasive aquatic plants. Given this, on an annual basis after the baseline survey, the Licensee will repeat the same study methods as outlined above in the TFI from the Turners Falls Dam to the French King Bridge.

The same process as outlined above will be followed relative to a) preparing a report by February 1, b) meeting with USFWS and NHESP to discuss the report, c) obtaining USFWS and NHESP written comments on the report and d) filing the report and consultation record with FERC no later than May 1.

3.3 5-Year Invasive Aquatic Plant Survey (TFI and Bypass Reach)

The Licensee proposes to repeat the same study methods as outlined above in the entire TFI and bypass reach every 5 years. The same process as outlined above will be followed relative to a) preparing a report by February 1, b) meeting with USFWS and NHESP to discuss the report, c) obtaining USFWS and NHESP written comments on the report and d) filing the report and consultation record with FERC no later than May 1.

3.4 Invasive Aquatic Plants Control Measures

After reviewing the annual reports, if the USFWS and NHESP demonstrate that aquatic invasive plant species are significantly affecting fish and wildlife populations in the TFI or bypass reach and that control measures are needed, the Licensee will consult with USFWS and NHESP to undertake reasonable measures, as determined by FERC and the Massachusetts Department of Environmental Protection, to control aquatic invasive plant species in the TFI and bypass reach, commensurate with the Licensee's level of responsibility.

4 MEASURES TO PREVENT THE SPREAD OF INVASIVE PLANTS

4.1 Activities Associated with Daily Operations and Routine Maintenance

The Licensee will implement the following measures to help prevent the establishment, and/or spreading, of terrestrial and aquatic invasive plant species.

1. The Licensee will continue to maintain Project grounds to help prevent the introduction and spread of invasive plant species within the Project boundary, as described below.
2. The Licensee will not actively plant any terrestrial plants listed under the noxious weeds in the United States Department of Agriculture (USDA) Natural Resources Conservation Service Plants Database, which incorporates plants listed by the MIPAG.
3. The Licensee will monitor areas of disturbance caused by routine operation or maintenance activities within the Project Boundary to ensure that invasive plant species do not out-compete desirable vegetation during the reestablishment phase.
4. The Licensee will instruct its work personnel to visually inspect all of Licensee's exposed boating equipment for attached invasive plant species.
5. The Licensee will clean and dry its boats and trailers that come in contact with the water following removal from the water. The Licensee will remove any visible plants or animals before entering the water or leaving the site. Plants and animals are to be discarded in an upland area.
6. At Project recreation areas and state boat launches, the Licensee will post signage explaining the threats of nonnative aquatic species and steps to prevent the spread will be posted.

4.2 Activities Associated with Construction or Major Maintenance

Prior to major construction or major maintenance activities, the Licensee will consult with the Massachusetts Department of Fish and Wildlife (MDFW) regarding the best management practices (BMP) to be employed to help prevent the introduction and/or spread of invasive plant species within the area associated with the activity to be performed. In addition to activity specific BMPs that may be developed through consultation, the Licensee will employ the following BMPs during construction and major maintenance activities.

1. Clean, drain and dry boats and trailers encountering the water following removal from the water.
2. Remove visible plants or animals before entering the water or leaving the site. Plants and animals are to be discarded in an upland area.

4.2.1 During Construction

1. Workers will be trained to identify invasive plants and informed of the importance of infestation prevention.
2. Obvious vegetative material will be removed from construction equipment before allowing the equipment to enter an invasive-free area.
3. Invasive plants that could potentially be spread by construction equipment or workers will be removed. Along access roads, invasive plants will be identified and controlled to avoid introducing them into invasive-free areas.
4. Where practical, gravel and fill will come from invasive-free sources to avoid introducing invasive vegetation to the construction site.

5. Where practical, certified invasive-free straw, mulch, fiber rolls, and sediment logs will be used for erosion and sediment control.

4.2.2 During Seeding and Planting

1. Where practical, soil amendments (if any) and mulches will be obtained from invasive-free sources.
2. The Licensee will make a reasonable effort to use only native seed mixes for reseeding disturbed areas.
3. Seeding, planting operations and maintenance will be conducted to promote vigorous growth of desirable vegetation and discourage invasive species.
4. Bare ground will be seeded following disturbance.
5. Seeded sites will be monitored for infestation by invasive plant species.
6. Identified invasive plant species at monitored sites will be treated in the first full growing season.
7. Where practical, mulch will be used to limit the number of unwanted seed sources reaching bare soil.
8. The Licensee will ensure that all construction contractors are aware of, and comply with, the terms listed above.

4.2.3 Post Construction

1. The Licensee will monitor any areas of disturbance caused by construction activities on lands owned by the Licensee within the Project boundary as needed to ensure that invasive species have not out-competed desirable vegetation during the re-establishment.

Appendix C. Northfield Mountain Pumped Storage Project Invasive Aquatic Species Management Plan

**Northfield Mountain Pumped Storage
Project
(FERC Project Number 2485)**

Invasive Plant Species Management Plan



MARCH 2024

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LIST OF ACRONYMS

BMP	best management practices
FERC	Federal Energy Regulatory Commission
FirstLight or Licensee	Northfield Mountain LLC
MA	Massachusetts
MDFW	Massachusetts Department of Fish and Wildlife
MIPAG	Massachusetts Invasive Plant Advisory Group
Northfield Project	Northfield Mountain Pumped Storage Project (FERC No. 2485)
Plan	Invasive Plant Species Management Plan
TFI	Turners Falls Impoundment
USDA	United States Department of Agriculture

1 BACKGROUND

1.1 Project Ownership and Layout

Northfield Mountain LLC (FirstLight or the Licensee) is the owner and operator of the Northfield Mountain Pumped Storage Project (Northfield Project, FERC No. 2485). The Northfield Project is a pumped-storage facility located on the Connecticut River in Massachusetts (MA) that uses the Turners Falls Impoundment (TFI) as its lower reservoir. The Northfield Project Boundary ([Figure 1.1-1](#)) overlaps with Turners Falls Hydroelectric Project (FERC No. 1889) Boundary along nearly the entire perimeter of the TFI, but it does not include the Turners Falls Dam. The TFI is a shared project feature with the Turners Falls Hydroelectric Project. The Northfield Project tailrace is located approximately 5.2 miles upstream of Turners Falls Dam, on the east side of the TFI. The Northfield Project's Upper Reservoir is a man-made structure situated atop Northfield Mountain, to the east of the Connecticut River. During pumping operations, water is pumped from the TFI to the Upper Reservoir. When the Northfield Project is generating, water is passed from the Upper Reservoir through an underground pressure shaft to a powerhouse cavern and then a tailrace tunnel delivers the water back to the TFI.

Key features of the Northfield Project are shown on [Figure 1.1-2](#) and include a main dam, intake channel, pressure shaft and tailrace tunnel.

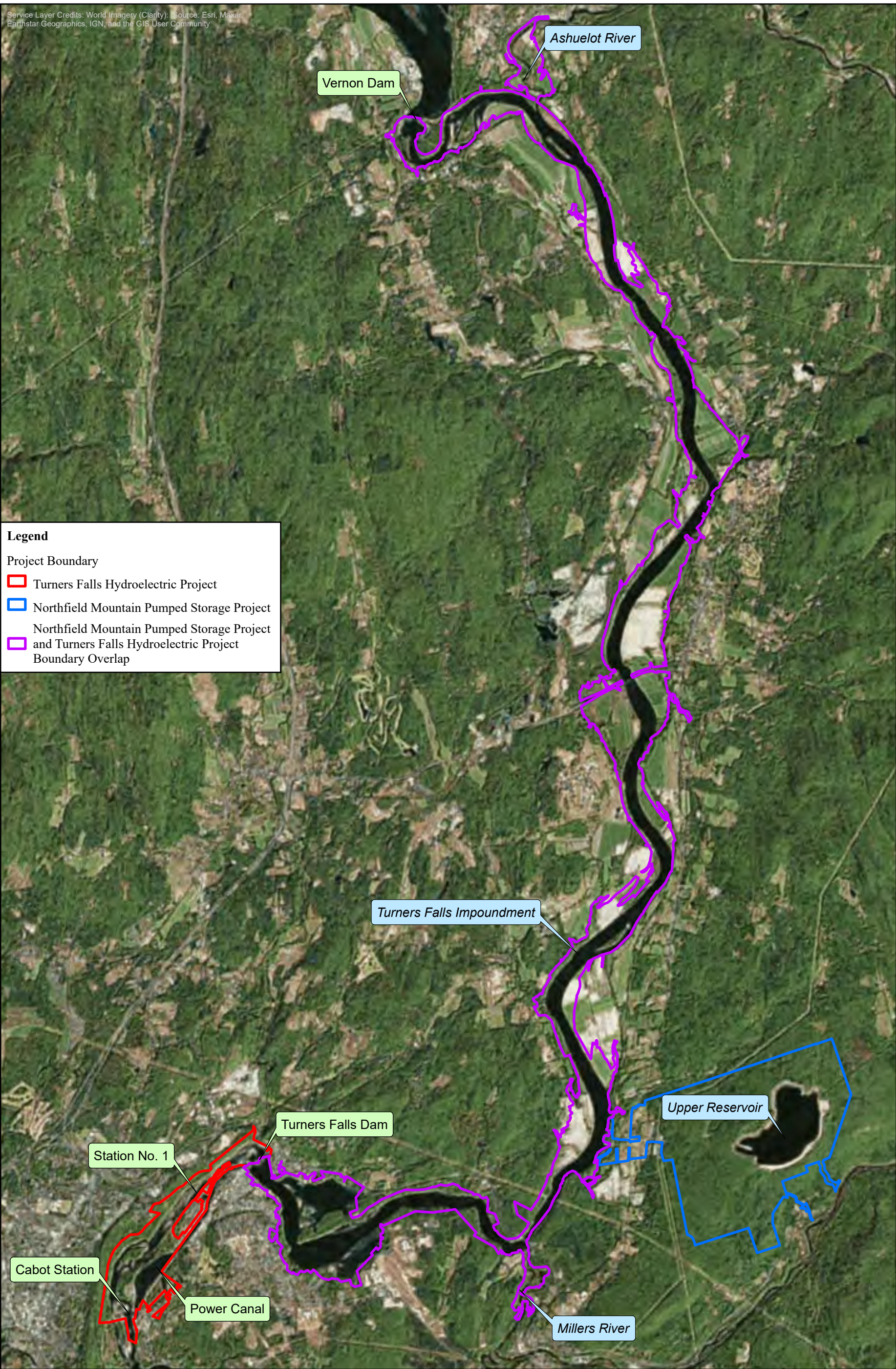
1.2 Purpose of Plan

The purpose of this Invasive Plant Species Management Plan (Plan) is to help prevent the introduction and/or spread of terrestrial plants by implementing best management practices (BMP) and through supporting the education of individuals performing construction, maintenance, and/or operational activities within the Project boundary. While the Northfield Project and the Turners Falls Hydroelectric Project share a common Project Boundary, the TFI, for purposes of this Plan, the geographic area is limited to the Northfield Project Boundary absent the TFI (as shown in blue in [Figure 1.1-1](#)). Issues pertaining to invasive aquatic plants in the TFI are addressed in the Turners Falls Hydroelectric Project Invasive Species Management Plan.

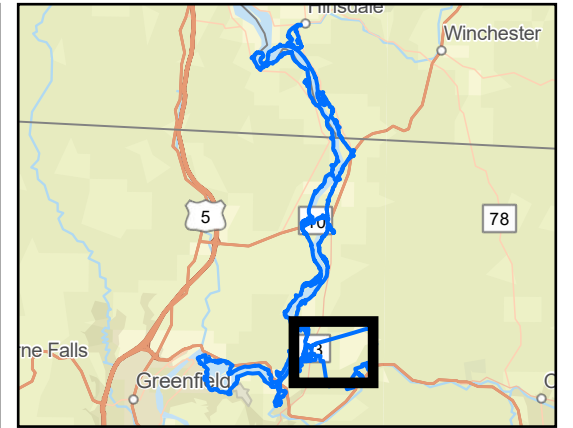
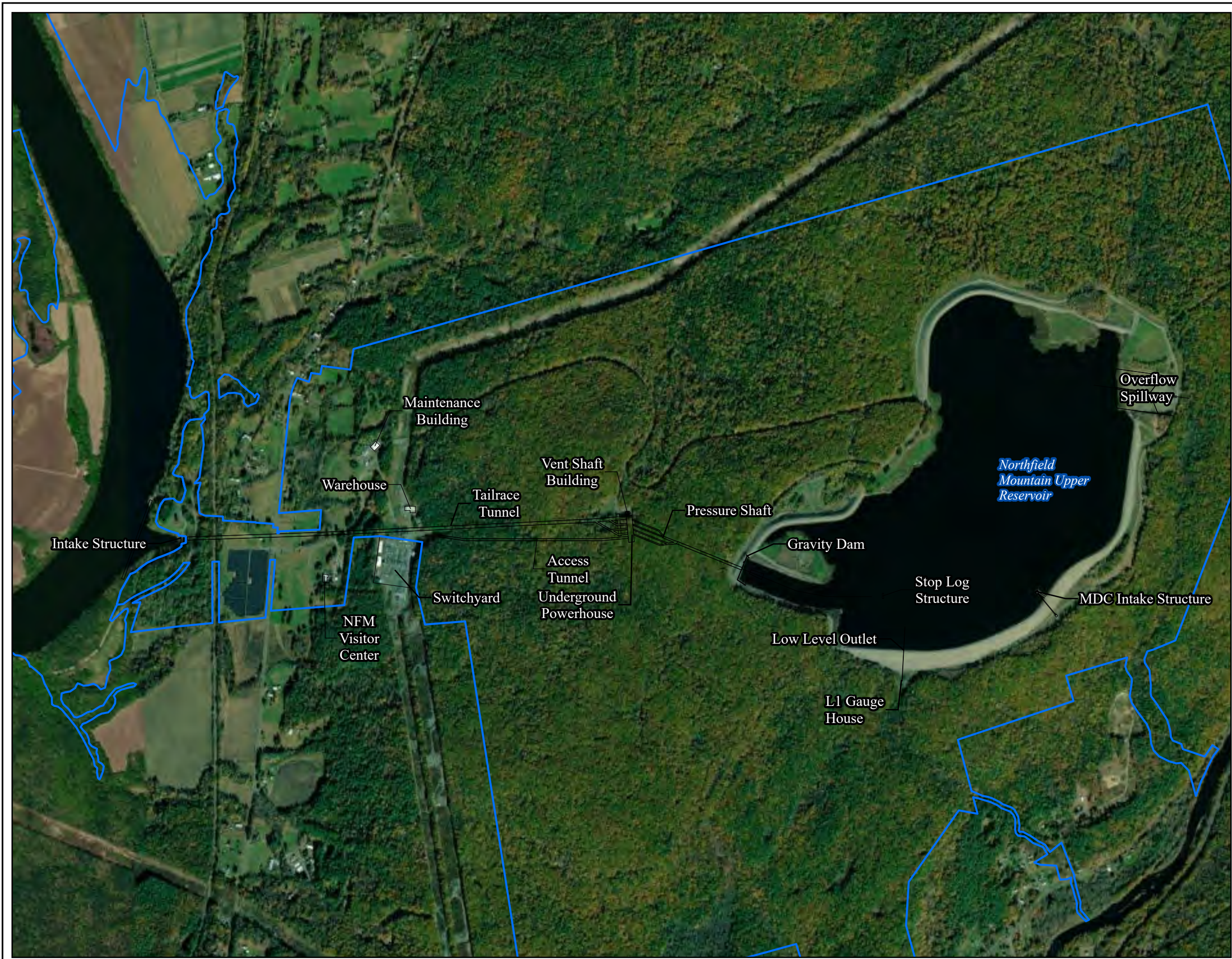
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Project Boundary

- Turners Falls Hydroelectric Project
- Northfield Mountain Pumped Storage Project
- Northfield Mountain Pumped Storage Project and Turners Falls Hydroelectric Project Boundary Overlap



**Figure 1.1-1:
Turners Falls Hydroelectric Project and
Northfield Mountain Pumped Storage Project
Project Boundary**




NORTHFIELD MOUNTAIN LLC
Northfield Mountain Pumped Storage Project No. 2485

Invasive Plant Species Management Plan

Figure 1.1-2:
Northfield Mountain Pumped Storage
Project Features

Legend

 Project Boundary



Service Layer Credits: World Street Map: Esri, HERE, Garmin, NGA, USGS, NPS
World Street Map: Esri, TomTom, Garmin, SafeGraph, FAO, METI/ NASA, USGS, EPA, NPS, USFWS
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2 EXISTING INFORMATION

As part of the Federal Energy Regulatory Commission (FERC) licensing of the Project, studies were conducted to document the locations of rare, threatened and endangered plants as well as invasive plant species. The two key studies were:

- Study No. 3.4.1. Baseline Study of Terrestrial Wildlife and Botanical Resources at the Turners Falls Impoundment, in the Bypass Reach and below Cabot Station within the Project Boundary.
- Study No. 3.5.1. Baseline Inventory of Wetland, Riparian, and Littoral Habitat in Turners Falls Impoundment, and Assessment of Operational Impacts on Special-Status Species.

The study findings regarding terrestrial invasive plants are summarized below.

2.1 Invasive Terrestrial Plant Species

Methods

In 2014 and 2015¹, biologists conducted plant surveys in the study area defined as including a) uplands adjacent to the TFI, bypass reach, and Connecticut River from Cabot Station to the Route 116 Bridge in Sunderland, MA and b) upland areas in the Turners Falls and Northfield Mountain Project Boundaries.

To document an infested area, biologists used a GPS survey data collector with sub-foot accuracy to delineate the boundary of the infestation as defined by the dominant cover of the invasive plant. Biologists also used field notes, photographs, and field mark-ups of aerial maps to document observations. Areas containing only occasional invasive species were recorded with a GPS center point and radius necessary to enclose the population. For areas where invasive species were ubiquitous or impractical to map, biologists characterized invasive species populations using estimates of areal coverage and percent cover of species present. Along the shoreline, biologists estimated areal coverage using cover classes of 50%.

Findings

The Massachusetts Invasive Plant Advisory Group (MIPAG) maintains a list of invasive plant species occurring in Massachusetts.² Invasive plants as defined by the MIPAG are, “*non-native species that have spread into native or minimally managed plant systems in Massachusetts, causing economic or environmental harm by developing self-sustaining populations and becoming dominant and/or disruptive to those systems.*” Prior to conducting the study, biologists reviewed the MIPAG for a list of invasive plant species occurring in Massachusetts. The findings described below reflect observations in the study area.

Biologists identified 21 upland invasive plants in the study area as shown in [Table 2.1-1](#). Because invasive species were widely distributed along the shoreline, the relative abundance and distribution of invasive plants in the study area were mapped using estimated cover classes of 50%. The following five invasive plant species were found to be common within the study area during the 2014 and 2015 field reconnaissance surveys:

- Oriental Bittersweet - found throughout the study area, particularly ubiquitous along the edge of the river where there is abundant sunlight. Highest concentrations were noted in the TFI north of Pauchaug Brook where the TFI transitions to a more dynamic riverine environment. In the upper

¹ The Study No. 3.4.1 Report was filed with FERC on 3/2/2016.

² The MIPAG is a voluntary collaborative representing organizations and professionals concerned with the conservation of the Massachusetts landscape. MIPAG was charged by the Massachusetts Executive Office of Environmental Affairs to provide recommendations to the Commonwealth regarding which plants are invasive and what steps should be taken to manage these species. [MIPAG - Massachusetts Invasive Plant Advisory Group \(massnrc.org\)](http://massnrc.org)

reaches of the TFI, Oriental bittersweet can be found covering at least 50% of the trees and shrubs along the shoreline.

- Japanese Knotweed - typically confined to discrete patches along the immediate shoreline and, in some instances, in small stands along the edge habitat of previously disturbed areas.
- Multiflora Rose - scattered throughout the study area, particularly along edges of field habitat and along shoreline/transition areas abutting agricultural lands.
- Japanese Barberry - throughout the study area, a common forest understory shrub that forms monoculture thickets. Particularly found in low lying lands and on upland islands within the river.
- Black Swallowwort – found throughout study area, particularly on the banks of the river and the TFI.

Invasive species occurring within the study area are present in areas that have been cleared in the past and are subsequently labeled as disturbed habitat. The forested habitat in the study area along the river has varying amounts of invasive species abundance and distribution.

Table 2.1-1: Upland Invasive Plant List in Study Area

Scientific Name	Common Name	Lifeform Type	Notes	MIPAG Status
<i>Acer platanoides</i>	Norway maple	Tree	Common in woodlands with colluvial soils, grows full sun to full shade dispersed by water, wind and vehicles	MIPAG listed non-native invasive
<i>Alliaria petiolata</i>	Garlic mustard	Biennial Herb	Widespread, grows full sun to full shade, spreads by seed, especially in wooded areas	MIPAG listed non-native invasive
<i>Berberis thunbergii</i>	Japanese barberry	Shrub	Wooded uplands and wetlands, grows in full sun to full shade, spread by birds, forms dense stands	MIPAG listed non-native invasive
<i>Celastrus orbiculatus</i>	Oriental bittersweet	Perennial vine	Grows in full sun to partial shade, berries spread by birds and humans	MIPAG listed non-native invasive
<i>Centaurea maculosa</i>	Spotted knapweed	Perennial herb	Occurs in full sun, spreads rapidly in artificial corridors, agricultural fields, and margins.	Early Detection Species - recorded as potentially invasive in MA by USDA Forest Service
<i>Cynanchum louiseae</i>	Black swallow-wort	Perennial vine	Grows in full sun to partial shade, forms dense stands, deadly to Monarch butterfly larvae	MIPAG listed non-native invasive
<i>Elaeagnus umbellata</i>	Autumn olive	Shrub	Grows in full sun, berries spread by birds, aggressive in open areas	MIPAG listed non-native invasive
<i>Euonymus alatus</i>	Burning bush	Shrub	Capable of germinating in full sun to full shade. Escapes from cultivation and can form dense thickets and dominate the understory	MIPAG listed non-native invasive
<i>Euphorbia esula</i>	Leafy spurge	Perennial herb	Occurs in grasslands	MIPAG listed non-native invasive
<i>Fallopia japonica</i>	Japanese knotweed	Perennial Herb-subshrub	Widespread, grows in full sun to full shade, spreads vegetatively and by seed, forms dense thickets	MIPAG listed non-native invasive
<i>Lonicera japonica</i>	Japanese honeysuckle	Perennial vine	Widespread, grows full sun to full shade, climbs vegetation, seeds dispersed by birds	MIPAG listed non-native invasive
<i>Lonicera morrowii</i>	Morrow's honeysuckle	Shrub	Widespread, grows full sun to full shade, dispersed by birds, can hybridize with other honeysuckle species	MIPAG listed non-native invasive
<i>Lysimachia nummularia</i>	Creeping jenny	Perennial herb	Occurs in uplands and wetlands, grows in full sun to full shade, forms dense mats	MIPAG listed non-native invasive

Scientific Name	Common Name	Lifeform Type	Notes	MIPAG Status
<i>Lythrum salicaria</i>	Purple loosestrife	Perennial herb	Occurs in uplands and wetlands, grows in full sun to partial shade, high seed production, overtakes wetlands	MIPAG listed non-native invasive
<i>Phalaris arundinacea</i>	Reed canary grass	Perennial grass	Occurs in uplands and wetlands, grows full sun to partial shade, can form large colonies, common in agricultural settings	MIPAG listed non-native invasive
<i>Phragmites australis</i>	Common reed	Perennial grass	Grows in uplands and wetlands, full sun to full shade, forms dense stands, flourishes in disturbed areas	MIPAG listed non-native invasive
<i>Polygonum perfoliatum</i>	Mile-a-minute	Perennial vine	Occurs in streamside, fields, and road edges in full sun to partial shade; highly aggressive.	MIPAG listed non-native invasive
<i>Ranunculus ficaria</i>	Lesser celandine	Perennial herb	Occurs in lowland and upland woods, grows in full sun to full shade, spreads vegetatively and by seed, forms dense stands	MIPAG listed non-native invasive
<i>Rhamnus cathartica</i>	Common buckthorn	Shrub-tree	Occurs in uplands and wetlands, grows in full sun to full shade.	MIPAG listed non-native invasive
<i>Robinia pseudoacacia</i>	Black locust	Tree	Occurs in uplands, grows full sun to full shade, aggressive in areas with sandy soils	MIPAG listed non-native invasive
<i>Rosa multiflora</i>	Multiflora rose	Shrub	Widespread, grows in full sun to full shade, forms thorny thickets, dispersed by birds.	MIPAG listed non-native invasive

3 MEASURES TO PREVENT THE SPREAD OF INVASIVE PLANTS

3.1 Activities Associated with Daily Operations and Routine Maintenance

The Licensee will implement the following measures to assist in preventing the establishment, and/or spreading, of terrestrial and aquatic invasive plant species.

1. The Licensee will continue to maintain Project grounds to help prevent the introduction and spread of invasive plant species within the Project boundary, as described below.
2. The Licensee will not actively plant any terrestrial plants listed under the noxious weeds in the United States Department of Agriculture (USDA) Natural Resources Conservation Service Plants Database, which incorporates plants listed by the MIPAG.
3. The Licensee will monitor areas of disturbance caused by routine operation or maintenance activities within the Project Boundary to ensure that invasive plant species do not out-compete desirable vegetation during the reestablishment phase.
4. The Licensee will instruct its work personnel to visually inspect all of Licensee's exposed boating equipment for attached invasive plant species.
5. The Licensee will clean and dry its boats and trailers that come in contact with the water following removal from the water. The Licensee will remove any visible plants or animals before entering the water or leaving the site. Plants and animals are to be discarded in an upland area.
6. At Project recreation areas and state boat launches, the Licensee will post signage explaining the threats of nonnative aquatic species and steps to prevent the spread will be posted.

3.2 Activities Associated with Construction or Major Maintenance

Prior to major construction or major maintenance activities, the Licensee will consult with the Massachusetts Department of Fish and Wildlife (MDFW) regarding the best management practices (BMP) to be employed to help prevent the introduction and/or spread of invasive plant species within the area associated with the activity to be performed. In addition to activity specific BMPs that may be developed through consultation, the Licensee will employ the following BMPs during construction and major maintenance activities.

3.2.1 During Construction

1. Workers will be trained to identify invasive plants and informed of the importance of infestation prevention.
2. Obvious vegetative material will be removed from construction equipment before allowing the equipment to enter an invasive-free area.
3. Invasive plants that could potentially be spread by construction equipment or workers will be removed. Along access roads, invasive plants will be identified and controlled to avoid introducing them into invasive-free areas.
4. Where practical, gravel and fill will come from invasive-free sources to avoid introducing invasive vegetation to the construction site.
5. Where practical, certified invasive-free straw, mulch, fiber rolls, and sediment logs will be used for erosion and sediment control.

3.2.2 During Seeding and Planting

1. Where practical, soil amendments (if any) and mulches will be obtained from invasive-free sources.
2. The Licensee will make a reasonable effort to use only native seed mixes for reseeding disturbed areas.
3. Seeding and planting operations and maintenance will be conducted in a manner to promote vigorous growth of desirable vegetation and discourage invasive species.
4. Bare ground will be seeded following disturbance.
5. Seeded sites will be monitored for infestation by invasive plant species.
6. Identified invasive plant species at monitored sites will be treated in the first full growing season.
7. Where practical, mulch will be used to limit the number of unwanted seed sources reaching bare soil.
8. The Licensee will ensure that all construction contractors are aware of, and comply with, the terms listed above.

3.2.3 Post Construction

1. The Licensee will monitor any areas of disturbance caused by construction activities on lands owned by the Licensee within the Project boundary as needed to ensure that invasive species have not out-competed desirable vegetation during the re-establishment.

Appendix D. Upper Reservoir Dewatering Protocols

Relicensing Study 3.1.3

Northfield Mountain Pumped Storage Project Sediment Management Plan

Upper Reservoir Dewatering Protocols **Northfield Mountain Pumped Storage Project (No. 2485)**



JUNE 2017

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APPENDIX A – DREDGING BEST MANAGEMENT PRACTICES

LIST OF ABBREVIATIONS

BMP	Best Management Practice
FERC	Federal Energy Regulatory Commission
Final Report	Northfield Mountain Pumped Storage Project Sediment Management Plan Final Report (October 2016)
FirstLight	FirstLight Power Resources
ft	Foot or feet
GIS	Geographic Information System
GPS	Global Positioning System
MA	Massachusetts
MADEP	Massachusetts Department of Environmental Protection
MW	megawatt
NTU	Nephelometric Turbidity Unit
PE	Professional Engineer
PG	Professional Geologist
QAPP	Quality Assurance Project Plan
SCADA	Supervisory Control and Data Acquisition
SSC	Suspended Sediment Concentration
TFI	Turners Falls Impoundment
the Plan	Northfield Mountain Pumped Storage Project Sediment Management Plan
the Project	Northfield Mountain Pumped Storage Project

1 INTRODUCTION

The Northfield Mountain Pumped Storage Project (the Project) is a 1,168-MW pumped storage hydroelectric project, completed in 1972 along the Connecticut River near Northfield, MA. The Project is owned by FirstLight Power Resources (FirstLight) and consists of an Upper Reservoir, underground powerhouse, four reversible pump-turbine generators, an underground pressure shaft, four penstocks and draft tubes, and a mile-long tailrace tunnel connecting the powerhouse to the Connecticut River. An approximately 20-mile segment of the Connecticut River, technically referred to as the Turners Falls Impoundment (TFI), serves as the Project's Lower Reservoir. The manmade Upper Reservoir is approximately 286 acres in area at elevation 1000.5 feet and contains an approximately 1,800 ft. long by 130 ft. wide intake channel. The Upper Reservoir was formed with four earth-core rockfill embankment structures and a concrete gravity dam.

Since 2010, FirstLight has completed several field data collection, data analysis, and modeling efforts to better understand sediment dynamics in the Connecticut River and at the Project, including both the Upper Reservoir and tailrace areas. The work was completed both as part of the Federal Energy Regulatory Commission (FERC) relicensing process (as Study No. 3.1.3) and in response to an Administrative Order issued by the United States Environmental Protection Agency (USEPA) dated August 4, 2010. The work was described as part of the July 15, 2011 *Northfield Mountain Pumped Storage Project Sediment Management Plan* (the Plan)¹, which was developed in consultation with the USEPA and the Massachusetts Department of Environmental Protection (MADEP).

Efforts associated with Study No. 3.1.3 were described in detail in the *Northfield Mountain Pumped Storage Project Sediment Management Plan Final Report* (Final Report), dated October 2016. The Final Report is integral to this document. As described in the Final Report, during normal Project operations (i.e., generation) material sediment releases to the Connecticut River are highly unlikely due to a combination of factors including the physical characteristics of the sediment, the velocity of the water during generation, the configuration of the Upper Reservoir intake structure, and the water level of the Upper Reservoir. Based on this, and other findings, FirstLight proposed adaptive, multi-step sediment management measures in the Final Report, which focused on minimizing the entrainment of sediment into the Project works and Connecticut River during drawdowns or dewatering activities. FirstLight did not propose other operational changes or physical modifications.

As proposed in the Final Report and in response to a December 16, 2016 comment letter from the USEPA, FirstLight has prepared the enclosed protocols to be followed in the event of a dewatering to minimize the potential for the release of excess sediment to the Connecticut River. FirstLight has provided these dewatering protocols to MADEP, USEPA, and FERC staff and may update them periodically as needed to reflect changes in site conditions, new technologies, or otherwise.

¹ In addition to the Sediment Management Plan, FirstLight also developed a Quality Assurance Project Plan (QAPP) in June 2012 at the USEPA's request. The QAPP was subsequently revised in October 2012.

2 BACKGROUND

The Connecticut River is an alluvial river meaning silt and sediment is naturally present within the river channel and is entrained in suspension through normal river dynamics. As noted in the previous section, the Project requires the use of a “lower” and “upper” reservoir as a component of the power generation process. The TFI serves as the Lower Reservoir, with the Upper Reservoir being man-made at the top of Northfield Mountain. During Project operations, silt is drawn into the facility when pumping and accumulates in the Upper Reservoir as it settles out of the water column. As Alden’s Upper Reservoir computational hydrodynamic sedimentation modeling demonstrated (conducted for Study No. 3.1.3 and discussed in the Final Report) (Alden, 2014)², once sediment is deposited in the Upper Reservoir the sediment generally lies undisturbed.

The results of Study No. 3.1.3 found that during pumping cycles (i.e., up to 4 units operational in pumping mode), there is no practical way to prevent sediment from being transported to the Upper Reservoir. Conversely, the study also found that during generation (i.e., up to 4 units operational in generation mode), Project operations do not cause the release or transport of accumulated sediment from the Upper Reservoir to the Connecticut River. As a result, over time, sediment will accumulate in the Upper Reservoir intake channel and can require periodic removal to ensure that sediments have not accumulated to the point where there is a risk of material discharges of sediment into the Project works and potentially into the Connecticut River in the course of an unwatering (also known as dewatering). In the past, FirstLight has removed this sediment both “hydraulically” (with the Upper Reservoir in use) and in the “dry” (with the Upper Reservoir empty). FirstLight may periodically need to unwater the Upper Reservoir for maintenance and dam safety purposes. Maintenance drawdowns may be planned or unplanned depending on the circumstances.

During a dewatering there are several key physical Project features which help to prevent the release of excessive concentrations of sediment. The first feature is the “check dam” or “stop log structure”. The check dam is an approximately 100 ft. long by 10 ft. high reinforced concrete structure spanning the entrance to the Upper Reservoir intake channel, separating the 1,750 foot long intake channel from the main storage area of the Upper Reservoir ([Figure 2.1](#)). The purpose of the check dam is to trap sufficient water in the Upper Reservoir to refill the pressure conduit after it has been unwatered and to prevent storm water from draining into the pressure shaft when the Upper Reservoir is unwatered. The check dam also retains sediment that has been accumulated behind the dam so long as sediment accumulation has not exceeded the height of the dam (i.e., 10 feet). As such, so long as the accumulated sediment remains below the height of the check dam, the check dam can reduce the release of excess sediments.

The second key Project feature is the geometry of the 1,750 foot long intake channel. The results of Alden’s Upper Reservoir computational hydrodynamic sedimentation model found that during pumping, water and sediment from the Connecticut River are transported at a high velocity through the conduit system to the intake channel leading to the Upper Reservoir. As the water and sediment combine with the water already in the Upper Reservoir intake channel, the wider and deeper intake channel leads to a deceleration of the sediment rich pumped water, which results in the sediment depositing. During generation (i.e., up to four units), the expanded width and depth of the intake channel, combined with the relatively low exit velocity of the water being transported from the Upper Reservoir to the Connecticut River, result in much of the previously deposited sediment remaining in place and not being re-entrained back into the Project works during normal generation (Alden, 2014 [Page 55]). The results of the computational modeling are consistent with the continuous, empirical data collected at the Project tailrace during pumping and generating cycles, which demonstrated no appreciable increase in sediment concentration during generation.

² Alden Research Laboratory, Inc. (2014). Engineering Studies of Sedimentation at the Northfield Mountain Project. Holden, MA: FirstLight

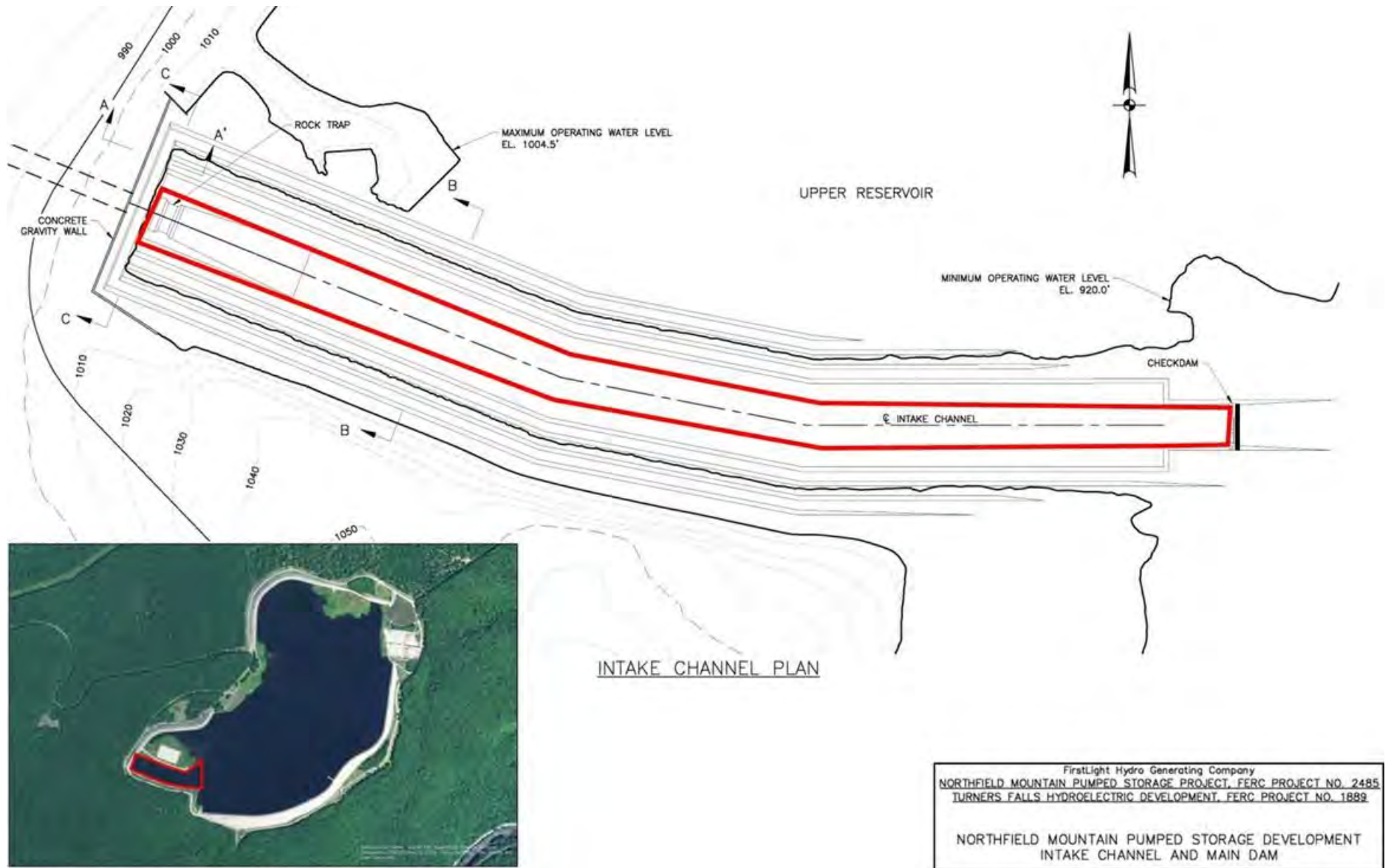
NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT SEDIMENT MANAGEMENT PLAN UPPER
RESERVOIR DEWATERING PROTOCOLS

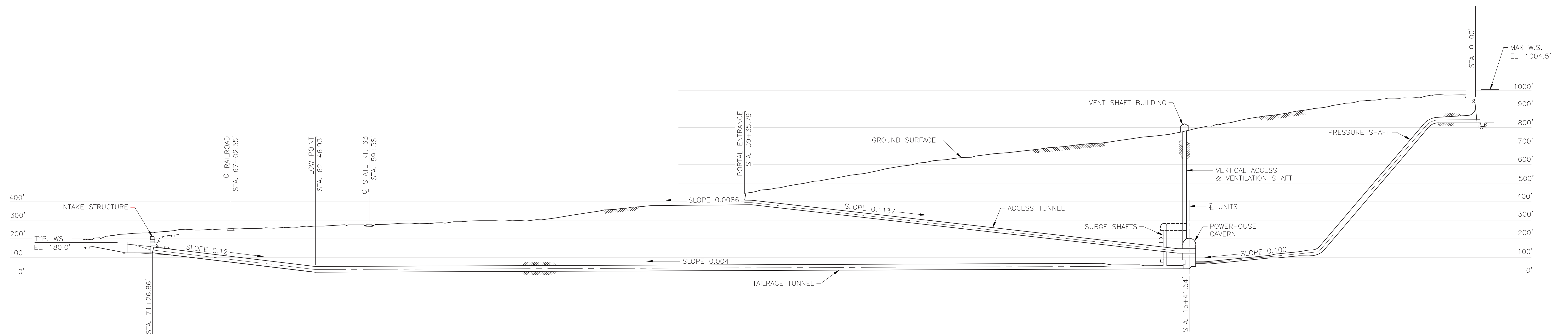
Per FirstLight's dewatering procedures, discussed in subsequent sections, the rate of drawdown during a dewatering, and therefore the exit velocity of the water, is essentially the same as, or less than, that which occurs during normal periods of generation. Given this, based on the results of the modeling conducted by Alden (Alden, 2014 [Page 55]), if accumulated sediment is kept below a reasonable threshold in this area (i.e., below the crest of the check dam and of an appropriate thickness and distribution in the intake channel itself), entrainment of sediment in the Project works and the Connecticut River during a dewatering is unlikely as the corresponding velocity is insufficient to mobilize the previously deposited sediment.

The final key Project feature is the physical configuration of the tailrace tunnel. During a dewatering, water exits the Upper Reservoir through the intake channel, into the pressure conduit, through the turbines and draft tubes, into the tailrace tunnel and out through the tailrace exit structure to the Connecticut River. From the draft tubes, the tailrace tunnel runs nearly flat (downward slope of 0.4% for approximately 4,300 ft. or 0.8 miles) and then slopes upward at 12% for approximately 900 ft. or 0.2 miles where it then discharges to the Connecticut River. [Figure 2.2](#) depicts the Project works described above. Due to the length and configuration, it is anticipated that the vast majority of any sediment transported through the pressure conduit and turbines during a dewatering will settle out and deposit in the mile long tailrace tunnel where it will either (1) be transported back to the Upper Reservoir during the next pumping cycle; (2) remain undisturbed; or (3) be removed during Project maintenance activities.

This is consistent with what was observed during the 2010 drawdown, when the shape and configuration of the tunnel, combined with the other factors discussed earlier in this section, resulted in minimal release of sediment to the Connecticut River during the drawdown even though a large amount of sediment had accumulated in the Project Works including the tailrace tunnel. It was not until sediment was being removed from the tailrace tunnel that excessive sediment concentrations were released to the Connecticut River. Issues associated with sediment removal from the tailrace tunnel during the 2010 dewatering have since been addressed and will not be repeated in the future.

The combination of the key Project features discussed above, the rate at which the Upper Reservoir is drawn down and the corresponding velocities, and maintaining the amount of accumulated sediment in the Upper Reservoir intake channel below a certain threshold minimizes the risk of excessive sediment releases during a dewatering. Based on the results of Study No. 3.1.3, FirstLight has focused its measures to minimize the risk of excessive sediment concentrations during a dewatering on ensuring the check dam remains effective and that the amount of accumulated sediment in the intake channel remains below a predetermined threshold. This document describes those measures in more detail.





POWERHOUSE AND WATER CONDUITS

FirstLight Hydro Generating Company
NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT, FERC PROJECT NO. 2485

NORTHFIELD MOUNTAIN PUMPED STORAGE DEVELOPMENT
SECTION - POWERHOUSE AND WATER CONDUITS

250' 0 250' 500'



3 MINIMIZING THE RISK OF EXCESSIVE SEDIMENT RELEASES DURING DEWATERING EVENTS

Consistent with the proposals made in the Final Report, the USEPA's letter dated December 15, 2016, notes that FirstLight must develop "...a plan and procedures to prevent the release of excessive concentrations of sediment during dewatering events." In response to this requirement, FirstLight will actively monitor and manage the amount of sediment which accumulates in the Upper Reservoir, with special emphasis on the intake channel and the area in the vicinity of the check dam, to ensure that sediment accumulates at appropriate levels. The steps to prevent the release of excessive sediment during a dewatering event are discussed below.

Bathymetric Surveys

As described in the Final Report, to monitor the amount of sediment accumulation occurring throughout the Upper Reservoir, FirstLight will retain a qualified bathymetric surveying company to perform bathymetric mapping at least once every two years to help understand the location, volume, and rate of sediment accumulation in the Upper Reservoir. The specific techniques and technologies may evolve over time; however, the present plan for surveys is detailed below.

Bathymetric mapping will be performed by boat and is proposed to occur when the Upper Reservoir is near its normal maximum elevation so the maximum extent of bathymetric data can be obtained. Each survey will utilize a multi-beam echo sounder paired with GPS receiver to ensure comparability between surveys. Horizontal and vertical positioning data will be collected continuously on survey lines at predetermined grid spacing in a north-south and east-west direction. Where feasible, subsequent surveys will be conducted at approximately the same time of year as the initial survey to better predict annual sediment dynamics. If excavation of accumulated sediment were to occur, a survey of the excavated area will be conducted to establish an updated baseline.

Bathymetric data will be post processed and translated into a GIS compatible format for analysis purposes. For all bathymetric mapping conducted, data collected will be compared to previous data to estimate rates of sediment accumulation, depth of sediment, and the volume of accumulated sediment throughout the Upper Reservoir, Upper Reservoir intake channel, and the area in the vicinity of the check dam (which is detectable during bathymetric surveys). The results of the bathymetric surveys will reveal sediment location as well as changes in sediment depth and allow for timely removal decisions to be made. A series of steps will then be used to help determine the appropriate action.

Sediment Removal Determination Process

If the results of the bathymetric survey indicate an average sediment depth throughout the middle of the intake channel (as shown in red in [Figure 2.1](#)) of 5 ft. or greater, an internal detailed review by an engineering team will be initiated and planning for future sediment removal will commence. The detailed review will include an evaluation as to whether sediment levels have increased to the point where the check dam and/or intake channel geometry would not be able to prevent an excessive release of sediment to the Connecticut River during an unplanned or planned dewatering. The engineering review team will prepare a report of its findings and recommendations. FirstLight will then notify the appropriate agencies and inform them of the next steps.

Once the 5 ft. threshold has been reached, sediment removal will commence within 3 years unless there is a technical and engineering basis for a longer period of time, which would be submitted to USEPA, MADEP, and FERC for review and comment. After reaching the 5 ft. threshold, and until sediment removal occurs, FirstLight will perform bathymetric surveys and detailed engineering reviews annually.

NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT SEDIMENT MANAGEMENT PLAN UPPER
RESERVOIR DEWATERING PROTOCOLS

An average sediment depth of 5 ft. throughout the middle of the intake channel (as shown in red in [Figure 2.1](#)) was chosen as the trigger point for two primary reasons. First, the results of the pilot dredge conducted for Study No. 3.1.3, combined with prior professional experience, found that 5 ft. of sediment accumulation represents the minimum amount of sediment necessary for hydraulic dredging to be effective. At sediment depths below this threshold, hydraulic dredging has been found to be less effective due to the fact that hydraulic dredging requires a sufficient depth of sediment into which the dredging head is inserted to function properly.

Secondly, based on the results of the computational modeling conducted for Study No. 3.1.3, exit velocities through the intake channel are insufficient to cause the mobilization and entrainment of bed sediment during typical periods of generation (i.e., up to 4 units) (Alden, 2014 [Page 55]). Given that the rate of drawdown, and therefore the velocity, during a dewatering is equal to or less than that of normal generation, it is anticipated that accumulated sediment will remain undisturbed on the bed of the intake channel. By maintaining an average sediment depth of 5 ft. or less throughout the middle of the intake channel, FirstLight believes it will have minimized the risk of excessive sediment releases during planned or unplanned unwatering while still being able to unwater whenever needed.

If the decision to dredge is made, FirstLight will notify the USEPA, MADEP, and FERC. Best Management Practices (BMPs) to prevent the release of sediment during dredging activities will follow those developed as part of Study No. 3.1.3 ([Appendix A](#)); these may be updated over time to reflect advances in techniques or technologies and/or to respond to specific conditions anticipated to be encountered during a specific dredging event. In addition, following each dredging event, FirstLight will review all BMPs and update as needed. In the event that the BMPs are updated, FirstLight will provide the most recent version to USEPA, MADEP, and FERC in advance of future dredging activities. The current estimated upland storage capacity available in the Upper Reservoir area for dredged sediments is approximately 50,000 cubic yards. Future sediment management options for dredged sediments include both the development of additional storage and beneficial reuse. Currently, the sediment stockpiled during the 2015 pilot dredge project is being removed from the Project for beneficial reuse.

[Figure 3.1](#) depicts a summary flow chart detailing the decisions and steps involved to prevent the release of excessive sediment concentrations during a dewatering. The steps outlined above, combined with the physical characteristics of the Project works discussed in [Section 2](#) and the dewatering protocols discussed in [Section 4](#), will minimize the risk of excessive sediment releases to the Connecticut River during a planned or unplanned unwatering.

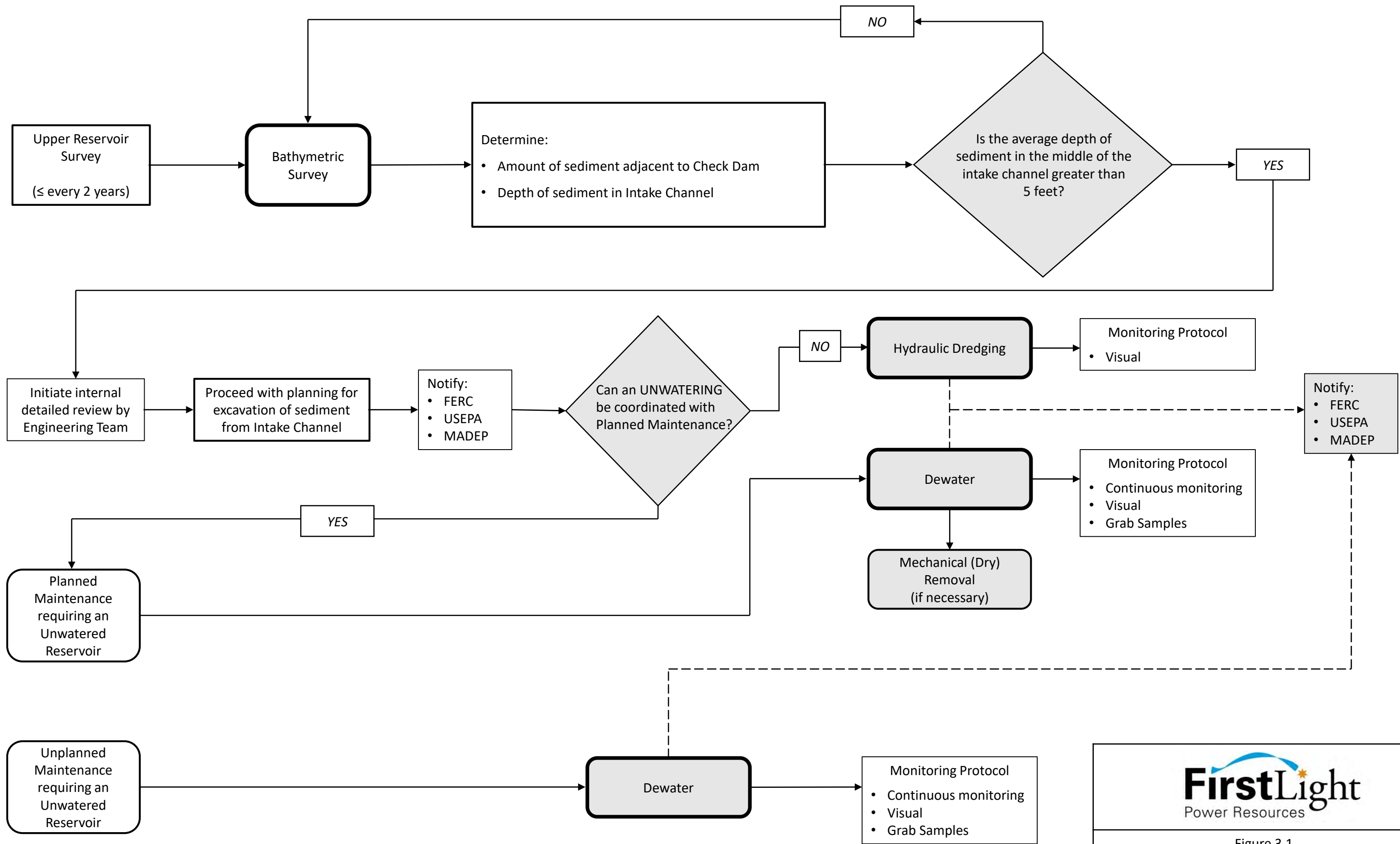


Figure 3.1
Northfield Mountain Upper Reservoir
Sediment Removal and Dewatering Flowchart

4 DEWATERING PROTOCOLS

As discussed in [Section 2](#), there are typically two types of dewatering's which may occur at the Project, those for planned maintenance and those for unplanned maintenance. Planned maintenance may include repair of powerhouse electrical or hydraulic equipment, inspection of the Upper Reservoir dams and dikes, and repair of intake structures. A planned maintenance dewatering may also include sediment removal using traditional excavation equipment. Conversely, if conditions should arise such that the security or safety of the Project is at risk, FirstLight may require an unplanned dewatering of the Upper Reservoir. Under this scenario, FirstLight would follow the normal dewatering protocol to the extent possible but notify the appropriate agencies as soon as practical.

It should be noted that in the Final Report, FirstLight committed to developing two types of dewatering protocols, one for an emergency and one for maintenance or other. As a result of the sediment management measures discussed in [Section 3](#) (i.e., maintaining the amount of accumulated sediment at a stable level at all times), FirstLight has minimized the risk of excessive sediment releases during planned or unplanned dewatering. As such, separate dewatering protocols are no longer needed as originally discussed in the Final Report.

4.1 Dewatering Protocols

Normal dewatering of the Upper Reservoir is a complicated process and includes steps to minimize the risk of damage to equipment, conduits, and structures and to prevent the entrainment of sediment into the Project works that could result in deposition in the Connecticut River. Typically, dewatering the Upper Reservoir takes 7-10 days due to the slow rate of drawdown and complexity of the process. In case of an emergency drawdown for safety reasons, it may be deemed necessary to advance the process as quickly as possible to reduce exposure to the public or potential for equipment damage.

Once the decision to dewater has been made, FirstLight will notify the appropriate agencies as discussed in [Section 4.3](#). Operationally, FirstLight will begin the drawdown process utilizing all four units until a certain Upper Reservoir water surface elevation is reached. As the Upper Reservoir water surface level decreases, FirstLight will reduce the number of units from four to three, three to two, and two to one after which the dewatering process will transition to a slow drain. The rate of which the Upper Reservoir is drawn down, as well as the corresponding exit velocity of the water, will be equal to or less than that which occurs during normal Project operations. For the reasons discussed in the preceding sections (i.e., intake channel geometry and corresponding water velocities, configuration of Project works, and the amount of accumulated sediment in the intake channel), FirstLight does not anticipate the release of excessive sediment concentrations during this process.

Once the Upper Reservoir has been successfully unwatered, tailrace stop logs will be put in place to seal off the tailrace tunnel from the TFI. A series of sump pumps will then be utilized to remove water present within the tailrace tunnel. The sump pumps are connected to an independent pipe which eventually runs to the surface before discharging to a drainage swale in the vicinity of the Riverview Picnic area, located just upstream of the Project tailrace; the drainage swale discharges to the Connecticut River. It is anticipated that any sediment pumped to the drainage swale would be a de minimis amount; however, FirstLight will monitor the discharge and, if necessary, install a silt curtain, or implement other similar sediment retention strategies, at the drainage swale during the pumping of the water from the tailrace tunnel.

FirstLight will monitor turbidity or suspended sediment concentration (SSC) levels in the tailrace and mainstem TFI over the course of the dewatering as discussed in the next section.

NORTHFIELD MOUNTAIN PUMPED STORAGE PROJECT SEDIMENT MANAGEMENT PLAN UPPER
RESERVOIR DEWATERING PROTOCOLS

4.2 Monitoring

FirstLight will employ a three-tiered approach to suspended sediment or turbidity monitoring during a dewatering including: (1) visual monitoring; (2) continuous monitoring; and (3) grab sample collection and laboratory analysis. Each monitoring component is discussed in greater detail below.

Visual Monitoring

FirstLight shall perform visual monitoring during daylight hours of the area adjacent to the Upper Reservoir intake channel and tailrace area. If increased turbidity is observed (i.e., water exiting the tailrace that appears to be more turbid than the TFI), the continuous monitoring data (see below) will be reviewed to determine if turbidity levels have risen to a point that the dewatering procedure should stop.

Continuous Monitoring

Continuous turbidity monitors, or similar technology, will be deployed in the tailrace and at an appropriate location along the TFI just upstream of the tailrace for the duration of the dewatering. Data will either be transmitted directly to the Project's SCADA system or be offloaded and reviewed at the beginning and end of each day as well as every two hours during normal business hours. In the event that visual monitoring indicates an increase in turbidity and (1) turbidity readings from the tailrace monitor are two times greater than those observed at the mainstem monitor or (2) turbidity levels measured at the tailrace monitor exceed 25 NTU, whichever is greater, for two hours, FirstLight shall investigate and correct the cause of the turbidity.

It should be noted that in its December 15, 2016 letter, the USEPA noted that FirstLight should deploy the suspended sediment monitors used for Study No. 3.1.3 to monitor suspended sediment concentrations during a dewatering. Due to the extensive issues encountered using the suspended sediment monitors during Study No. 3.1.3 (as detailed in the Final Report), FirstLight has instead elected to propose the monitoring approach detailed above.

Laboratory Analysis of Grab Samples

In advance of a non-emergency dewatering, FirstLight will collect grab samples in the tailrace and at an appropriate location along the TFI just upstream of the tailrace to conduct calibration testing of the continuous monitoring equipment described above. Grab samples will be submitted to a qualified laboratory for analysis. Results will then be compared to the data collected by the continuous monitors.

4.3 Agency Consultation / Notification

Should FirstLight choose to perform a non-emergency dewatering, it will follow this protocol unless an updated protocol has been submitted to reflect changes in site conditions, new technologies, or otherwise. FirstLight will notify MADEP, USEPA, and FERC in advance to document the specific plan and provide BMPs. FirstLight will comply with all applicable federal, state, and local regulations. Under emergency conditions, FirstLight will take immediate measures to protect human health and safety or property and notify the appropriate agencies as soon as practical and in any event within 2 hours of beginning those measures.

4.4 Protocol Review and Update

FirstLight shall review this protocol, at a minimum, after each dewatering event and provide revisions to the agencies listed in [Section 4.3](#), as necessary. The intent of subsequent revisions is to improve the usefulness of the protocol by incorporating best practices learned from each event.

APPENDIX A – DREDGING BEST MANAGEMENT PRACTICES

Potential Pilot Dredging Project Best Management Practices

Northfield Mountain Pumped Storage Project FERC Project No. 2485-063

Prepared For:



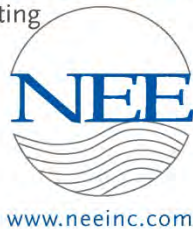
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Date:

February 24, 2015

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1.0 INTRODUCTION

New England Environmental, Inc. (NEE) and Doucet & Associates, Inc. (Doucet) have prepared this Best Management Practices (BMP) Manual on behalf of FirstLight Power Resources Services, LLC (FirstLight), an agent for FirstLight Hydro Generating Company, an affiliate of GDF SUEZ Energy North America, Inc., for the Northfield Mountain Pumped Storage Project Pilot Dredge Program. This document sets forth BMPs to minimize the risk of adverse impacts to the Upper Reservoir and the Connecticut River due to sediment extraction and storage associated with the dredging operation. The BMPs and procedures included in this plan were developed in consultation with the Massachusetts Department of Environmental Protection (MADEP) and the United States Environmental Protection Agency (USEPA).

It is FirstLight's policy that all construction, operation and maintenance activities be conducted in a safe manner that minimizes impacts on stream and wetlands, wildlife habitat, cultural resources and the human environment. The objective of this Manual is to provide FirstLight's personnel and contractors with the information necessary to perform the dredging activities while minimizing project impacts. FirstLight will meet these objectives by employing the BMPs contained in this Manual. In general, the BMPs are designed to minimize erosion and sedimentation by:

- Minimizing the extent and duration of soil exposure
- Protecting critical areas by reducing the velocity of water and redirecting runoff
- Installing erosion and sediment control BMPs
- Monitoring and maintaining BMPs as necessary throughout the dredging and sediment management activities
- Complete the dredging and sediment management activities in a safe and timely manner

2.0 PROJECT DESCRIPTION

Deep water hydraulic dredging of the Upper Reservoir will be employed as a mechanism to avoid the entrainment of accumulated silt into the intake and ultimately the Connecticut River at harmful levels during operational activities. One of the advantages of deep water hydraulic dredging is that it can occur while the Project is available for generation or pumping, which allows for removal of sediments without the need for removing the Project from service. In contrast, other mechanical means of sediment removal may require dewatering of the Upper Reservoir and would likely require an extended outage.

Because the dredging could occur during generation, BMPs will be implemented prior to, during and post any dredging to avoid sediment migration from the Upper Reservoir through the Project and the Connecticut River.

Dredging of the Upper Reservoir will include the preparation of a staging area. The staging area would receive a slurry of suspended sediment and water pumped from the hydraulic dredge to geotubes. In the staging area, solids are separated from water and collected for processing and removal.

The existing peninsula north of the intake channel will be used for staging. Within this area, dredged material will be processed. The land area required for this is approximately 130,000 square feet. The design of the staging area includes enough workspace for daily operations while allowing for containment of materials.

Before the tubes are pumped into, a manifold piping system will be setup surrounding the tube area. This system of pipes and valves will feed the tubes with the combined sediment and water mixture removed from the lake bottom. In order to keep the tubes stable each tube will be secured to the adjacent tube using the manufactured ties built into the tubes. Each of the outside tubes will be secured to stakes driven into the ground around the perimeter of the staging area. Once the piping system is setup, which would include a polymer injection system, pumping can begin.

3.0 SITE DESCRIPTION

The Northfield Mountain Pumped Storage Project (Project No. 2485) is a 1,143-MW pumped storage project located along the east bank of the Connecticut River in the Towns of Northfield and Erving, MA.

The Project began commercial operation in 1972 and consists of an underground powerhouse, four reversible pump-turbine generators, an underground pressure shaft, four unit penstocks and draft tubes, and a mile-long tailrace tunnel connecting the powerhouse to a 20-mile-long reach of the Connecticut River known as the Turners Falls Impoundment, which serves as the lower reservoir. The manmade upper reservoir (Upper Reservoir) was formed with four earth-core rock fill embankment structures and a concrete gravity dam.

The plant's operation does not affect the river water temperature and is nonpolluting. Power from the plant is quickly available to help maintain system reliability in emergencies or to help meet peak power requirements of over 1.7 million electric customers.

The dredging will occur in an approximately 300 feet by 600 feet section of the Upper Reservoir.

4.0 BEST MANAGEMENT PRACTICES (BMPs)

Erosion occurs whenever water, wind or other forces, such as gravity, remove soil materials. Sedimentation occurs when these materials are deposited in low-lying areas, such as waterbodies and wetlands. The potential for erosion and sedimentation increases during periods of soil exposure and thus are more susceptible to erosion.

FirstLight prepared this BMP Manual to describe measures to be utilized to minimize erosion of disturbed soils and transportation of sediments during the Northfield Mountain Pumped Storage Project Pilot Dredge Program. The procedures developed in this Manual are designed to accommodate varying field conditions while maintaining rigid minimum standards for the protection resources.

This Manual is designed to provide specifications for the installation and implementation of soil erosion and sediment control measures while allowing adequate flexibility to use the most appropriate measures based on site-specific conditions.

The following descriptions are meant to be used in conjunction with the Project Drawings showing the proposed plan for management of sediment on site. There may also be additional measures required based on site activities which would be implemented as the project proceeds.

4.1 Stabilized Construction Exit

Applications:

- A temporary stone stabilized pad located at points of vehicular ingress and egress on a work site.
- Provides a stable entrance and exit from a site in order to keep mud and sediment off public roads and other paved areas.

Advantages:

- Mud and sediment on vehicle tires is significantly reduced which avoids hazards caused by depositing mud on the public roadway and other paved areas.
- Sediment, which is otherwise contained on the construction site, does not enter stormwater runoff elsewhere.

Limitations:

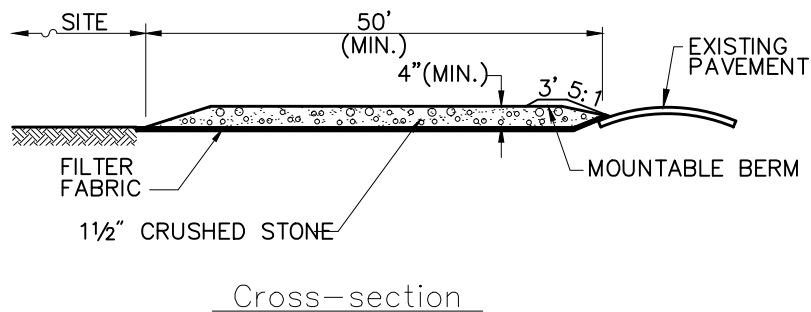
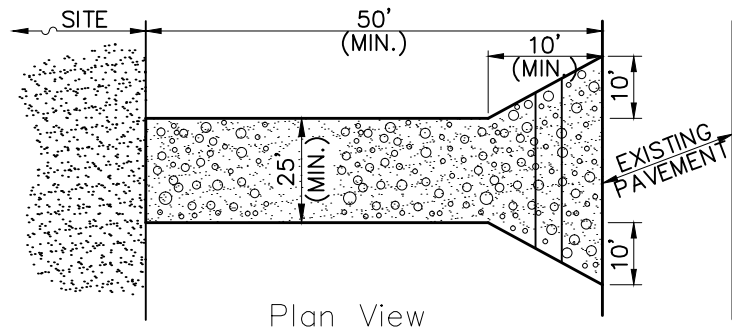
- This practice will only be effective if sediment control is used throughout the rest of the site.

Considerations:

- Avoid locating at curves in public roads or on steep slopes.
- If the action of the vehicle travelling over the gravel pad is not sufficient to remove the majority of the mud, then the tires may need to be washed before entering a public roadway or other paved areas.
- If washing is used, provisions must be made to intercept the wash water and trap the sediment before it is carried off-site. Construction entrances should be used in conjunction with the stabilization of construction roads to reduce the amount of mud picked up by vehicles.

Maintenance:

- The entrance should be maintained in a condition that will prevent tracking or flowing of sediment onto public rights-of-way. This may require periodic topdressing with additional stone.
- Remove mud and sediment tracked or washed onto public roads.
- Mud and soil particles will eventually clog the voids in the gravel and the effectiveness of the gravel pad will not be satisfactory. When this occurs, the pad should be topdressed with new stone. Complete replacement of the pad may be necessary when the pad become completely clogged.
- If washing facilities are used, the sediment traps should be cleaned out as often as necessary to assure that adequate trapping efficiency and storage volume is available.
- All temporary erosion and sediment control measures shall be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed. Trapped sediment shall be removed or stabilized onsite. Disturbed soil areas resulting from removal shall be permanently stabilized.



Notes:

1. ENTRANCE WIDTH SHALL BE A TWENTY-FIVE (25) FOOT MINIMUM, BUT NOT LESS THAN THE FULL WIDTH AT POINTS WHERE INGRESS OR EGRESS OCCURS.
2. THE ENTRANCE SHALL BE MAINTAINED IN A CONDITION WHICH SHALL PREVENT TRACKING OR FLOWING OF SEDIMENT ONTO PUBLIC RIGHTS-OF-WAY. THIS MAY REQUIRE PERIODIC TOP DRESSING WITH ADDITIONAL STONE AS CONDITIONS DEMAND AND REPAIR OR CLEANOUT OF ANY MEASURES USED TO TRAP SEDIMENT. ALL SEDIMENT SPILLED, DROPPED, WASHED OR TRACKED ONTO PUBLIC RIGHTS-OF-WAY MUST BE REMOVED IMMEDIATELY. BERM SHALL BE PERMITTED. PERIODIC INSPECTION AND MAINTENANCE SHALL BE PROVIDED AS NEEDED.

SOURCE: DOUCET & ASSOCIATES, INC.

SCALE:
NOT TO SCALE

Stabilized Construction Exit

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4.2 Construction Road Stabilization

Applications:

- Stabilization of temporary access routes, on-site vehicle transportation routes, and construction parking areas to control erosion.

Advantages:

- Proper grading and stabilization of construction roads and parking areas reduces erosion and minimizes dust problems.
- Road stabilization can significantly speed on-site work, avoid instances of immobilized machinery and delivery vehicles, and generally improve site efficiency and working conditions during adverse weather.

Limitations:

- Measures on temporary roads must be cost-effective not only to install but also to remove.
- May require maintenance to replace aggregate or repair ruts.

Considerations:

- Avoid steep slopes, excessively wet areas, and highly erodible soils.
- Controlling surface runoff from the road surface and adjoining areas is a key erosion control consideration. Provide surface drainage and divert excess runoff to stable areas.
- Areas which are graded for vehicle transport and parking purposes are especially susceptible to erosion. The exposed soil surface is continually disturbed, leaving no opportunity for vegetative stabilization. Such areas also tend to collect and transport runoff waters along their surfaces. During wet weather, they often become muddy which generate significant quantities of sediment that may pollute nearby streams or be transported off-site on the wheels of vehicles.

Maintenance:

- Inspect stabilized areas regularly, especially after large storm events. Add crushed rock if necessary and restabilize any areas found to be eroding.
- All temporary erosion and sediment control measures should be removed within 30 days after final site stabilization is achieved or after the temporary practices are no longer needed.
- Trapped sediment should be removed or stabilized on site. Disturbed soil areas resulting from removal should be permanently stabilized.

4.3 Timber Mats

Applications:

- Used for access where the ground surface is unstable due to saturated soils or other substrates not suitable for heavy vehicles.

Advantages:

- Prevents rutting of unstable ground surfaces.

Limitations:

- Only for temporary use.
- Need to be installed with heavy machinery.
- Equipment operators must remain cautious to not drive or slip off the mats.

Considerations:

- Should be placed along the travel area so that the individual boards are resting perpendicular to the direction of traffic. No gaps should exist between mats.
- Should be removed one at a time by backing out of the site. Upon removal of mats, the soil surface should be re-graded and stabilized as necessary.

Maintenance:

- Should be cleaned after use to remove any invasive plant species.
- In winter, mats must be plowed, sanded or heated to prevent equipment from sliding off mats.

4.4 Silt Fence

Applications:

- A silt fence is a temporary sediment barrier consisting of a filter fabric stretched across and attached to supporting posts and entrenched. The silt fence is constructed of stakes and synthetic filter fabric.
- A silt fence intercepts and detains small amounts of sediment from disturbed areas and reduces runoff velocity.
- Applicable where erosion would occur in the form of sheet erosion.

Advantages:

- Removes sediments and prevents downstream damage from sediment deposits.
- Reduces speed of runoff flow.
- Minimal clearing and grubbing required for installation.
- Silt fences trap a much higher percentage of suspended sediments than hay/straw bales.

Limitations:

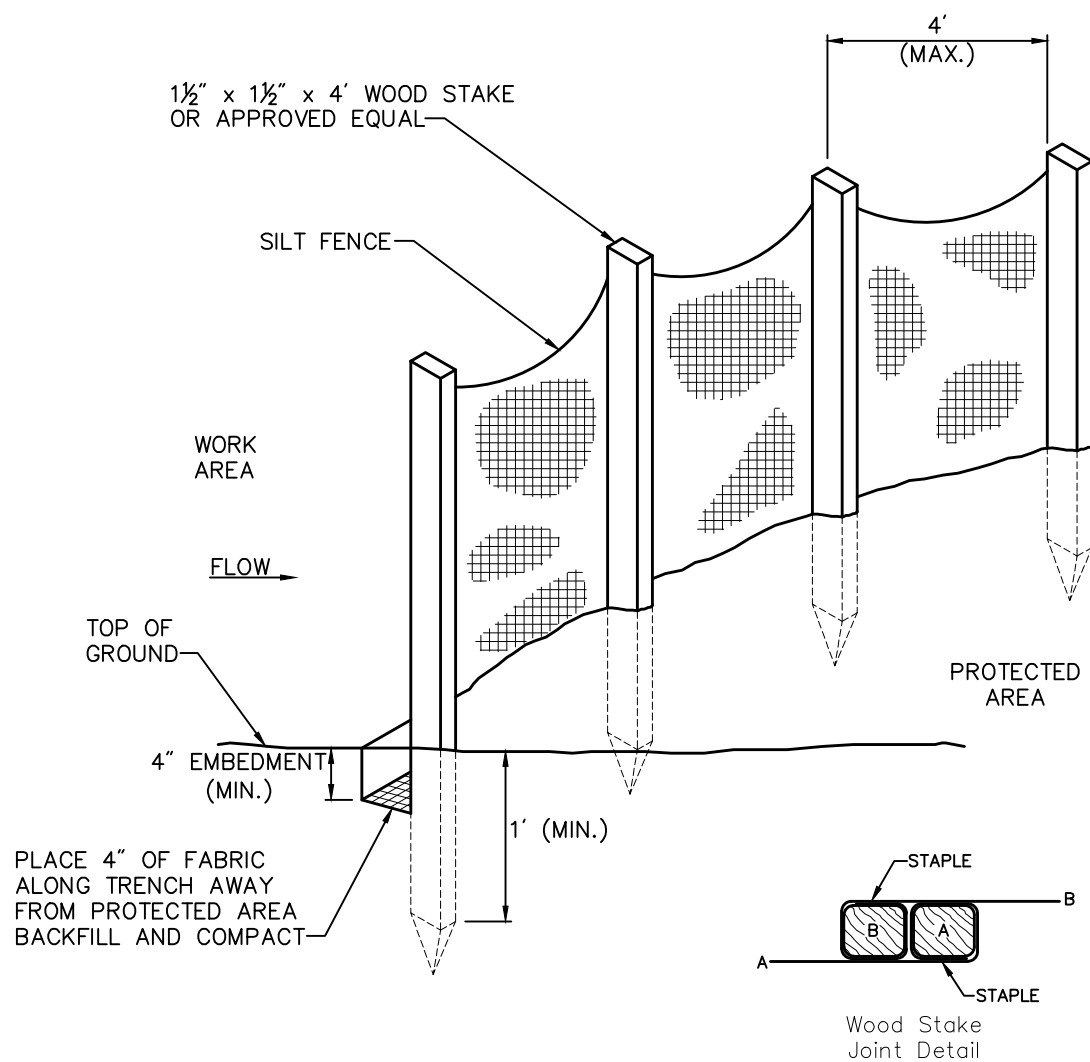
- Silt fences are not practical where large flows of water are involved. Their use is recommended only for small drainage areas, and flow rates of less than 0.5 cfs.
- Flow should not be concentrated.
- Problems may arise from improper installation.

Considerations:

- Silt fences have a low permeability to enhance sediment trapping. This may create ponding behind the silt fence.

Maintenance:

- Silt fences should be inspected after each rainfall and at least daily during prolonged rainfall. Repair as necessary.
- Remove sediment deposits promptly to provide adequate storage volume for the next storm event and to reduce pressure on the fence. Take care to avoid undermining the fence during cleanout.
- If the fabric tears, decomposes, or in any way becomes ineffective, replace it immediately.
- Remove all fencing materials after the contributing drainage area has been properly stabilized. Sediment deposits remaining after the fence has been removed should be graded to conform with the existing topography and vegetated.



SOURCE: DOUCET & ASSOCIATES, INC.

SCALE:
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Silt Fence Barrier

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4.5 Straw Bale

Applications:

- A temporary sediment barrier consisting of a row of entrenched and anchored straw bales. Used to intercept and detain small amounts of sedimentation from disturbed areas of limited extent to prevent sediment from leaving the site. Decreases the velocity of sheet flows and low-to-moderate level channel flows.
- Downslope of disturbed areas.

Advantages:

- When properly used, straw bale barriers are an inexpensive method of sediment control.

Limitations:

- Straw bale barriers are easy to misuse.
- Straw bale barriers require more maintenance than silt fence barriers and permeability through the bales is slower.

Considerations:

- Straw bale barriers are used similarly to silt fence barriers; especially where the area below the barrier is undisturbed and vegetated.
- Straw bales should be located where they will trap sediment.
- Straw bales should be placed in a single row, lengthwise on the contour, with ends of adjacent bales tightly abutting one another.
- Straw bales should be installed so that bindings are oriented around the sides rather than along the tops and bottoms of the bales in order to prevent deterioration of the bindings.
- The barrier should be entrenched and backfilled. A trench should be excavated the width of a bale and the length of the proposed barrier. The trench must be deep enough to remove all material which might allow underflow.

Maintenance:

- Straw bale barriers should be inspected immediately after each runoff-producing rainfall and at least daily during prolonged rainfall.
- Close attention should be paid to the repair of damaged bales, undercutting beneath bales, and flow around the end of bales.
- Necessary repairs to barriers or replacement of bales should be accomplished promptly.
- Sediment deposits should be checked after each runoff-producing rainfall. They must be removed when the level of deposition reaches approximately one-half the height of the barrier.

4.6 Erosion Control Blanket

Applications:

- Porous fabrics used to stabilize the flow in channels/swales and to stabilize slopes subject to the forces of erosion.

Advantages:

- A wide variety of materials are available to match specific needs.
- Fabrics are relatively inexpensive.

Limitations:

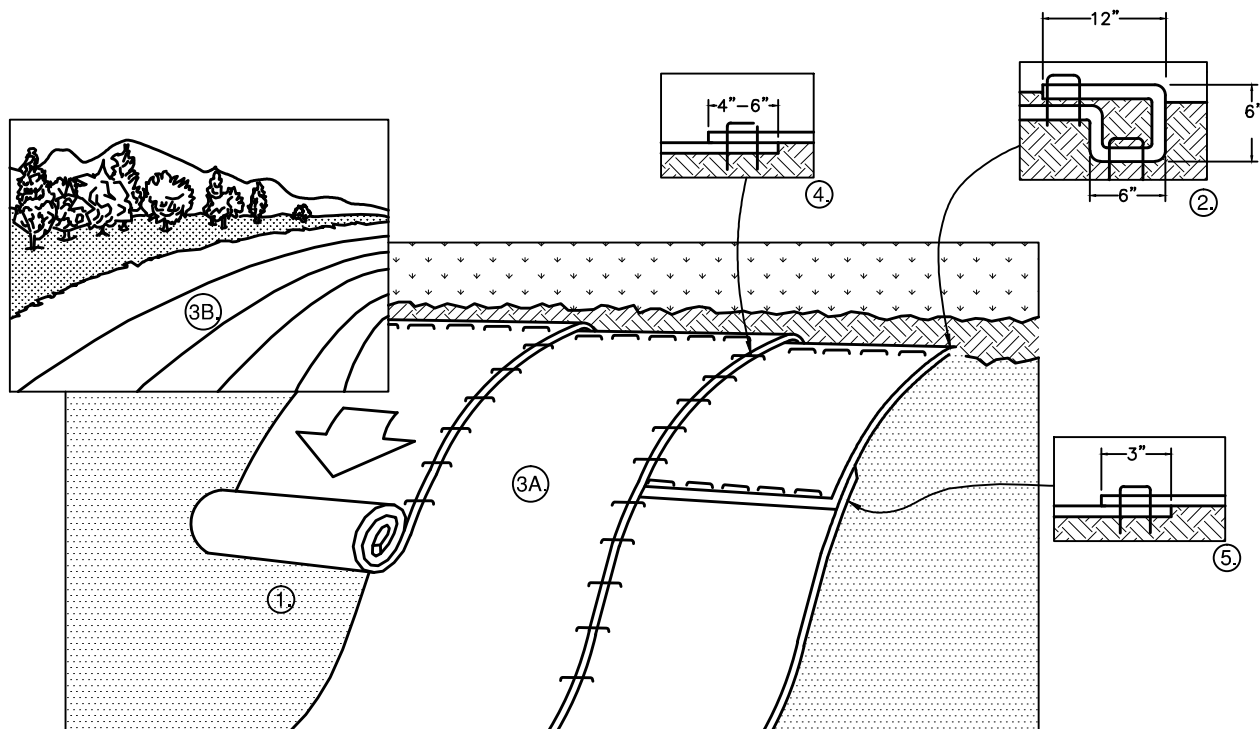
- If the fabric is not properly selected, designed, or installed, the effectiveness may be reduced.
- Many synthetic geotextiles are sensitive to light and must be protected prior to installation.

Considerations:

- Effective netting and matting require firm, continuous contact between the materials and the soil. If there is no contact, the material will not hold and erosion will occur underneath the material.

Maintenance:

- There are numerous types of geotextiles available, therefore the selected fabric should match its purpose. In the field, important concerns include regular inspections to check for cracks, tears, or breaches in the fabric.



Installation

1. PREPARE SOIL BEFORE INSTALLING BLANKETS, INCLUDING ANY NECESSARY APPLICATION OF LIME, FERTILIZER, AND SEED
2. BEGIN AT THE TOP OF THE SLOPE BY ANCHORING THE BLANKET IN A 6" DEEP X 6" WIDE TRENCH WITH APPROXIMATELY 12" OF BLANKET EXTENDED BEYOND THE UP-SLOPE PORTION OF THE TRENCH AS SHOWN IN DETAIL
3. ANCHOR THE BLANKET WITH A ROW OF STAPLES/STAKES APPROXIMATELY 12" APART IN THE BOTTOM OF THE TRENCH. BACKFILL AND COMPACT THE TRENCH AFTER STAPLING. APPLY SEED TO COMPACTED SOIL AND FOLD REMAINING 12" PORTION OF BLANKET BACK OVER SEED AND COMPACTED SOIL. SECURE BLANKET OVER COMPACTED SOIL WITH A ROW OF STAPLES/STAKES SPACED APPROXIMATELY 12" APART ACROSS THE WIDTH OF THE BLANKET.
4. ROLL THE BLANKETS (A.) DOWN OR (B.) HORIZONTALLY ACROSS THE SLOPE. BLANKETS WILL UNROLL WITH APPROPRIATE SIDE AGAINST THE SOIL SURFACE. ALL BLANKETS MUST BE SECURELY FASTENED TO SOIL SURFACE BY PLACING STAPLES/STAKES IN APPROPRIATE LOCATIONS AS PER MANUFACTURES RECOMMENDATION.
5. THE EDGES OF PARALLEL BLANKETS MUST BE STAPLED WITH MINIMUM 6" OVERLAP. TO ENSURE PROPER SEAM ALIGNMENT, PLACE THE EDGE OF THE OVERLAPPING BLANKET (BLANKET BEING INSTALLED ON TOP) EVEN WITH THE SEAM STITCH ON THE PREVIOUSLY INSTALLED BLANKET.
6. CONSECUTIVE BLANKETS SPLICED DOWN THE SLOPE MUST BE PLACED END OVER END (SHINGLE STYLE) WITH AN APPROXIMATE 3" OVERLAP. STAPLE THROUGH OVERLAPPED AREA, APPROXIMATELY 12" APART ACROSS ENTIRE BLANKET WIDTH.
7. PLACE STAPLES/STAKES PER MANUFACTURER'S RECOMMENDATION FOR THE APPROPRIATE SLOPE BEING APPLIED.

Notes:

1. IN LOOSE SOIL CONDITIONS, THE USE OF STAPLE OR STAKE LENGTHS GREATER THAN 6" MAY BE NECESSARY TO PROPERLY SECURE THE BLANKETS.
2. FOLLOW EROSION CONTROL TECHNOLOGY COUNCIL SPECIFICATION FOR PRODUCT SELECTION.

SOURCE: DOUCET & ASSOCIATES, INC.

SCALE:
NOT TO SCALE

Erosion Control Blanket Slope Installation

11/1/07
SED-8

4.7 Vegetated Filter Strip

Applications:

- A vegetated filter strip is an area of vegetation for runoff to flow through before it leaves a disturbed site or enters into a designated drainage system.
- This practice applies to sites where adequate vegetation can be established and maintained. Vegetative filter strips can be used effectively:
 - Adjacent to water courses such as waterways and diversions and waterbodies such as streams, ponds, and lakes.
 - At the outlet of stormwater management structures.
 - Along the top and at the base of slopes.
- A vegetative filter strip is designed to provide runoff treatment of conventional pollutants, but not nutrients. This practice is not designed to provide streambank erosion control.

Advantages:

- It improves water quality by removing sediment and other pollutants from runoff as it flows through the filter strip. Some of the sediment and pollutants are removed by filtering, absorption, adsorption and settling as the velocity of flow is reduced.

Limitations:

- A vegetative filter strip should not be used for conveyance of larger storms because of the need to maintain sheet flow conditions.
- If the flow becomes concentrated in rills, the effectiveness of the strip is greatly reduced.

Considerations:

- Filter strips may occur naturally or be constructed. It is important that filter strips be designed and constructed so that runoff flows uniformly across the filter strip as sheet flow.
- Natural filter areas can provide excellent pollutant removal, particularly those areas left adjacent to natural water courses and bodies of water. It is also important to evenly distribute the runoff into these natural areas for best performance.
- To prevent soil compaction, no equipment should be allowed to operate within the filter strip area. Uncompacted soil encourages percolation and minimizes rapid surface runoff.

Maintenance:

- Filter strips should be maintained as natural areas once the vegetation is established. The filter strip should be protected from damage.
- The filter strip should be inspected periodically and after every major rainstorm to determine if the entrance conditions are still uniform and level and to see if rills have formed. Any problem areas should be repaired promptly to prevent further deterioration.

4.8 Grassed Waterway

Applications:

- A natural or constructed waterway or outlet shaped or graded and established in suitable vegetation as need for the safe disposal of runoff water. Used to convey and dispose of concentrated runoff to a stable outlet without damage from erosion, deposition, or flooding.
- This practice applies to sites where:
 - Concentrated runoff will cause damage from erosion or flooding.
 - A vegetated lining can provide sufficient stability for the channel cross section and grade.
 - Slopes are generally less than 5 percent.
 - Typical uses include roadside ditches and outlets for diversions.

Advantages:

- Vegetated swales reduce runoff velocities and reduce potential erosion from the discharge of runoff.
- Vegetated swales may also remove some particulate pollutants from stormwater runoff and increase infiltration.

Limitations:

- Vegetation should be established before runoff is allowed to flow in the waterway.
- During the initial establishment period, flow should be diverted out of the channel if possible to allow for a good stand of grass. If this is not possible use matting.

Considerations:

- Grass-lined channels resemble natural systems and are usually preferred where design velocities are suitable.
- Adequate capacity and sufficient erosion resistance must be considered.

Maintenance:

- During the establishment period, the channel should be checked after every rainfall to determine if the grass is in good condition.
- After the vegetation has become established, the channel should be checked periodically and after every major storm to see if damage has occurred. Any damaged areas should be repaired and revegetated immediately.
- Maintenance of the vegetation in the grassed waterway is extremely important in order to prevent rilling, erosion, and failure of the waterway.
- Mowing should be done frequently enough to control encroachment of weeds and woody vegetation and to keep the grasses in a vigorous condition. The vegetation should not be mowed too closely so as to reduce the erosion resistance in the waterway.
- Remove all significant sediment and debris from channel to maintain the design cross section and grade and prevent spot erosion.

4.9 Silt Curtain

Applications:

- A silt curtain is a temporary sediment barrier installed in a waterbody to contain sediment and prevent the pollution and degradation of waters outside the work areas.

Advantages:

- A silt curtain will contain coarse sediment suspended in water to the work area.

Limitations:

- A silt curtain will not keep water from being muddy during work activities.

Considerations:

- The silt curtain should obstruct the flow as little as possible to reduce the chance of failure.

Maintenance:

- Accumulated sediment must be removed periodically. The curtain must be inspected often. Any damage must be immediately repaired.

4.10 Rock Lined Channel

Applications:

- Rock lined swales are conveyance systems designed, shaped, and lined to convey water in a non-erosive manner.
- Suitable in systems which collect, concentrate, and Convey water at the ground surface.

Advantages:

- Reduce velocities and filter runoff.
- Convey water in a non-erosive manner.

Limitations:

- Converts sheet flow to channel flow, which may increase flow velocities and erosive energy.
- Concentrates the volume of runoff.

Considerations:

- Ensure the swale has sufficient capacity to convey water and is also resistant to erosion during peak flows.
- Determine the capacity of the swale and the velocity of flow from the type of lining, cross-sectional areas and shape, and slop of the swale.
- Use rock lined swales to withstand high velocities (3-10 feet per second), using larger rock for greater flow velocities. Consider incorporating check dams into the swale system at regular intervals to encourage sedimentation where high rates of sedimentation occur.

Maintenance:

- Inspect for dislodged or unstable rocks and any erosion and undercutting, especially along swale bottom and adjacent slopes. Repair as necessary.
- Monitor ongoing effectiveness and determine if another BMP (i.e., check dam) could improve long-term effectiveness.
- If accumulated material has decreased swale capacity, removal of accumulated material is necessary.

4.11 Mulching Exposed Soil Surfaces

Applications:

- Applying a blanket of straw to the soil surface to provide immediate protection to exposed soils.
- In areas that have been seeded either for temporary or permanent cover, mulching should immediately follow seeding.
- Areas which cannot be seeded because of the season, or are otherwise unfavorable for plant growth.

Advantages:

- Mulching offers instant protection to exposed areas.
- Mulches conserve moisture and reduce the need for irrigation.
- Mulching does not require removal; seeds can grow through.
- It's one of the most effective and economical erosion control practices.

Limitations:

- Care must be taken to apply mulch at the specified thickness, and on steep slopes mulch may need to be supplemented with netting.
- Thick mulches can reduce the soil temperature, delaying seed germination.
- Mulch can be blown or washed away by runoff if not secured.

Considerations:

- Inadequate coverage may result in erosion, washout, and poor plant establishment.
- If an appropriate tacking agent is not applied or applied in insufficient amount, then mulch can be lost to wind and runoff.

Maintenance:

- Inspect after rainstorms to check for movement of mulch or erosion. Repair as necessary.
- Blanket mulch that is displaced by flowing water should be repaired as soon as possible.

4.12 Temporary Seeding

Applications:

- Planting rapid-growing annual grasses, small grains, or legumes to provide initial, temporary cover for erosion control on disturbed areas.
- Temporarily stabilize areas that will be exposed for a period of more than 30 working days.
- To stabilize disturbed areas before final grading or in a season not suitable for permanent seeding.
- Temporary seeding controls runoff and erosion until permanent vegetation or other erosion control measures can be established.
- Root systems hold down the soils so that they are less apt to be carried offsite by storm water runoff or wind.
- Temporary seeding also reduces the problems associated with mud and dust from bare soil surfaces during construction.

Advantages:

- Vegetation will not only prevent erosion from occurring, but will also trap sediment in runoff from other parts of the site.
- Temporary seeding offers fairly rapid protection to exposed areas.

Limitations:

- Temporary seeding is only viable when there is a sufficient window in time for plants to grow and establish. It depends heavily on the season and rainfall rate for success.
- If sown on subsoil, growth will be poor unless heavily fertilized and limed. Because overfertilization can cause pollution of stormwater runoff, other practices such as mulching alone may be more appropriate. The potential for overfertilization is an even worse problem in or near aquatic systems.
- Once seeded, areas should not be travelled over.
- Irrigation may be needed for successful growth. Regular irrigation is not encouraged because of the expense and the potential for erosion in areas that are not regularly inspected.

Considerations:

- Temporary seedings provide protective cover for less than one year. Areas must be reseeded annually or planted with perennial vegetation.
- Temporary seeding is used to protect earthen sediment control practices and to stabilize areas that will be exposed for weeks or months. Temporary seeding can provide a nurse crop for permanent vegetation, provide residue for soil protection and seedbed preparation, and help prevent dust production.
- Use low-maintenance native species wherever possible.
- Planting should be timed to minimize the need for irrigation.
- Temporary seeding is effective when combined with phasing so bare areas of the site are minimized at all times.

Maintenance:

- Inspect within 6 weeks of planting to see if stands are adequate. Check for damage after heavy rains.
- Seeds should be supplied with adequate moisture. Furnish water as needed, especially in abnormally hot or dry weather. Water application rates should be controlled to prevent runoff.

4.13 Dewatering Sump

Applications:

- A temporary pit constructed to trap and filter water for pumping into suitable discharge areas.
- When water collects and must be pumped away during excavating, dewatering, maintenance or removal of sediment traps and basins or other areas that collect sediment-laden water and can only be removed by pumping.

Advantages:

- Provides an area from which to dewater and reduce sediment in the discharge.

Limitations:

- The sump pit will become clogged with sediment, oils, and organic matter over time.

Considerations:

- A design is not required for the sump, but consideration should be given to site conditions.

Maintenance:

- It is important to remove material over time to prolong its effectiveness.
- The pit should be checked after every major storm to evaluate its effectiveness. If the pit and filter fabric become plugged with sediment, the pit should be rehabilitated.

4.14 Frac Tank

Applications:

- Can be used in large clean-up operations or simply for temporary storage of water or other liquids.

Advantages:

- They contain a series of baffles that allow fine materials to settle out of the water column.
- Can be used in conjunction with pumps, filters, dewatering units and vacuum boxes as part of a large scale project.
- Can hold 21,000 gallons or more.

Limitations:

- Site specific conditions can limit set-up locations (e.g., slopes, unlevel ground).
- If contents are contaminated, it may require disposal at a regulated facility.

Considerations:

- The use of multiple tanks may be necessary for the management of large volumes.

Maintenance:

- Frac tanks must be monitored to ensure proper functioning.
- Limited onsite maintenance is required.

4.15 Sediment Trap

Applications:

- A sediment trap is formed by excavating a pond or by placing an earthen embankment across a low area or a drainage swale. An outlet or spillway is constructed using large stones or aggregate to slow the release of runoff. The trap retains the runoff long enough to allow silt to settle out.
- To intercept sediment-laden runoff from small disturbed areas (<5 acres) and detains it long enough for the majority of sediment to settle out.

Advantages:

- Reduces sediment deposits downstream.
- Can simplify the design process by trapping sediment at specific spots onsite.

Limitations:

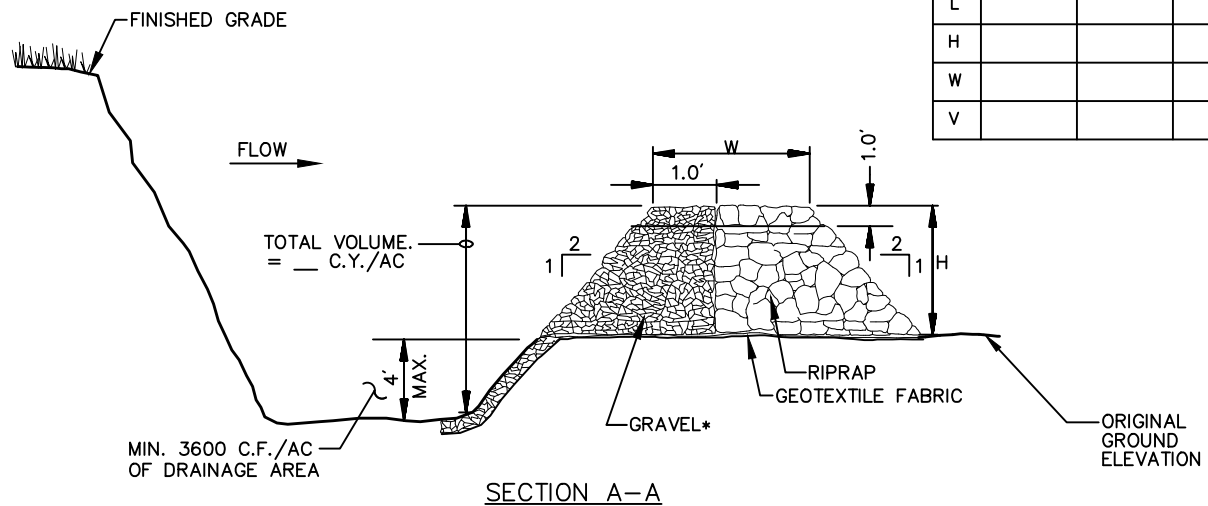
- Effective only if properly maintained.
- Will not remove very fine silts and clays.
- Serves only limited areas.

Considerations:

- Locate sediment trap as near the sediment source as topography allows.
- Divert runoff from undisturbed areas away from sediment trap.
- Sediment traps may be installed before land disturbance occurs in the drainage area.

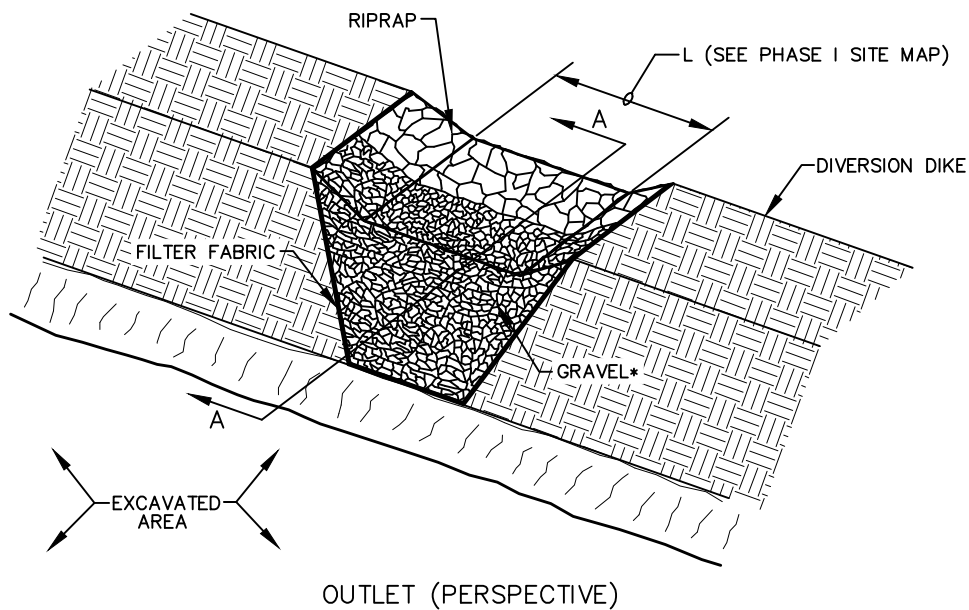
Maintenance:

- The trap should be readily accessible for periodic maintenance and sediment removal.
- Remove sediment when it has accumulated to one-half the design depth.
- Inspect sediment trap after each significant rainfall event.
- Clean or replace spillway gravel facing if clogged.
- Promptly replace any displaced riprap, being careful that no stones in the spillway are above design grade.



* GRAVEL SHALL BE 2"-3" CLEAN STONE

NOTE:
PROVIDE DIMENSIONS AND VOLUME
FOR AND LABEL EACH SEDIMENT
TRAP LOCATED ON THE PLANS.
(SEE SITE MAPS)



MAX DRAINAGE AREA:
5 ACRES

L (IN FEET) = 6' OR
1 x DRAINAGE AREA (AC)
WHICHEVER IS LARGER

SOURCE: DOUCET & ASSOCIATES, INC.

SCALE:
NOT TO SCALE

Temporary Sediment Trap

11/1/07
SED-20

Appendix E. 2024 Supplemental Erosion Summary Report & Erosion Proposal

Supplemental Turners Falls Impoundment Erosion Summary Report & Erosion Proposal

**Northfield Mountain Pumped Storage Project (No. 2485)
and Turners Falls Hydroelectric Project (No. 1889)**

Prepared for:



Prepared by:



APRIL 2024

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LIST OF ABBREVIATIONS

2013 FRR	Study No. 3.1.1 2013 Full River Reconnaissance Survey
401 WQC	401 Water Quality Certificate
BSTEM	Bank Stability and Toe Erosion Model
Commission	Federal Energy Regulatory Commission
CRSEC	Connecticut River Streambank Erosion Committee
CRWC	Connecticut River Watershed Council
CWA	Clean Water Act
ECP	Erosion Control Plan
Erosion Causation Study	Study No. 3.1.2 Northfield Mountain/Turners Falls Operations Impacts on Existing Erosion and Potential Bank Instability
Erosion Proposal	Bank Erosion Proposal for the Turners Falls Impoundment
FCD	Franklin Conservation District
FERC	Federal Energy Regulatory Commission
FFP	Flow and Fish Passage
FLA	Final License Application
FRCOG	Franklin Regional Counsel of Governments
ft.	feet / foot
GPS	Global Positioning System
HEC-RAS	Hydraulic Engineering Center-River Analysis System
ILP	Integrated Licensing Process
LCCLC	Landowners and Concerned Citizens for License Compliance
MA	Massachusetts
MADEP	Massachusetts Department of Environmental Protection
NH	New Hampshire
NMFS	National Marine Fisheries Service
Northfield Mountain Pumped Storage Project	Northfield Mountain Pumped Storage Project (FERC No. 2485)
Operations Model	HEC-ResSim Operations Model
PME	Protection, mitigation, and enhancement
RSP	Revised Study Plan
S&A	Simons & Associates
SD2	Scoping Document 2
Sediment Management Plan	Study No. 3.1.3 Northfield Mountain Project Sediment Management Plan
SPD	Study Plan Determination
Study 3.1.1	Study No. 3.1.1 2013 Full River Reconnaissance Survey

Study 3.1.2	Study No. 3.1.2 Northfield Mountain/Turners Falls Operations Impacts on Existing Erosion and Potential Bank Instability
Study 3.1.3	Study No. 3.1.3 Northfield Mountain Project Sediment Management Plan
Study 3.2.2	Study No. 3.2.2 Hydraulic Study of Turners Falls Impoundment, Bypass Reach and below Cabot Station
TFI	Turners Falls Impoundment
Turners Falls Project	Turners Falls Hydroelectric Project (FERC No. 1889)
USACE	United States Army Corps of Engineers
VT	Vermont

1 INTRODUCTION

The Turners Falls Hydroelectric Project (Turners Falls Project, FERC No. 1889) and Northfield Mountain Pumped Storage Project (Northfield Mountain Project, FERC No. 2485), collectively “the Projects”, are located on the Connecticut River in the Commonwealth of Massachusetts. The Turners Falls Dam impoundment extends upstream into the States of New Hampshire and Vermont. FirstLight MA Hydro LLC is the owner of the Turners Falls Project, while Northfield Mountain LLC is the owner of the Northfield Mountain Project (collectively, “FirstLight”). The current licenses for the Turners Falls and Northfield Mountain Projects were issued on May 5, 1980 and May 14, 1968, respectively. Both licenses expired on April 30, 2018, and both Projects are now operating under annual licenses. FirstLight is in the midst of relicensing the Projects with the Federal Energy Regulatory Commission (FERC or Commission) utilizing FERC’s Integrated Licensing Process (ILP). The next major step in the licensing process is for FirstLight to apply for Clean Water Act (CWA) Section 401 Water Quality Certification (401 WQC) with the Massachusetts Department of Environmental Protection (MADEP).

In Scoping Document 2 (SD2), FERC noted that the “...effects of Project induced water level fluctuations in the Turners Falls Impoundment (TFI), on shoreline stability and river bank erosion particularly where river bank erosion might impact protected plant species, critical wildlife habitat, adjacent structures, recreational use facilities, and/or private landowners within the Project boundary” should be analyzed as part of the licensing process. As a result, FirstLight conducted numerous studies and supplemental analyses over the course of the licensing to evaluate potential impacts of Project operations on bank erosion and sediment transport throughout the TFI. Such studies include:

- Study 3.1.1 *2013 Full River Reconnaissance Survey* (Study 3.1.1 or 2013 FRR)
- Study 3.1.2 *Northfield Mountain/Turners Falls Operations Impacts on Existing Erosion and Potential Bank Instability* (Study 3.1.2 or Erosion Causation Study)
- Study 3.1.3 *Northfield Mountain Project Sediment Management Plan* (Study 3.1.3 or Sediment Management Plan)
- *Supplemental BSTEM Modeling Report Reflecting Operating Conditions in the Flows and Fish Passage Settlement Agreement* (March 2024)¹

Furthermore, the *Final Massachusetts Integrated List of Waters for the Clean Water Act 2022 Reporting Cycle* (May 2023) lists two impairments within the TFI from the Massachusetts – Vermont/New Hampshire border to the Turners Falls Dam. These impairments include:

- Alteration in Stream-side or Littoral Vegetative Covers, with the source of impairment listed as Streambank Modifications/Destabilization
- Flow Regime Modification, the source of the impairment listed as Impacts to Hydrostructure Flow Regulation/Modification

Based on the results of the aforementioned studies and analyses, FirstLight developed its *Bank Erosion Proposal for the Turners Falls Impoundment* (Erosion Proposal), which was filed with the Commission on March 22, 2024 and is detailed in [Section 4](#) of this report.

The purpose of this report is to provide a summary of the various erosion evaluations that have been conducted over the course of the relicensing, which have culminated in FirstLight’s Erosion Proposal. The Erosion Proposal details FirstLight’s proposed protection, mitigation, and enhancement (PME) measures to address the impairments noted above as they pertain to bank erosion in the TFI.

¹ This report superseded previous supplemental reports as discussed in [Section 3](#).

2 GEOMORPHIC SETTING

The Connecticut River is primarily an alluvial river which formed after the end of the most recent ice age (approximately 15,000 years before present). The river flows in a southerly direction through New England and into Long Island Sound passing through a number of impoundments formed by dams, many of which are relatively low head hydropower facilities. One such impoundment is the Turners Falls Impoundment (TFI), which extends approximately 20 miles in length through Vermont, New Hampshire, and Massachusetts. The TFI begins in the south at the Turners Falls Dam in Montague, MA and extends north to the Vernon Dam in Vernon, VT. The TFI provides a wide variety of uses including hydropower generation, agriculture, and recreation. Land-use adjacent to the TFI is primarily agriculture or forested with some development in select areas. Due to a variety of factors including the geomorphic and geologic composition of the TFI, hydrologic and hydraulic conditions, adjacent land-use, and various other TFI uses, erosion has been a long term concern of landowners, adjacent municipalities, and various stakeholder groups.

In the late 1970s, the U.S. Army Corps of Engineers (USACE) commissioned a study of erosion along approximately 140 miles of the Connecticut River extending from the Turners Falls Dam upstream through the Wilder Hydroelectric Project Impoundment that documented erosion sites along the river and analyzed the causes of erosion ([USACE, 1979](#)). Experimental bank protection methods were employed and constructed in the 1970's by the USACE to stabilize banks in the TFI along a short reach downstream of the Route 10 Bridge. Additionally, during this time, other reaches of the TFI were lined with rip-rap using rock from the construction of the Northfield Mountain Project to further protect banks in the vicinity of the tailrace.

Additional studies of erosion were conducted in the 1990s culminating in the development of the Erosion Control Plan (ECP) in 1998 ([Simons, 1999](#)). As part of the ECP a reconnaissance survey of the length of the TFI banks was conducted to identify and rank erosion sites. From this survey, a list of the 20 most severely eroded sites was developed. Following completion of this list FirstLight's predecessors began to stabilize these sites using bio-engineering techniques. The 1998 list of sites has served as the basis for the construction of 26,125 linear feet of stabilization efforts since 1999.

Fifteen of the twenty sites identified in 1998 have been stabilized utilizing a range of bioengineering techniques. In general, these projects have succeeded in meeting the objectives of the ECP by stabilizing eroding slopes, protecting adjacent property, and reducing sediment loading to the river. Of the five sites not stabilized, two are in areas where extreme hydraulic conditions exist that are not Project related (just below Vernon Dam and just upstream of the Route 10 Bridge), one site is located on an island (island locations have typically not been as high a priority to repair as bank locations), and two other sites were not selected for stabilization based on feedback from stakeholders and landowners. [Table 2-1](#) denotes the status of the 20 most severely eroded sites identified during the 1998 FRR.

In addition to the 26,125 linear feet of TFI banks that have been stabilized since 1998, previous stabilization work associated with construction of the Northfield Mountain Project totaled 25,900 feet of rip-rap or rip-rap with vegetation with an additional 2,600 feet of grading and planting. An additional 2,000 feet of experimental stabilization was also constructed by the USACE in the 1970s. Overall, approximately 56,625 linear feet (10.7 miles) of TFI banks have been stabilized through construction of the Northfield Mountain Project, implementation of the ECP, or other efforts (e.g., USACE).

Since inception of the 1998 ECP, TFI bank conditions with respect to erosion have improved. The 1998 FRR identified 3.4% of TFI banks as being Severely eroded while the 2013 FRR found that only 0.6% of banks were classified as having Extensive erosion.² The majority of the 20 most severely eroding sites

² Due to classification differences between the 1998 and 2013 FRR's "Severely Eroded" and "Extensive Erosion" were the most severe erosion classifications for the 1998 and 2013 FRR, respectively.

identified in 1998 have successfully been treated, are now stable and supporting heavy vegetation, and have not experienced any significant erosion. Moreover, erosion sites in 1998 were quite large in magnitude and stark in appearance with very little vegetation and significant potential for ongoing erosion and sediment production. By contrast, during the most recent FRR eroding sites were found to be generally smaller in magnitude with a greater degree of vegetation. In addition, based on the findings of the 2013 FRR it was observed that from 2008 to 2013 there has been an increase in bank stability, and therefore a corresponding decrease in eroding banks, of approximately 1.5%.

To put the current health of TFI banks with respect to erosion processes into context and to better understand the current condition of the TFI the results of the 2013 FRR were compared with the conclusions of the Connecticut River bank erosion comparison study conducted by Simons and Associates (S&A) in 2012 ([Simons, 2012](#)). The 2012 S&A report was the result of recommendations made in Field ([2007](#)) to study patterns of erosion in other reaches of the Connecticut River as a means of comparison to the conditions of the TFI. The 2012 S&A report compared bank erosion along the Connecticut River from Holyoke Dam (Holyoke, MA), upstream through various hydropower impoundments (including Turners Falls, Bellow Falls, and Wilder), and continuing to the un-impounded, free-flowing reach from Pittsburg, NH to Gilman Dam. The study reach was approximately 240 miles long. Key conclusions from the 2012 S&A report, which were reinforced by the results of the 2013 FRR, found that:

- The segment of river with the greatest extent of eroding banks is the un-impounded northern reach (Pittsburg, NH down to Gilman Dam). At the time of the available study ([Field, 2004](#)), 48.4% of the un-impounded banks were experiencing moderate or more significant erosion. Banks that had been rip-rapped covered 17.1% of the length of the river.³
- Despite the fact that similar percentages of banks have been stabilized in the northern, free flowing reach and in the TFI; the percentage of erosion in the TFI is only about one-third the extent of erosion that is occurring in the northern, un-impounded reach of the Connecticut River (16.7% compared to 48.4%).
- Several erosion sites were identified and photographed in the Bellows Falls, Vernon, Turners Falls, and Holyoke Impoundments in 1997. These erosion sites were photographed again in 2008. All erosion sites in 1997 in the Bellows Falls and Holyoke Impoundments, and all but one of the 1997 erosion sites in the Vernon Impoundment, remained in essentially the same state of erosion when photographed in 2008. Many of these sites are significant in both size and severity. In contrast, most of the erosion sites in the TFI in 1998 have been stabilized and are no longer eroding as of 2008, with several additional erosion sites scheduled to be stabilized as part of the 1998 ECP by 2012.
- In addition to the direct stabilization of many of the erosion sites in the TFI that were identified in the 1998 ECP, there is evidence of some natural stabilization processes including increased upper bank vegetation and areas of dense low bank aquatic vegetation that are helping provide a degree of additional stability in some areas.
- Based on the state of erosion in the northern un-impounded reach as well as the state of continued erosion in the Bellows Falls, Vernon and Holyoke impoundments it can be concluded that the banks in the TFI are in the best condition (more stable and less eroding) than in any other part of the Connecticut River examined.

³ The study reach along the Connecticut River from Pittsburg, NH to Gilman Dam is 85 miles.

Table 2-1: Twenty Sites with Highest Erosion Rank from the Erosion Control Plan (1998) and Current Status (2020)

Site #	Site Name	Length in feet 1998	Status
1	Vernon Dam	827	Base of Vernon dam. Left Bank (looking downstream) - Not selected for stabilization due to extreme hydraulic conditions associated with Vernon spillway
2	Rod & Gun Club	20	Restored - 240 ft. stabilized in 2004 – Turners Falls Rod & Gun Club
3	Bennett Meadow	100	Restored - 50 ft. stabilized in 2005 – Bennett Meadows
4	Urgiel Upstream	1150	Restored - 1200 ft. stabilized in 2001 – Urgiel Upstream
5	RT. 10	730	Upstream of RT 10 Bridge Left Bank - Not selected for stabilization due to unique hydraulic conditions in the vicinity of the Route 10 Bridge
6	Skalski	1640	Restored - 1600 ft. stabilized in 2004 – Skalski
7	Flagg Farm	2180	Restored - 2500 ft. stabilized 1999-2000 – Flagg
8	West bank	630	Not selected for stabilization – opposite great meadow
9	Old VT bridge west bank	260	Restored - 915 ft. stabilized in 2007 – Kendall
10	River Road	500	Restored - 980 ft. stabilized in 2003 – River Road
11	Urgiel Downstream	690	Restored - 980 ft. stabilized in 2005 – Urgiel Downstream
12	Durkee Point	20	Restored - 500 ft. stabilized in 2003 – Durkee Point
13	Across from River Road	20	Restored - Stabilized in 2009 – 1725 ft., Split River
14	Country Road (south)	2300	Restored - 850 ft. stabilized in 2006 – Country Road (includes site #20)
15	NH island	210	Point of island. Not recommended for restoration, except for possible Preventative Maintenance work
16	Kaufold/Split River farm	4000	Restored – Stabilized in 2010-2012 – 1360 ft., Upper Split River 1; 1000 ft., Upper Split River 2; 1250 ft., Bathory-Gallagher; Wallace-Watson, 1000 ft. (Note: The combination of these sites was formerly known as the Kaufold site)
17	Rod & Gun Club at Narrows East Bank	560	Restored - 1000 ft. stabilized by preventative maintenance in 2008 – Montague
18	Narrows	700	Restored - 1000 ft. stabilized by preventative maintenance in 2008 – Campground Point
19	VT	450	Not selected for stabilization – below Davenport Island
20	Country Road (North)	480	Restored - 850 ft. stabilized in 2006 – Country Road (included as part of site # 14)

3 CHRONOLOGY OF EROSION EVALUATIONS CONDUCTED DURING RELICENSING

The Erosion Proposal ([Section 4](#)) represents the culmination of 11 years of agency and stakeholder consultation, study, and analysis. During this time, the analyses that were conducted to evaluate bank erosion included holistic qualitative geomorphic evaluations and peer review of existing literature, extensive field data collection, quantitative engineering analyses, and computer modeling. The foundation for the Erosion Proposal is the studies conducted during relicensing, namely Study 3.1.1 (2013 FRR) and Study 3.1.2 (Erosion Causation Study) as well as the supplemental computer modeling and analyses that have occurred since completion of the studies. The methodology for each of these studies were established through extensive consultation with resource agencies (including MADEP), non-governmental organizations, and other stakeholder groups over the past 11 years. Consultation included providing numerous drafts of study plans, interim reports and deliverables, final reports, receiving and responding to written and verbal comments, as well as numerous public meetings. [Appendix A](#) provides a consultation summary as it pertains to Studies 3.1.1 and 3.1.2, while [Table 3-1](#) presents an overview of relevant reports for Studies 3.1.1, 3.1.2, and 3.1.3. A high-level overview of each study is provided in the ensuing sections.

Table 3-1: Chronology of Erosion Evaluations Conducted During Relicensing

Study / Evaluation	Document Name	Year Issued ¹	Study / Document Description
Study No. 3.1.1, 3.1.2, and 3.1.3	Revised Study Plan ²	August 2013	Study plans detailing methodology for each study
Study No. 3.1.1 2013 Full River Reconnaissance	Final Report	September 2014	Holistic, qualitative desktop analysis and field-based survey to identify and define bank features, characteristics, and erosion conditions throughout the TFI
Study No. 3.1.2 Northfield Mountain/Turners Falls Operations Impacts on Existing Erosion and Potential Bank Instability	Selection of Detailed Study Sites Report	September 2014	Selection of representative detailed study sites spanning the TFI where data collection would occur to inform qualitative and quantitative assessments as well as computer modeling
Study No. 3.1.1 2013 Full River Reconnaissance	Addendum to Final Report	April 2015	Supplemental information to complement the September 2014 final report
Study No. 3.1.3 Northfield Mountain Project Sediment Management Plan	Final Report	October 2016	Field data collection, computer modeling, and analyses associated with the Project’s Sediment Management Plan to avoid or minimize the entrainment of sediment into the Project works during reservoir maintenance drawdowns
Study No. 3.1.2 Northfield Mountain/Turners Falls Operations Impacts on Existing Erosion and Potential Bank Instability	Final Report (Volumes I-III)	April 2017 ³	Comprehensive assessment of TFI erosion to determine the causes of erosion at each bank segment throughout the TFI. The comprehensive assessment included: (1) holistic, qualitative geomorphic assessments and existing literature review, (2) quantitative engineering and geomorphic analyses, and (3) computer modeling
Supplemental Erosion Evaluation	Supplemental BSTEM Modeling Report Reflecting Operating Conditions in the Flows and Fish Passage Settlement Agreement	March 2024 ⁴	Computer modeling evaluating the operating conditions in the Flows and Fish Passage Settlement Agreement and their potential impact on bank erosion throughout the TFI
Summary Report	Supplemental Turners Falls Impoundment Erosion Summary Report & Erosion Proposal	April 2024	Summary report providing an overview of the erosion evaluations conducted during relicensing, culminating in FirstLight’s TFI Erosion Proposal

Notes:

¹ Reports noted in the table reflect final reports only. For each study, there were numerous study progress reports, interim deliverables, or other related FERC filings. Such interim filings were superseded by the final reports noted in the table above. The full list of filings is contained within Appendix A of FirstLight’s 401 WQC Application.

² Note that the methodologies of some study plans contained within the Revised Study Plan were modified by FERC via their Study Plan Determinations that were issued throughout the relicensing process

³ The April 2017 filing superseded the October 2016 filing

⁴ Following the filing of the Final License Application (FLA), FirstLight conducted several supplemental analyses pertaining to proposed Project operations and potential impacts to bank erosion (i.e., Amended FLA, March 11, 2013 supplemental evaluation). Such filings have been superseded by the March 2024 supplemental report.

3.1 Study No. 3.1.1 Full River Reconnaissance

The goal of Study 3.1.1 was to identify and define bank features and characteristics and the types, stages, indicators, and extent of erosion throughout the TFI. Erosion classifications occurred at a reconnaissance level without reference to the cause of erosion. Specific objectives of the study included:

- Conduct a land-based investigation of the banks and islands to document indicators of potential erosion and potential bank instability;
- Identify land-use practices within 200 feet of the bank and islands from Turners Falls Dam to Vernon Dam;
- Identify and define bank features and characteristics such as bank slope, height, sediment composition, and vegetation using clearly defined, and easily repeatable, classification techniques;
- Identify and define the type, stage, indicators, and extent of erosion in the TFI using clearly defined, and easily repeatable, classification techniques;
- Identify and map the location(s) of sensitive receptors, including important wildlife habitat, along the banks and islands of the impoundment;
- Spatially define, using a global positioning system (GPS), the transition points where bank characteristics or features change from one classification to another;
- Create video and photographic documentation of all banks classified including geo-referenced video and reproduction of the photo log used by Field Geology Services as part of the report titled *Fluvial Geomorphology Study of the Turners Falls Pool on the Connecticut River between Turners Falls, MA and Vernon, VT* (FGS, 2007);
- Conduct an evaluation of past bank stabilization projects and provide recommendations for future projects based on the results of the FRR;
- Conduct data evaluation based on the features identified in the field including, but not limited to: distribution and summary statistics, assessment of changes in bank conditions in context of the “*Erosion Control Plan for the Turners Falls Pool of the Connecticut River*” (S&A, 1999), and evaluation of change in bank conditions since previous FRRs;
- Create various maps and geospatial datasets based on the information gathered in the field. Maps generated included: bank features and characteristics, erosion type, erosion stage, extent of erosion, potential bank instability, land-use, and bank stabilization site locations (current and recommended); and
- Develop a final report describing and summarizing the findings of the 2013 FRR including all data evaluation, mapping, and field documentation.

The methodology and scope defined in this study took into consideration various recommendations made in Field (2007) and were approved with modifications by FERC in their Study Plan Determination (SPD) issued September 13, 2013 (FERC, 2013). In addition, FirstLight consulted with, and sought approval from, MADEP regarding the methodology and personnel⁴ conducting this study. MADEP approved this study following a meeting at the Northfield Visitors Center on November 4, 2013.

The boat-based survey identified and recorded the coordinates of the start and end points of bank segments based on common bank features, characteristics, and erosion conditions as defined in the Revised Study

⁴ Personnel conducting this study included a fluvial geomorphologist/hydraulic engineer, geotechnical engineer, wildlife biologist, environmental scientist/bank restoration design and permitting specialist, and various technical support staff.

Plan (RSP) ([FirstLight, 2013](#)). The 2013 boat-based survey resulted in the delineation of 641 total bank segments including islands. The land-based survey, conducted simultaneously with the boat-based survey as per MADEP request, identified and defined indicators of potential erosion and bank instability as well as erosion features that may not have been visible from a boat. Land-based segments were delineated and defined based on features and characteristics observed while traversing the top of the bank throughout the entire TFI, including islands. Detailed geotechnical and geomorphic assessments, including field notes, sketches, and photographs, were also conducted at areas of interest as noted by the fluvial geomorphologist and geotechnical engineer. Observations made during the land-based survey were used to complement the findings of the boat-based survey and provide supplemental information and perspective to the overall assessment of TFI banks.

The results of the 2013 FRR indicated that the majority of the upper banks in the TFI were found to have moderate or steep slopes, heights greater than 12 ft., be comprised of silt/sand, and have heavy vegetation. The majority of the lower banks were found to have flat/beach to moderate slopes, be comprised of silt/sand, and have none to very sparse vegetation. Erosion conditions in the TFI were found to be generally stable with 'None/Little' current erosion occurring through much of this reach. As noted in the report, the 2013 FRR also found the following:

- **Extent of Erosion:** 84.8% of the total length of the TFI banks were found to have 'None/Little' erosion, 14.1% 'Some' erosion, 0.5% 'Some to Extensive' erosion, and 0.6% 'Extensive' erosion.
- **Stage of Erosion:** 83.5% of the total length of TFI banks were found to be 'Stable', 5.5% indicated 'Potential Future Erosion', 0.6% were found to have 'Active' Erosion, 9.1% were found to be 'Eroded', and 1.3% were in the 'Process of Stabilization'.

The final report (Section 8) also provided a detailed review of the history of stabilization projects throughout the TFI, an evaluation of existing bank stabilization projects, and discussion pertaining to general considerations for preventative maintenance and bank stabilization projects.

The final report for the study was filed with FERC in September 2014 ([FirstLight, 2014a](#)), with an addendum filed in April 2015 ([FirstLight, 2015](#)).

3.2 Study No. 3.1.2 Northfield Mountain / Turners Falls Operations Impacts on Existing Erosion and Potential Bank Instability

The goal of Study 3.1.2, as defined in the RSP ([FirstLight, 2013](#)), was to evaluate and identify the causes of erosion in the TFI and to determine to what extent they are related to Project operations. To accomplish these goals, the study had the following objectives:

- Conduct a thorough data gathering and literature review of existing relevant data to identify data gaps;
- Conduct field investigations and field data collection to fill data gaps. Gather the field data required to conduct detailed analyses of the causes of erosion and forces related to them;
- Develop an understanding of the historic and modern geomorphology of the Connecticut River. Conduct a historic geomorphic assessment to provide context for analyzing the modern geomorphology of the Connecticut River;
- Identify the causes of erosion present in the TFI, the forces associated with them, and their relative importance at a particular location. Conduct various data analyses to gain a better understanding of these causes and forces;
- Identify and establish fixed bank transects representative of the range of bank features, characteristics, and conditions present in the TFI;
- Conduct detailed studies and analyses of erosion processes at the fixed bank transects;
- Evaluate the causes of erosion using the field collected data and the results of the data analyses, including quantifying and ranking all causes present at each fixed bank transect as well as in the TFI in general; and
- Develop a final report that summarized the findings of the study and the methods used.

During development of the RSP FirstLight conducted an in-depth literature review and data gathering effort which provided the foundation for the study and allowed for the identification of potential data gaps. In addition, FirstLight developed a list of the potential causes of erosion which may be present in the TFI. The preliminary list of potential causes of erosion was then divided into two categories: 1) potential primary causes of erosion, and 2) potential secondary causes of erosion. From this, the following classifications were developed (in no particular order):

Potential Primary Causes of Erosion

- Hydraulic shear stress due to flowing water
- Water level fluctuations due to hydropower operations
- Boat waves
- Land management practices and anthropogenic influences
- Ice

Potential Secondary Causes of Erosion

- Animals
- Wind waves
- Seepage and piping
- Freeze-thaw

Once the primary and secondary causes of erosion were identified, the next step was to identify the location of fixed bank transects (also known as detailed study sites) where erosion processes would be investigated in depth. The final set of detailed study sites were selected in collaboration with stakeholders and were

presented in FirstLight (2014b).⁵ Stakeholders consulted during this process included: the Connecticut River Streambank Erosion Committee (CRSEC), Connecticut River Watershed Council (CRWC), Franklin Regional Council of Governments (FRCOG), Landowners and Concerned Citizens for License Compliance (LCCLC), National Marine Fisheries Service (NMFS), Massachusetts Riverways, and the Franklin Conservation District (FCD) as well as MADEP and FERC.

The final set of detailed study sites included 25 locations throughout the geographic extent of the TFI. Detailed study sites encompassed a representative range of bank features, characteristics, and erosion conditions and included several sites that had been previously restored as a result of the ECP. Sites were selected at existing, permanent transects (which have been surveyed annually since the 1990's) and at newly identified supplemental detailed study points. Supplemental detailed study points were proposed based on the results of the detailed geomorphic and geotechnical assessments conducted during the 2013 FRR (Study 3.1.1).

Once the final set of detailed study sites was established, field data collection efforts were carried out during 2014 with supplemental field work also conducted in 2015 and 2016 (ice monitoring). Field data that were collected (either as part of this study or other studies) included:

- TFI water level, flow, and Project operations data (Study 3.2.2 *Hydraulic Study of Turners Falls Impoundment, Bypass Reach and below Cabot Station* (Study 3.2.2));
- Bathymetric surveys of the TFI to support development of hydraulic models (Study 3.2.2);
- Bank features, characteristics, and erosion conditions as observed during the 2013 FRR (Study 3.1.1);
- Annual cross-section surveys at the existing, permanent transects and newly identified supplemental detailed study sites;
- Bank Stability and Toe Erosion Model (BSTEM) input parameters including: surface erodibility (critical shear stress), geotechnical strength (effective cohesion and friction angle), bulk unit weight, bank sediment particle-size distribution, maximum rooting depth of vegetation, and riparian species distribution;
- Vegetative parameters of five species including root density, distribution and root tensile-strength data;
- Boat-wave data and boat statistics for input into the BSTEM boat-wave algorithm;
- Suspended sediment concentration data (Study 3.1.3); and
- Ice monitoring photos

In addition, historic groundwater and boat wave data collected in the 1990's were examined.

Following the completion of the various field studies and data collection efforts, FirstLight conducted robust data analyses utilizing a combination of qualitative and quantitative assessments as well as computer modeling. This three-level approach provided a comprehensive, holistic assessment of erosion processes throughout the TFI that consisted of:

1. Qualitative geomorphic analysis:

The qualitative geomorphic analysis included developing a geomorphic understanding of the Connecticut River and TFI, including: (a) geomorphology of alluvial rivers; (b) geomorphic history of the Connecticut River; (c) analysis of historic datasets and publications (e.g., Field (2007)); (d)

⁵ The *Selection of Detailed Study Sites Report* was filed with FERC as part of the Relicensing Study 3.1.2 Initial Study Report Summary on September 15, 2014.

geomorphic analysis of tributaries and upland erosion features; and (e) erosion comparison of the TFI and Connecticut River.

2. Quantitative engineering and geomorphic analysis:

The quantitative engineering and geomorphic analysis included: (a) analysis of the hydrologic and hydraulic characteristics of the TFI based on field collected data and hydraulic model results; (b) sediment transport analysis; (c) analysis of hydraulic shear stress, water level fluctuations, boat waves, and ice as potential primary causes of erosion; and (d) analysis of land-use and land management practices via geospatial analysis.

3. Computer modeling:

Computer modeling was used to better understand the complex hydrologic, hydraulic, and geotechnical dynamics of the TFI. This included three models: a one-dimensional unsteady Hydraulic Engineering Center-River Analysis System (HEC-RAS) model, a two-dimensional River2D model, and BSTEM. The HEC-RAS model generated historic water levels and water surface slopes on an hourly basis through the TFI and at the 25 detailed study sites for inclusion into BSTEM and to support other analyses. The TFI River2D model provided information pertaining to the velocities and shear stresses in the near bank environment to better understand the complex hydraulics of the TFI and to enhance the understanding gleaned from the HEC-RAS model. BSTEM was used to better understand and evaluate erosion processes, and the forces associated with them at each of the 25 detailed study sites for the period 2000 to 2014. BSTEM is a state-of-the-science deterministic model that simulates the hydraulic and geotechnical processes responsible for bank erosion, including the effects of vegetation, pore-water pressure, and the confining forces due to flow in the channel.

The three-level approach ensured a proper understanding of the physical processes governing bank processes along the reach through the hydraulic action, transport of sediment, river form and response, interaction with infrastructure and/or biologic aspects of riverine morphology or habitat. The three-level approach allows for cumulatively supportive, scientifically justifiable results to be obtained. Each subsequent level of analysis builds on the understanding developed by the previous level.

Based on the results of the analyses discussed above, FirstLight evaluated the causes of erosion in the TFI, including the magnitude, location, and duration of the forces associated with erosion, to identify the dominant and contributing primary causes of erosion at each detailed study site. Secondary causes of erosion were also evaluated to the extent that they were found to be present at a given site. The BSTEM results from each detailed study site, combined with the results of the supplemental engineering and geomorphic analyses conducted as part of the three-level approach, were extrapolated across the TFI such that each bank segment identified during the 2013 FRR was assigned a cause(s) of erosion. The extrapolation process was a multi-step process that included analysis of the bank features, characteristics, and erosion conditions at each segment, the variability of hydraulic forces throughout the TFI, and the adjacent land-use. The end result of the extrapolation process was the quantification (based on relative percentages), of the dominant and contributing primary cause(s) of erosion at each detailed study site and the TFI overall.

The results of the analyses conducted as part of the three-level approach found that naturally occurring moderate and high flows have the greatest impact on erosion in the TFI, with hydropower operations having minimal impact. Boat waves are the dominant cause of erosion in the lower reach of the TFI (i.e., Barton Cove and the area immediately upstream). Ice has the potential to be a naturally occurring dominant cause of erosion in the TFI in the future given the right climactic conditions. Due to the hydrologic and hydraulic characteristics of the TFI, it is anticipated that hydropower operations will have limited to no impact on ice as related to bank erosion. Land management practices and anthropogenic influences are a potential contributing primary cause of erosion at almost half of the bank segments in the TFI. Potential secondary

causes of erosion such as wind waves, animals, seepage and piping, and freeze-thaw were found to be insignificant in causing erosion in the TFI beyond the limited, localized areas where they may exist.

The final report for the study (Volumes I-III) was filed with FERC in April 2017 ([FirstLight, 2017](#)).

3.3 Study No. 3.1.3 Northfield Mountain Project Sediment Management Plan

The purpose of Study 3.1.3 was to better understand sediment transport dynamics between the Connecticut River and the Northfield Mountain Project's upper reservoir. The goal of the study was to evaluate management measures to avoid or minimize the entrainment of silt into the Project works and the Connecticut River during future upper reservoir drawdowns. This study included several field data collection efforts, computer modeling, and analyses. Such efforts included (1) upper reservoir bathymetry surveys, (2) TFI suspended sediment monitoring, (3) computational hydrodynamic sedimentation modeling of the upper reservoir, (4) computational fluid dynamics sediment modeling of the Northfield Mountain Project intake/tailrace, (5) development of a physical model of the Project area, and (6) a pilot dredge of the upper reservoir. The results of the TFI suspended sediment monitoring were also used to inform Study 3.1.2.

The results of the study found that during normal Project operations material sediment releases are highly unlikely and that the periods of highest suspended sediment loads within the TFI corresponded with naturally occurring high flows. As such, the final study report identified management measures focused on minimizing the entrainment of sediment into the Project works and Connecticut River during dewatering activities. The final report for the study was filed with FERC in October 2016 ([FirstLight, 2016](#)).

3.4 Supplemental Erosion Evaluations

Following completion of the relicensing studies, supplemental evaluations were conducted to directly compare baseline conditions and various proposed operating regimes to determine the impact, if any, of proposed operations on TFI bank erosion. Supplemental evaluations were conducted for the Amended FLA and the March 2024 *Supplemental BSTEM Modeling Report Reflecting Operating Conditions in the Flows and Fish Passage Settlement Agreements* ([FirstLight, 2024](#)). The March 2024 report supersedes the analysis contained within the Amended FLA.

The March 2024 supplemental analysis was necessary because Study 3.1.2 only examined the impact of *existing* operations on TFI bank erosion under the current license whereas the March 2024 analysis evaluated the potential impact of *future* operations on TFI bank erosion under a new license as reflected in the March 31, 2023 Flow and Fish Passage (FFP) Settlement Agreement. The supplemental modeling used the same period of record as Study 3.1.2 and the same methodology except for how the hydraulic input parameters were determined. For Study 3.1.2, the hydraulic input parameters were based on historic empirical data whereas the hydraulic input parameters for the March 2024 analysis were based on the HEC-ResSim Operations Model (Operations Model) for both the baseline condition and proposed operating regime. Use of the Operations Model to determine hydraulic input parameters for both scenarios allowed for a direct comparison of the scenarios, which in turn allowed FirstLight to evaluate the impact, if any, of the proposed operating regime on TFI bank erosion.

A series of BSTEM production runs, utilizing the Operations Model-based hydraulic input data, were then executed to determine bank-erosion rates and the causes of erosion at each detailed study site under both scenarios. The BSTEM production runs utilized the same detailed study sites, geomorphic and geotechnical input parameters, and modeling period (i.e., 2000-2014) as that which were used for Study 3.1.2. The BSTEM results for the baseline condition and 2023 FFP scenarios were compared to determine the impact, if any, of the 2023 FFP operating regime on TFI bank erosion. Although the supplemental evaluation relied heavily on computer modeling, the foundation for that modeling was derived from the three-level approach conducted during Study 3.1.2 which included qualitative geomorphic assessments, quantitative engineering and geomorphic assessments, and computer modeling thus providing a holistic, comprehensive assessment of erosion processes throughout the TFI.

The results of the supplemental evaluation were generally consistent with those from Study 3.1.2 as well as the 1991 USACE report⁶ evaluating erosion in the TFI. Natural high flows are the dominant cause of bank erosion throughout the TFI (except for in the Barton Cove area where boat waves are the dominant cause), and Project operations have minimal impact. The final report for the supplemental evaluation was filed with FERC in March 2024 ([FirstLight, 2024](#)).

⁶ Following the 1991 USACE report, the USACE responded to comments from Northeast Utilities (previous Licensee) clarifying its findings. In their response, the USACE noted that “*It appears the Pages 31 and 32 of the July 1991 report have been misinterpreted by the Franklin County Commissioners and others. Our report does not say that “daily and weekly fluctuations of the Turners Falls Pool are the most important factor contributing to accelerated erosion.” It does indicate that tractive shear stress on the erodible (non-cohesive) river bank soils or river velocity during spring runoff periods and floods is the most important erosive factor (major force).*”

4 BANK EROSION PROPOSAL FOR THE TURNERS FALLS IMPOUNDMENT

Based on the results of the qualitative geomorphic assessments and existing literature review, quantitative engineering and geomorphic analysis, and computer modeling described in [Section 3](#), FirstLight developed the *Bank Erosion Proposal for the Turners Falls Impoundment* (Erosion Proposal). The Erosion Proposal represents the culmination of 11 years of agency and stakeholder consultation, study, and analysis and is developed based on the findings of extensive scientific analysis, which found that ([Figure 4-1](#)):

- The dominant cause of erosion throughout the TFI is high flows or, in the case of Barton Cove, boat waves;
- Project operations are not a *dominant* cause of erosion anywhere in the TFI; and,
- Project operations are found to be a *contributing* cause of erosion in Massachusetts in: (1) an approximately 21,600-foot-long reach from the exit of Barton Cove to the French King Gorge (both sides of the river), and (2) an approximately 4,700-foot-long reach on river right upstream of the Northfield Mountain tailrace.

The Erosion Proposal is designed to directly address the two impairments identified within the TFI by MADEP in the *Final Massachusetts Integrated List of Waters for the Clean Water Act 2022 Reporting Cycle* (May 2023), including:

- Alteration in Stream-side or Littoral Vegetative Covers, with the source of impairment listed as Streambank Modifications/Destabilization
- Flow Regime Modification, the source of the impairment listed as Impacts to Hydrostructure Flow Regulation/Modification

As a result, FirstLight proposes the following:

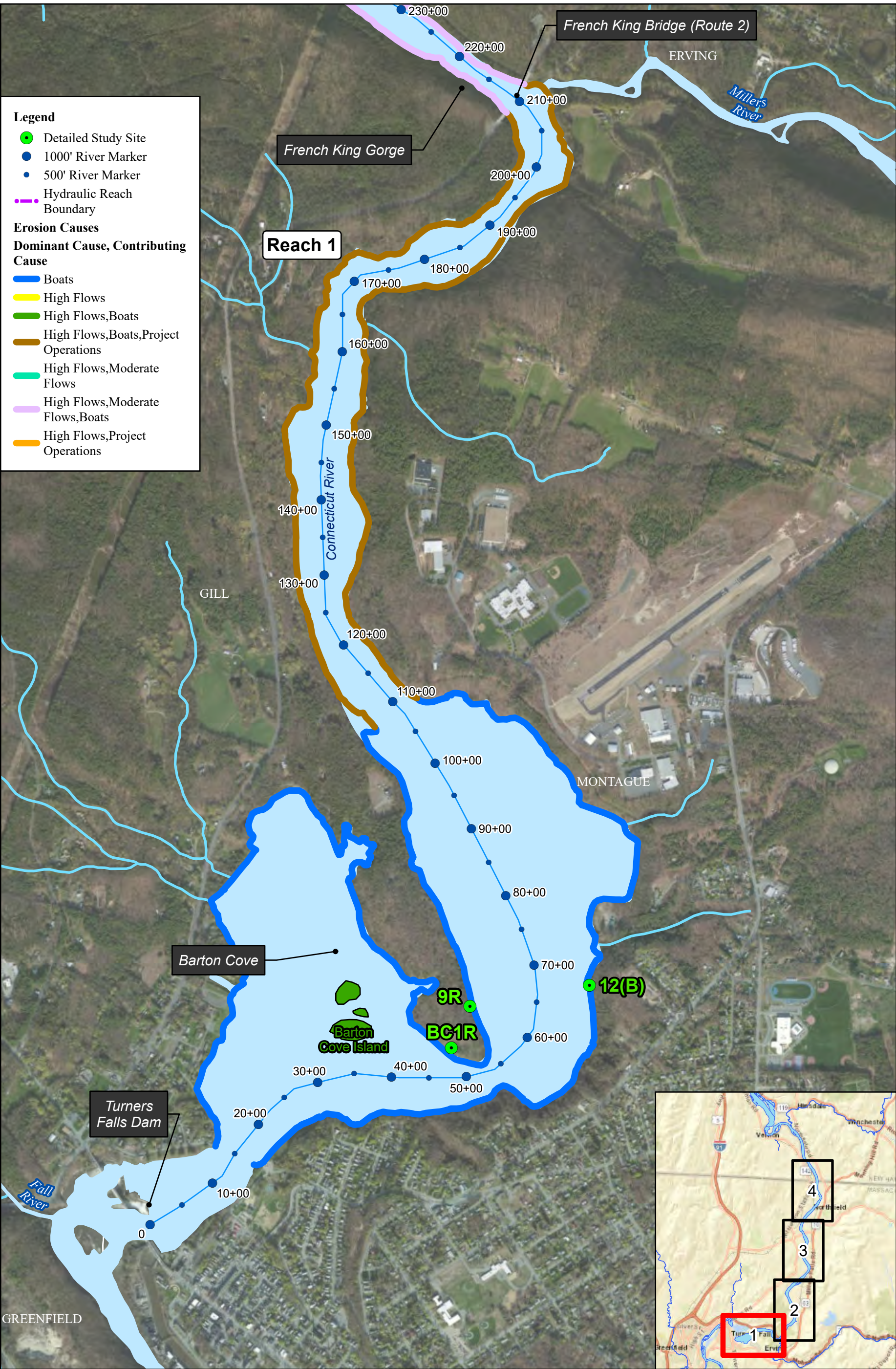
- As agreed to in the Recreation Settlement Agreement, conservation easements will be established along the TFI's riparian corridor on FirstLight owned land. The goal of the conservation easements will be to conserve the riparian buffers along the TFI, allow for the continued operation of the Bennett Meadow Wildlife Management Area, and conserve the 1.3 mile long portion of the New England National Scenic Trail in the Northfield Mountain Project boundary. Collectively, the conservation easements/restrictions that are part of the Turners Falls and Northfield Mountain Projects equates to approximately 761.4 acres.
- FirstLight will establish a boat wake restriction, in coordination with the Massachusetts Department of Conservation and Recreation, from the Turners Falls Dam extending upstream approximately two miles to where the TFI narrows to mitigate the impact of boat waves in the Barton Cove area.
- FirstLight will implement a shoreline erosion monitoring program for all TFI reaches in Massachusetts where the results of the March 2024 evaluation showed that proposed Project operations are a contributing cause of erosion ([Figure 4-2](#)).

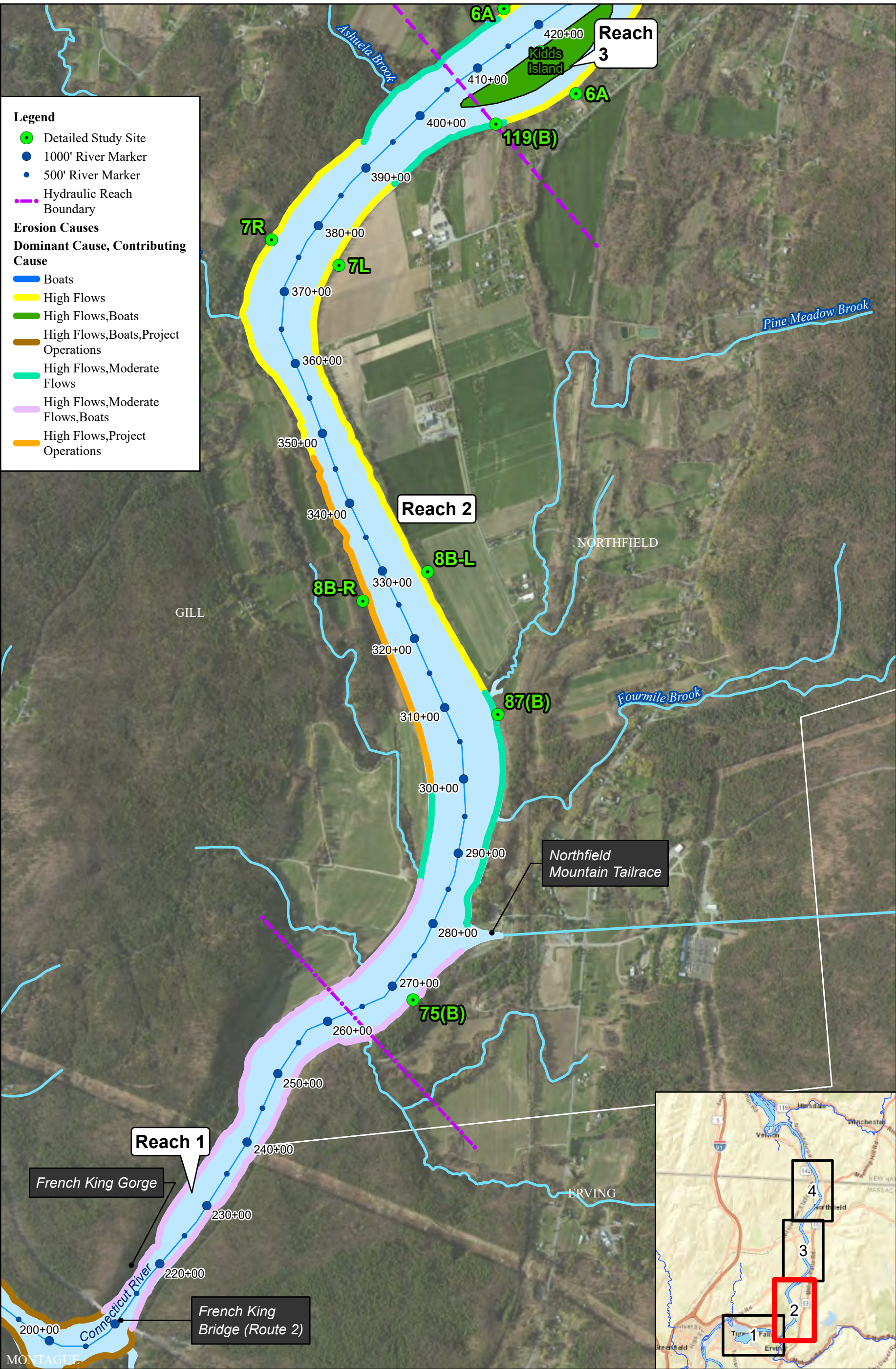
The shoreline erosion monitoring program would consist of the following:

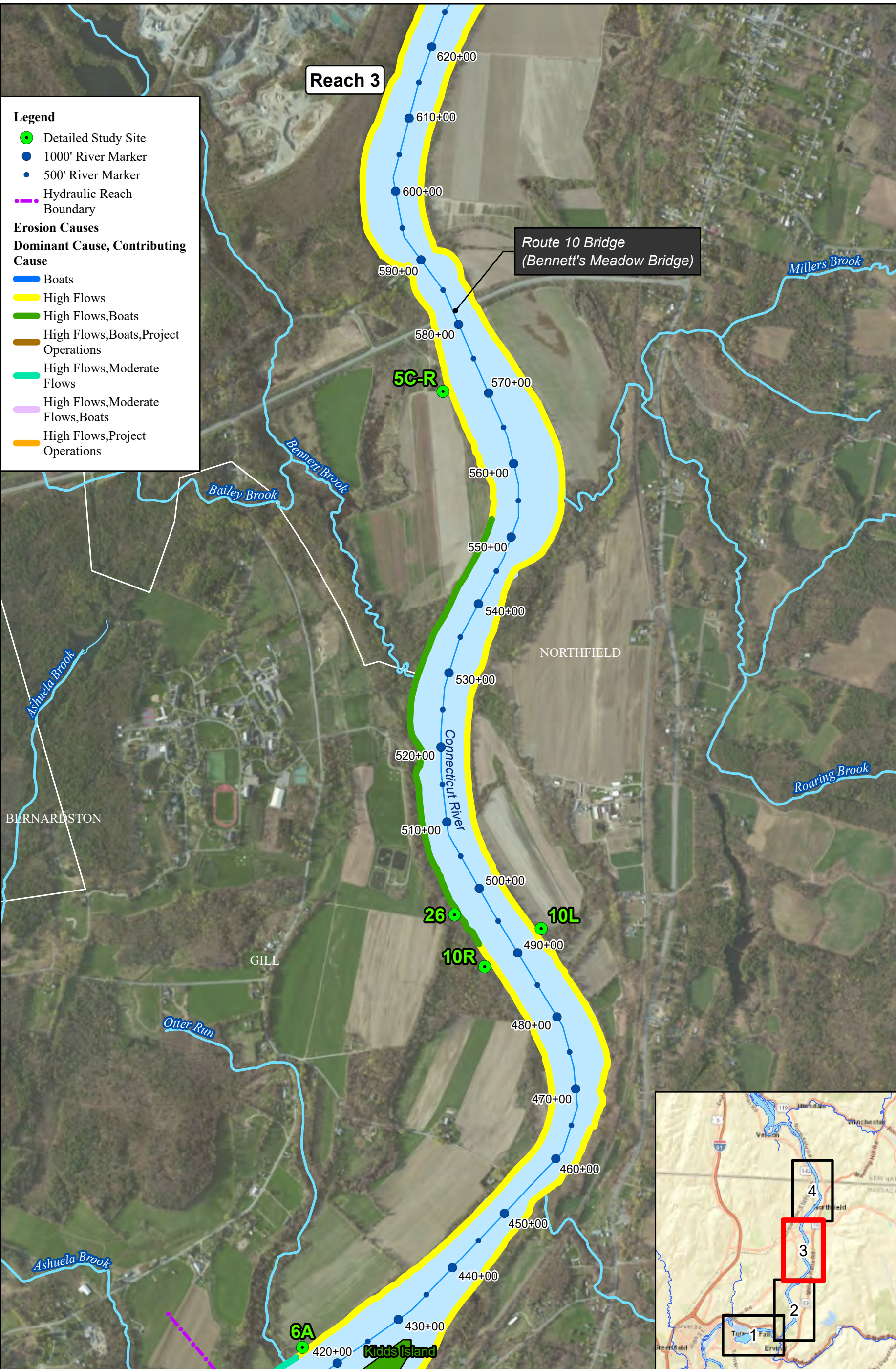
- Within one year of license issuance, FirstLight will develop a Shoreline Erosion Monitoring Plan in consultation with MADEP. MADEP will be responsible for approving the monitoring plan prior to FirstLight initiating any shoreline erosion surveys.

- FirstLight will conduct an initial shoreline erosion survey within two years of license issuance.
- FirstLight will conduct additional shoreline erosion surveys in Year 10, 20, 30, and 40 of the new license.
- Each erosion survey will consist of the following:
 - A reconnaissance survey of each TFI bank segment in Massachusetts where proposed Project operations are identified to be a contributing cause of erosion ([Figure 4-2](#)). The reconnaissance survey will characterize the bank characteristics and erosion conditions of each segment.
 - Cross-sectional surveys at existing detailed study sites within each TFI bank segment in Massachusetts where proposed Project operations are identified to be a contributing cause of erosion ([Figure 4-2](#)). If a detailed study site does not currently exist in such a reach (e.g., the reach from the Barton Cove exit to the French King Gorge), FirstLight will establish a representative detailed study site within that reach during the first erosion survey following license issuance. Any newly established detailed study sites will be re-surveyed during subsequent surveys.
- Following completion of each erosion survey, FirstLight will prepare a report summarizing the survey methods and results. The report will also identify surveyed bank segments that require stabilization or, in the event of a previously repaired bank segment, repair, if any. The report will be submitted to MADEP for approval.
- Upon approval from MADEP, FirstLight will complete the stabilization or repair measures identified in the final report, if any, within 5 years. Following completion of remediation activities, FirstLight will file as-built documentation (plans/photos) of the stabilization/repair efforts with MADEP.

Bank segments subject to future erosion monitoring are shown in [Figure 4-2](#) and include the 21,600-foot-long reach of river extending from the exit of Barton Cove to French King Gorge (river left and right) and the 4,700-foot-long reach associated with detailed study site 8B-R on river right upstream of the Northfield Mountain tailrace.





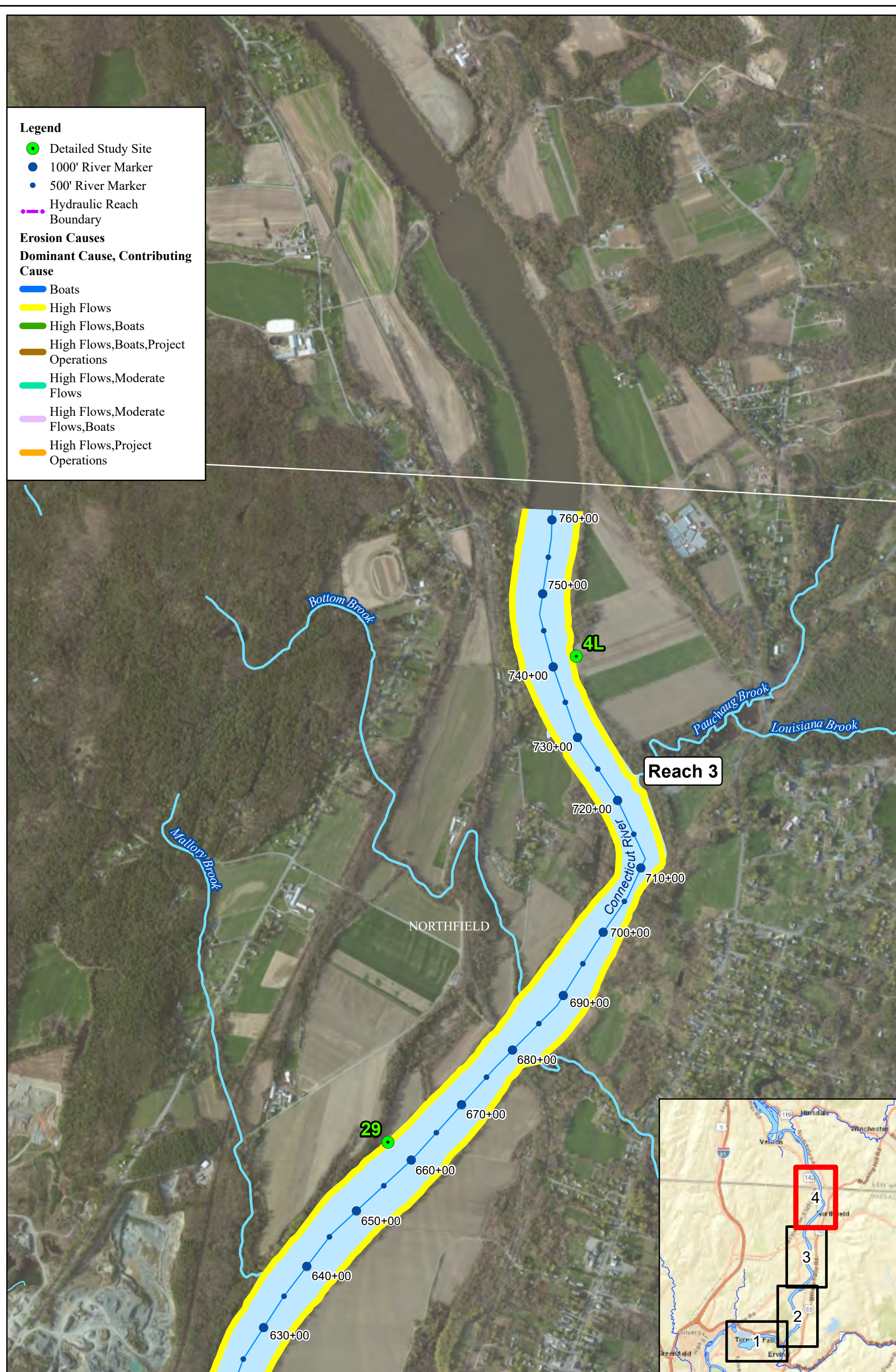


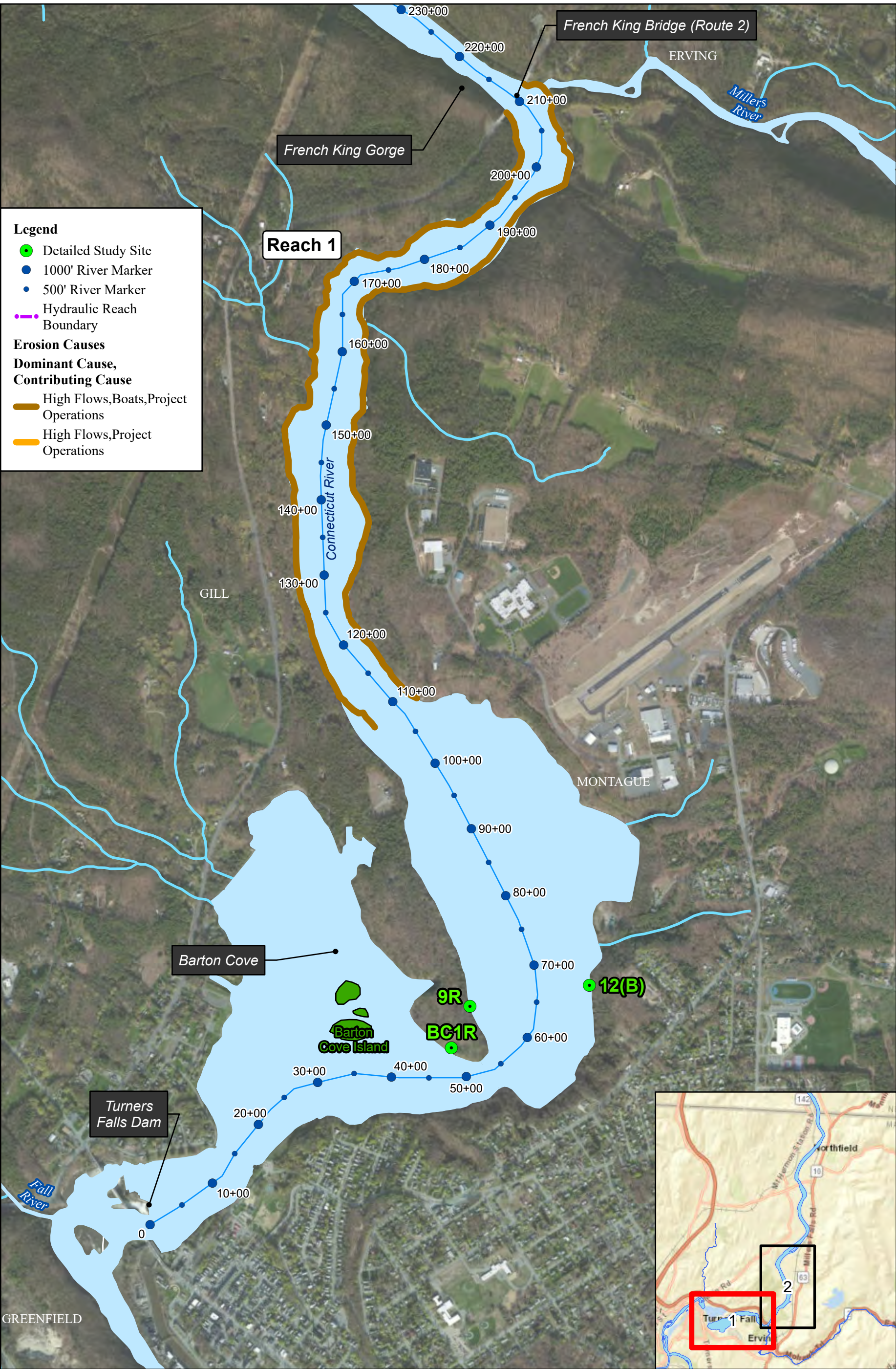
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

0 625 1,250 2,500
Feet

Figure 4-1:
Causes of Erosion for TFI Bank Segments
within Massachusetts
Map 3

Service Layer Credits: World Esri Imagery (Clarity) Basemap: Source: Esri, Maxar, Earthstar
Geographics, IGN, and the GIS User Community
World Esri Street Basemap: Esri, HERE, Garmin, NGA, USGS, NPS





Legend

- Detailed Study Site
- 1000' River Marker
- 500' River Marker
- Hydraulic Reach Boundary

Erosion Causes

Dominant Cause, Contributing Cause

- High Flows,Boats,Project Operations
- High Flows,Project Operations

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

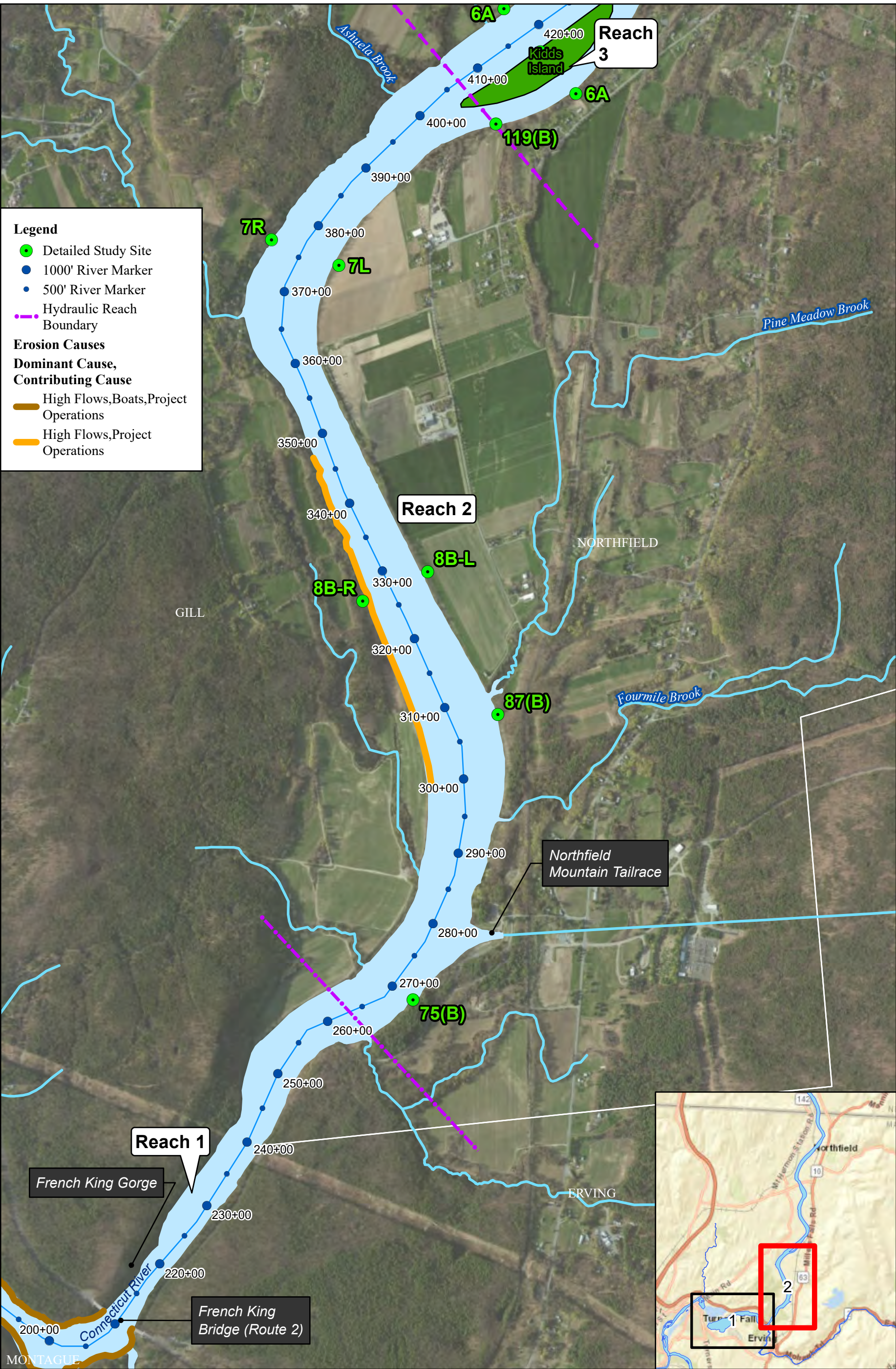
FirstLight

0 625 1,250 2,500 Feet

Figure 4-2:
TFI Bank Segments Subject to
Future Erosion Monitoring
Map 1

Service Layer Credits: World Esri Imagery (Clarity) Basemap: Source: Esri, Maxar, Earthstar
Geographics, IGN, and the GIS User Community
World Esri Street Basemap: Esri, HERE, Garmin, NGA, USGS, NPS

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Path: D:\FirstLight\GIS\maps\erosion\Initial_Erosion_Proposal\Initial_Erosion_Proposal.aprx



Legend

- Detailed Study Site
- 1000' River Marker
- 500' River Marker
- Hydraulic Reach Boundary

Erosion Causes

Dominant Cause, Contributing Cause

- High Flows,Boats,Project Operations
- High Flows,Project Operations

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

Figure 4-2:
TFI Bank Segments Subject to
Future Erosion Monitoring
Map 2

Service Layer Credits: World Esri Imagery (Clarity) Basemap: Source: Esri, Maxar, Earthstar
Geographics, IGN, and the GIS User Community
World Esri Street Basemap: Esri, HERE, Garmin, NGA, USGS, NPS

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APPENDIX A. CONSULTATION RECORD

Table A-1. Consultation Record Pertaining to Studies 3.1.1 and 3.1.2⁷

Date	Study	Consultation Description
January 30-31, 2013	-	FERC hosts public Scoping Meetings
March 1, 2013	-	MADEP issued its study request letter requesting two studies – Northfield Mountain/Turners Falls Operations Impacts on Sediment Transport and Water Quality Monitoring. FirstLight received over 200 comment letters
March 26, 2013	Study 3.1.1	FirstLight met with MADEP to discuss the 2013 FRR, Hydraulic and Geomorphic Analysis of Erosion in the TFI, and Water Quality Study
April 15, 2013	All	FirstLight filed its Proposed Study Plan
May 15, 2013	Study 3.1.1, 3.1.2	FirstLight met with CRSEC, FRCOG, FCD, CRWC, LCCLC, FERC, and MADEP to discuss the methodology for Study 3.1.1 and Study 3.1.2
June 14, 2013	Study 3.1.1, 3.1.2	FirstLight met with CRSEC, FRCOG, FCD, CRWC, LCCLC, FERC, and MADEP to discuss the methodology for Study 3.1.1 and Study 3.1.2
June 28, 2013	All	FirstLight filed its Updated Proposed Study Plan
July 12, 2013	Study 3.1.1, 3.1.2	MADEP filed its comments on Study 3.1.1 and Study 3.1.2. Numerous other stakeholders also filed comments on the studies.
August 14, 2013	All	FirstLight filed its Revised Study Plan
August 19, 2013	Study 3.1.2	FirstLight met with a subset of stakeholders to discuss Study 3.1.2
August 26, 2013	Study 3.1.1	FirstLight met with MADEP to discuss the methodology for Study 3.1.1
August 28, 2013	Study 3.1.1, 3.1.2	MADEP files comments on the Revised Study Plan
September 20, 2013	Study 3.1.1, 3.1.2	Following the August 26 th meeting, FirstLight sent MADEP a letter with the resumes for the consultants that would lead Studies 3.1.1 and 3.1.2, including Dr. Kit Choi, Dr. Robert Simons, and Dr. Andrew Simon
October 30, 2013	Study 3.1.1	FirstLight met with CRSEC to discuss the methodology for Study 3.1.1
November 5, 2013	Study 3.1.1	FirstLight met with MADEP to discuss the methodology for Study 3.1.1
December 13, 2013	Study 3.1.2	FERC issued an Interim Integrated Licensing Process schedule in its SPD. In the letter FERC states: <i>“In addition to the 19 deferred studies, stakeholders noted that the previously approved study 3.1.2: Project Impacts on Existing Erosion and Potential Bank Instability, did not consider ice process erosional effects within the Turners Falls reservoir. As a result, FirstLight requested that it be provided an opportunity to consider whether any modifications to the approved study are needed. Because any modifications to study 3.1.2 for this purpose could not be implemented in 2014 while Vermont Yankee is operational, we recommend that FirstLight evaluate the need for a study modification in consultation with stakeholders during the 2014 study season. FirstLight should present its findings and any proposed modifications to stakeholders, providing 30-days for stakeholder comment, and consider stakeholder input when determining the need for a modification to study 3.1.2. FirstLight should then present its findings and responses to stakeholder comments in its Initial Study Report (ISR) following the 2014 field season”.</i>
May 12, 2014	Study 3.1.2	FirstLight emailed MADEP a draft version of the Selection of Detailed Study Sites Report. The draft report included the locations where proposed field data collection efforts would occur.
June 4, 2014	Study 3.1.2	FirstLight met with MADEP to discuss the Selection of Detailed Study Sites Report and to seek input on the proposed locations for the field data collection efforts.
June 6, 2014	Study 3.1.2	FirstLight emailed CRWC, FRCOG, MADEP and the New Hampshire Department of Environmental Services (NHDES) the Selection of Detailed Study Sites Report, which incorporated MADEP’s comments. In that same email, FirstLight invited the same groups to a meeting on June 24, 2014 at the Northfield Mountain Visitors Center.
June 24, 2014	Study 3.1.2	FirstLight held a meeting attended by the CRWC, FRCOG, CRSEC, LCCLC, FERC, Massachusetts Riverways, NMFS, FCD, MADEP and Karl Meyer to consult on the Selection of Detailed Study Sites Report.

⁷ The consultation record contained herein reflects FirstLight’s best recollection of consultation that occurred over the past 11 years regarding relicensing Studies 3.1.1 and 3.1.2. Due to the extensive consultation that occurred it is possible that certain consultation activities may have been accidentally omitted from this table.

July 3-15, 2014	Study 3.1.2	CRWC, FRCOG, and MADEP (July 15) submitted via email comment letters to FirstLight in regard to the Selection of Detailed Study Sites Report and the June 24 meeting. FirstLight submitted via email a response to the Stakeholders on July 23, 2014. In that same email, FirstLight invited the Stakeholders to a meeting on August 4, 2014 at the Northfield Mountain Visitors Center.
July 23, 2014	Study 3.1.2	FirstLight submitted responses to the comments received on the Selection of Detailed Study Sites Report
August 2, 2014	Study 3.1.2	FRCOG provided comments on FirstLight's July 23, 2014 response.
August 4, 2014	Study 3.1.2	FirstLight held a meeting attended by CRWC, NMFS, FERC, FRCOG, CRSEC, and MADEP to discuss FirstLight's response and finalize the location of the detailed study sites.
August 12, 2014	Study 3.1.2	FirstLight emailed FERC, CRWC, FRCOG, MADEP, NMFS, MADEP, FCD, and LCCLC a proposed addendum to Study 3.1.2 to address ice issues as required by FERC in its December 13, 2013 SPD. Comments on the addendum were received from CRWC on September 11, 2014.
August 28, 2014	Study 3.1.2	CRSEC provided FirstLight a memo outlining information that would be included in the study report. Also on August 28, 2014, the CRSEC provided FirstLight a second memo relative to the definition of the upper and lower riverbank.
September 16, 2014	Study 3.1.1, 3.1.2	FirstLight filed its Initial Study Report, including an Initial Study Report Summary for Study 3.1.2 (including the final Selection of Detailed Study Sites Report) and the final report for Study 3.1.1
September 30-October 1, 2014	All	Initial Study Report Meeting
October 15, 2014	All	Initial Study Report Meeting Summary and Attachments
October 15, 2014	Study 3.1.1, 3.1.2	FirstLight met with MADEP and other stakeholders on Study 3.1.1 and 3.1.2
November 4, 2014	Study 3.1.2	FirstLight response to CRSEC August 28, 2014 Memo
November 4, 2014	Study 3.1.1, 3.1.2	Comments on Initial Study Reports for Study No. 3.1.1 and 3.1.2
November 14, 2014	Study 3.1.1, 3.1.2	Comments on Initial Study Report. No comments by MADEP. Comments received from CRWC, FRCOG (including a letter from the University of Illinois), and Northfield
December 15, 2014	Study 3.1.1, 3.1.2	FirstLight filed its responses to comments raised on the FRR and Erosion Causation Study.
January 9, 2015	Study 3.1.2	Request for erosion transect information
January 22, 2015	All	FERC issued its Determination Letter on the FRR. FirstLight was required to meet with stakeholders and file an addendum to the FRR by 04/22/2015. The only comment on the Erosion Causation study was that FERC required FirstLight to file progress reports.
February 24, 2015	Study 3.1.1	FirstLight sent MADEP and stakeholders a copy of the FRR addendum
March 3, 2015	Study 3.1.1	FRCOG submits letter to FirstLight regarding Study 3.1.1
March 4, 2015	Study 3.1.1	FirstLight hosts meeting with MADEP, NMFS, FERC, LCCLC, CRWC, and CRSEC to discuss the addendum to Study No. 3.1.1. At the end of the meeting, FirstLight requested comments on the Study 3.1.1 addendum by April 3, 2015. MADEP did not provide comments.
March 9, 2015	Study 3.1.1	FirstLight provides response to March 3 rd FRCOG letter
March 31, 2015	Study 3.1.2	FirstLight emailed stakeholders, including MADEP, information on groundwater data, boat wave data, TFI and flow data, and Project Boundary maps regarding Study 3.1.2
April 2, 2015	Study 3.1.1	FRCOG submits comments regarding the March 4, 2015 meeting and 3.1.1 addendum
April 22, 2015	Study 3.1.1	FirstLight files an Addendum to the final report for Study No. 3.1.1, including a consultation record
May 26, 2015	Study 3.1.2	FirstLight filed its 2015 Q1 data deliverable report for Study 3.1.2. The filing included information on groundwater data, boat wave data, TFI and flow data, and Project Boundary maps.
August 18, 2015	Study 3.1.2	Study No. 3.1.2 Progress Report No. 1

Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)
SUPPLEMENTAL TURNERS FALLS IMPOUNDMENT EROSION SUMMARY REPORT & PROPOSAL

September 14, 2015	Study 3.1.2	FirstLight filed its Updated Study Report Summary for Study 3.1.2. the filing included all of the 2015 correspondence log on Study 3.1.2.
September 30, 2015	Study 3.1.1, 3.1.2	FirstLight held its 2015 Updated Study Report Meeting. Studies 3.1.1 and 3.1.2 were discussed. MADEP attended the meeting.
October 15, 2015	Study 3.1.1, 3.1.2	FirstLight filed meeting minutes from 09/30/2015 USR meeting
October 22, 2015	Study 3.1.2	FirstLight filed information on Study 3.1.2 regarding the Exhibit K drawings.
December 14, 2015	Study 3.1.2	FirstLight filed its response to comments received on Study 3.1.2. No comments were filed by MADEP.
January 15, 2015	Study 3.1.2	FERC issued its Determination Letter on Study 3.1.2. FERC did not adopt any proposed changes to the study.
October 14, 2016	Study 3.1.2	FirstLight filed the final report for Study 3.1.2 - Vol I-III.
November 01, 2016	Study 3.1.2	FirstLight met with stakeholders, including MADEP on Study 3.1.2.
November 15, 2016	Study 3.1.2	FirstLight filed meeting minutes from 11/01/2016 meeting.
December 14, 2016	Study 3.1.2	MADEP filed comments on Study 3.1.2.
January 17, 2017	Study 3.1.2	FirstLight filed responses to comments on Study 3.1.2. This filing includes all comment letters.
February 17, 2017	Study 3.1.2	FERC issued its Determination Letter on Study 3.1.2. FERC did not adopt any proposed changes to the study.
April 03, 2017	Study 3.1.2	FirstLight filed an updated final report for Study 3.1.2 - Vol I-III and a Report on the Expanded Use of the Upper Reservoir. Regarding the report for Study 3.1.2, it was essentially the same report as filed on 10/14/2016, however, FirstLight discovered two sites used the incorrect bank geometry, which was addressed in this filing.
October 09, 2018	Study 3.1.2	FirstLight met with stakeholders, including MADEP, on Study 3.1.2, which was a summary of the activities between 10/14/2016 and 04/03/2017.
October 24, 2018	Study 3.1.2	FirstLight filed meeting minutes on the 10/09 meeting.
December 21, 2018	Study 3.1.2	FirstLight filed response to comments raised on Study 3.1.2 and the Expanded Use of the Upper Reservoir report. No comments were filed by MADEP.
September 18, 2020	Study 3.1.2	FirstLight met with MADEP to discuss the methodology for Study 3.1.2
December 4, 2020	All	FirstLight files its Amended Final License Application (AFLA), which included supplemental BSTEM modeling reflecting the operating proposal contained within the AFLA
May 11, 2023	Study 3.1.2	FirstLight files report titled Supplemental BSTEM Modeling Report, which evaluated the potential impact of the operating regime contained within the Agreement in Principle (AIP) on TFI erosion
March 22, 2024	Study 3.1.2	FirstLight files report entitled Supplemental BSTEM Model Report reflecting operating conditions in the Flows and Fish Passage Settlement Agreement and Streambank Erosion Proposal
March 22, 2024	-	FirstLight files Streambank Erosion Proposal with FERC