

# **Turners Falls Hydroelectric Project (FERC Project Number 1889)**

## **Invasive Plant Species Management Plan**



**MARCH 2024**

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## LIST OF ACRONYMS

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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

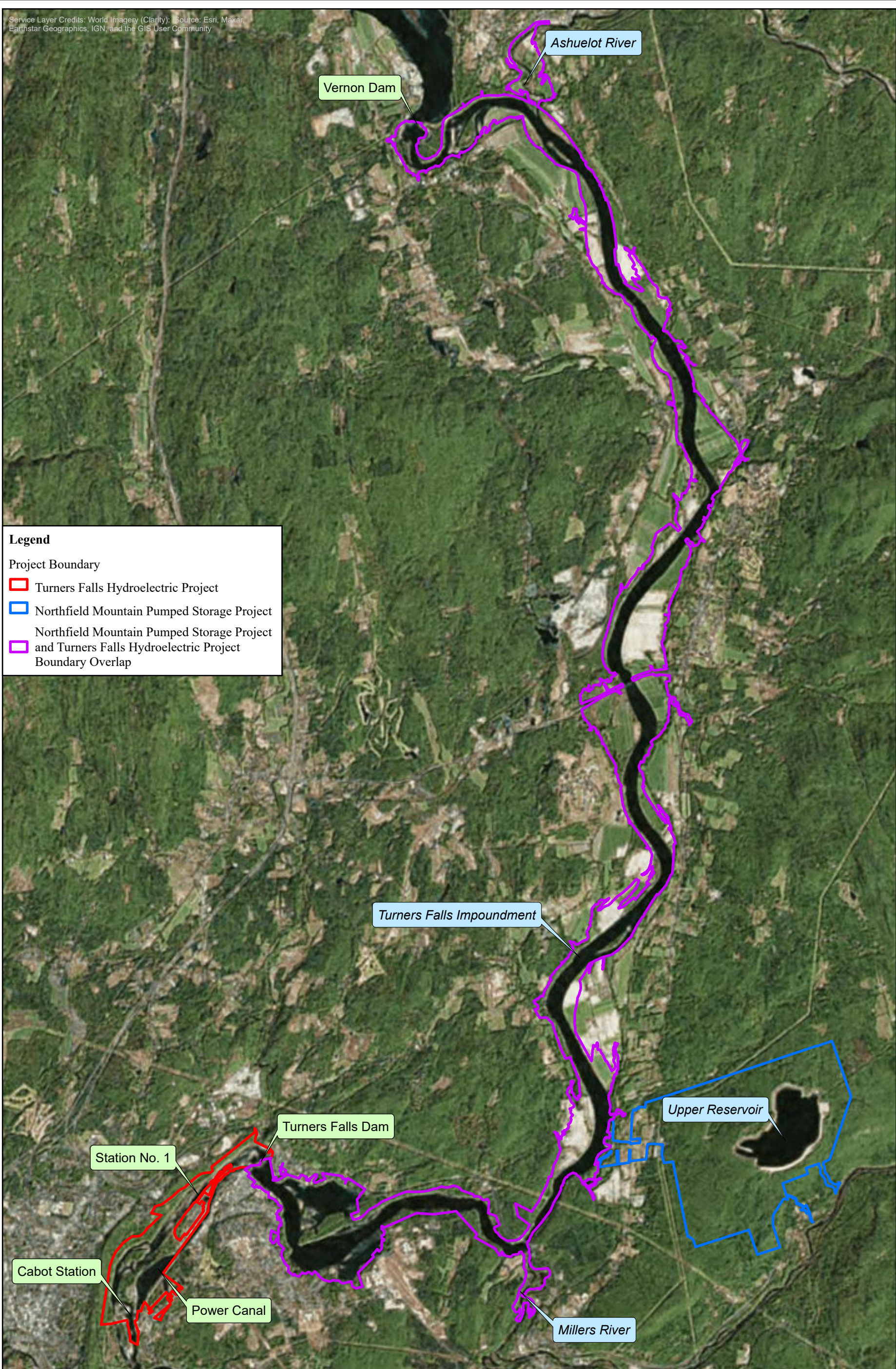
FirstLight MA Hydro LLC (FirstLight or the Licensee) is the owner and operator of the Turners Falls Hydroelectric Project (Project, FERC No. 1889). The Project is located on the Connecticut River in the Commonwealth of Massachusetts (MA), as well as in the states of New Hampshire (NH), and Vermont (VT). 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).



**Legend**

Project Boundary

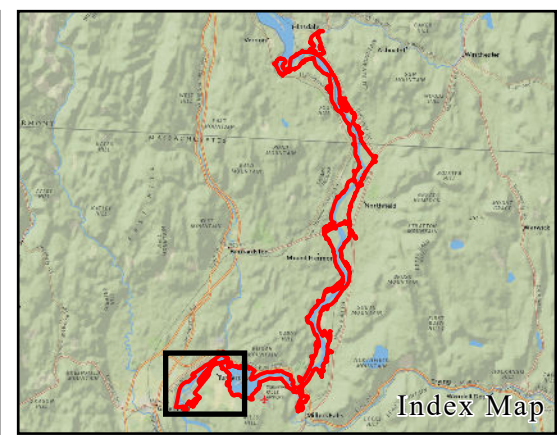
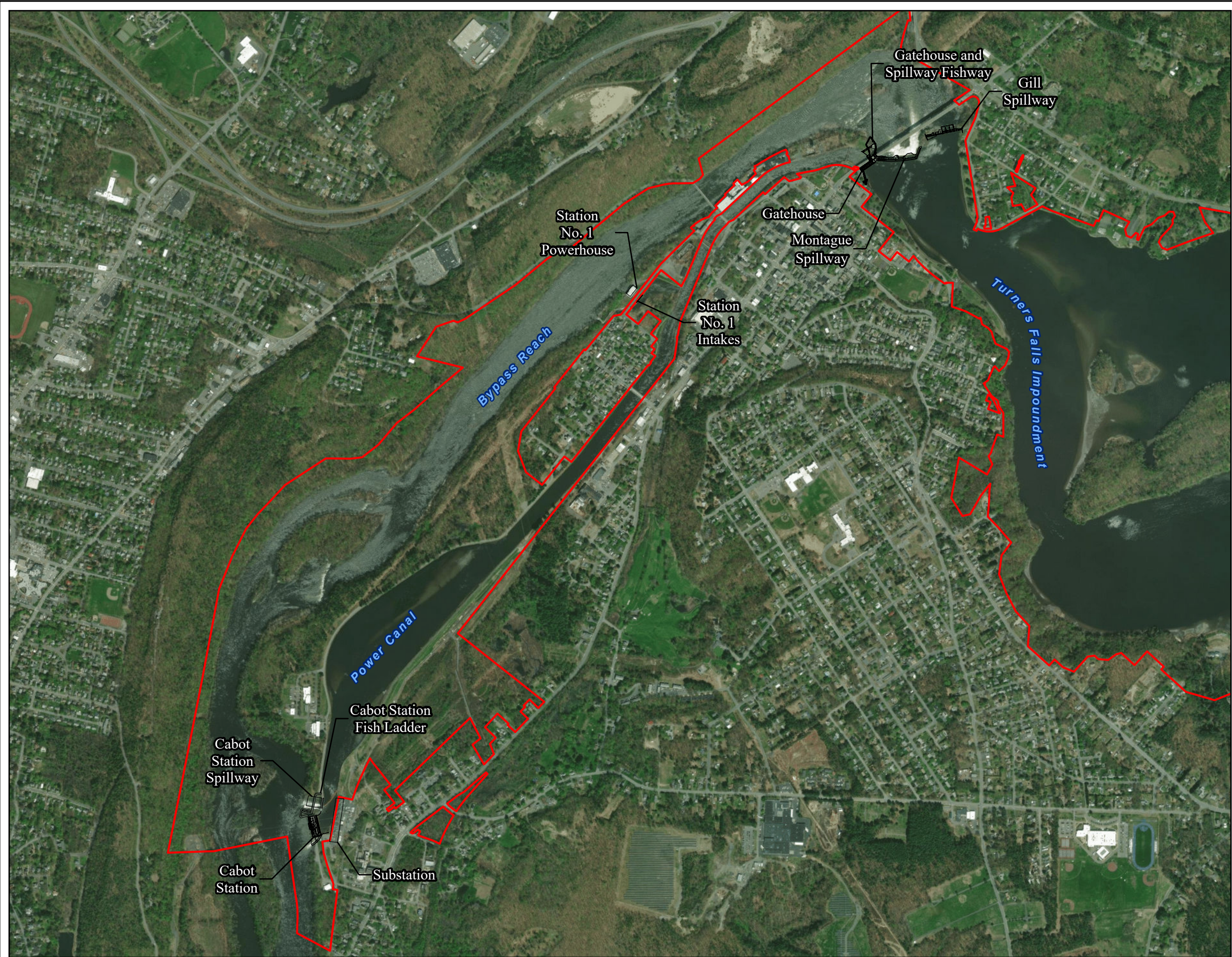
- Turners Falls Hydroelectric Project
- Northfield Mountain Pumped Storage Project
- Northfield Mountain Pumped Storage Project and Turners Falls Hydroelectric Project Boundary Overlap



FIRSTLIGHT MA HYDRO LLC  
Turners Falls Hydroelectric Project (No. 1889)  
Invasive Plant Species Management Plan

0 0.5 1 2 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

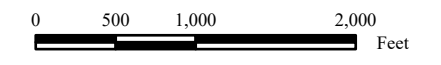
Figure 1.1-2:  
Turners Falls Hydroelectric Project  
Key Features

Legend

 Project Boundary



Service Layer Credits: National Geographic World Map: National Geographic, Esri, Garmin, HERE, UNEP-WCMC, USGS, NASA, ESA, METI, NRCAN, GEBCO, NOAA, increment P Corp.  
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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 2014<sup>1</sup> 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 beds<sup>2</sup> 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.<sup>3</sup> 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

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

<sup>2</sup>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.

<sup>3</sup>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 2015<sup>4</sup>, 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%

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<sup>4</sup> 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**

<b>Scientific Name</b>	<b>Common Name</b>
<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**

<b>Scientific Name</b>	<b>Common Name</b>	<b>Lifeform Type</b>	<b>Notes</b>	<b>MIPAG Status</b>
<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.<sup>5</sup> 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](#).

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<sup>5</sup> 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.