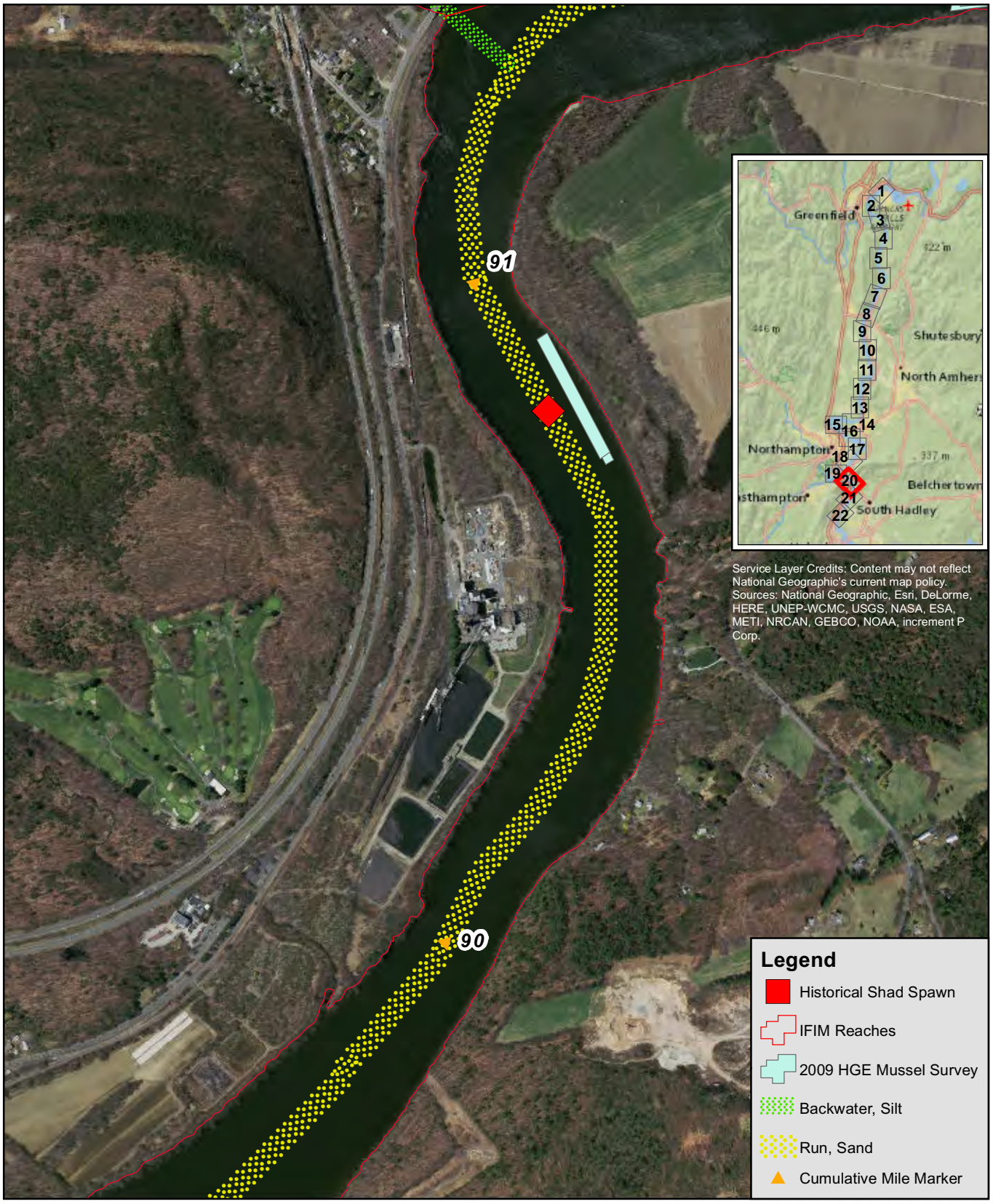

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Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

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Exhibit E

0 500 1,000 2,000 Feet

Figure 3.3.3.1-3
Downstream Mesohabitat
Linear Habitat Classification
Map 20

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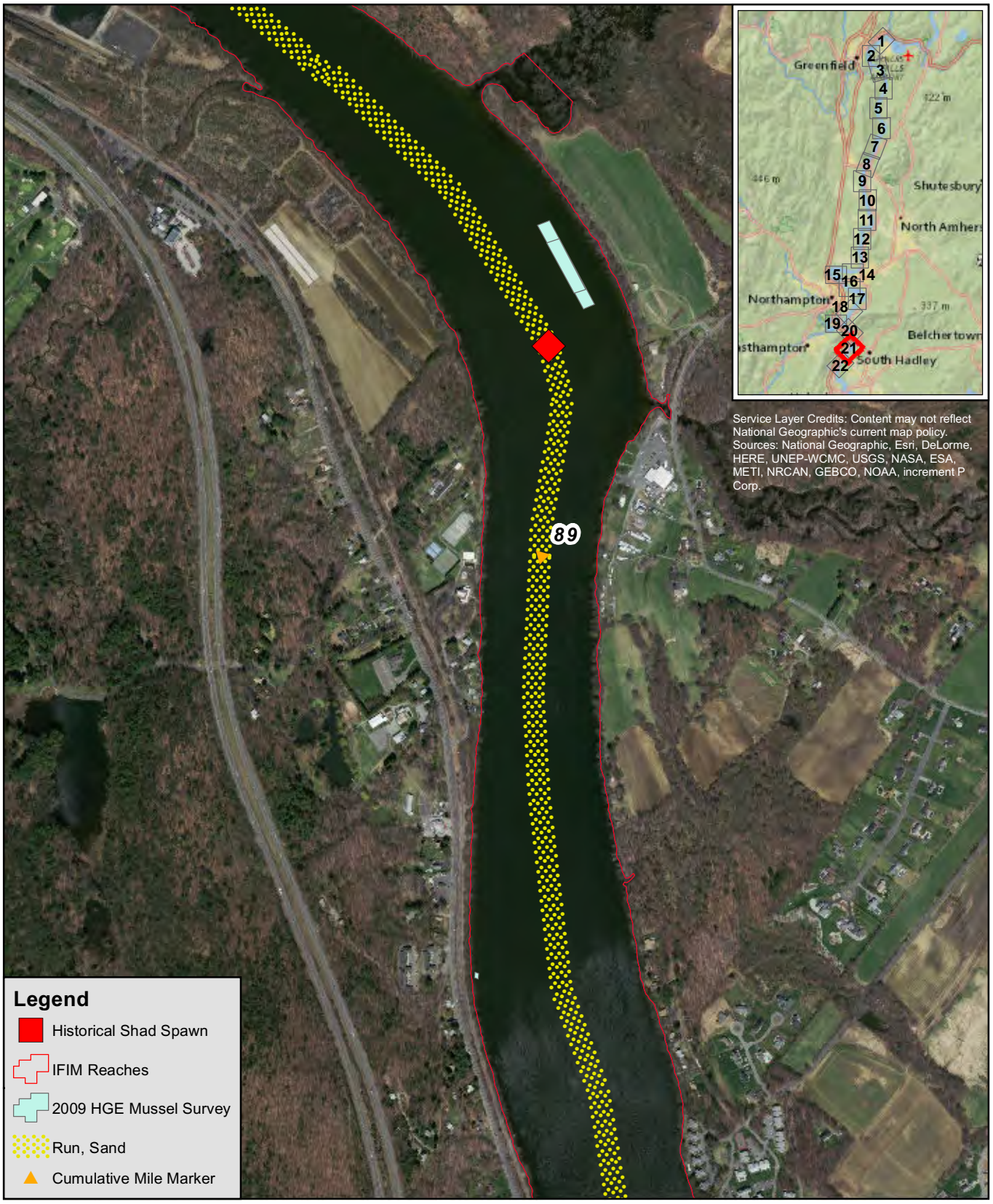

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Figure 3.3.3.1-3
Downstream Mesohabitat
Linear Habitat Classification
Map 21

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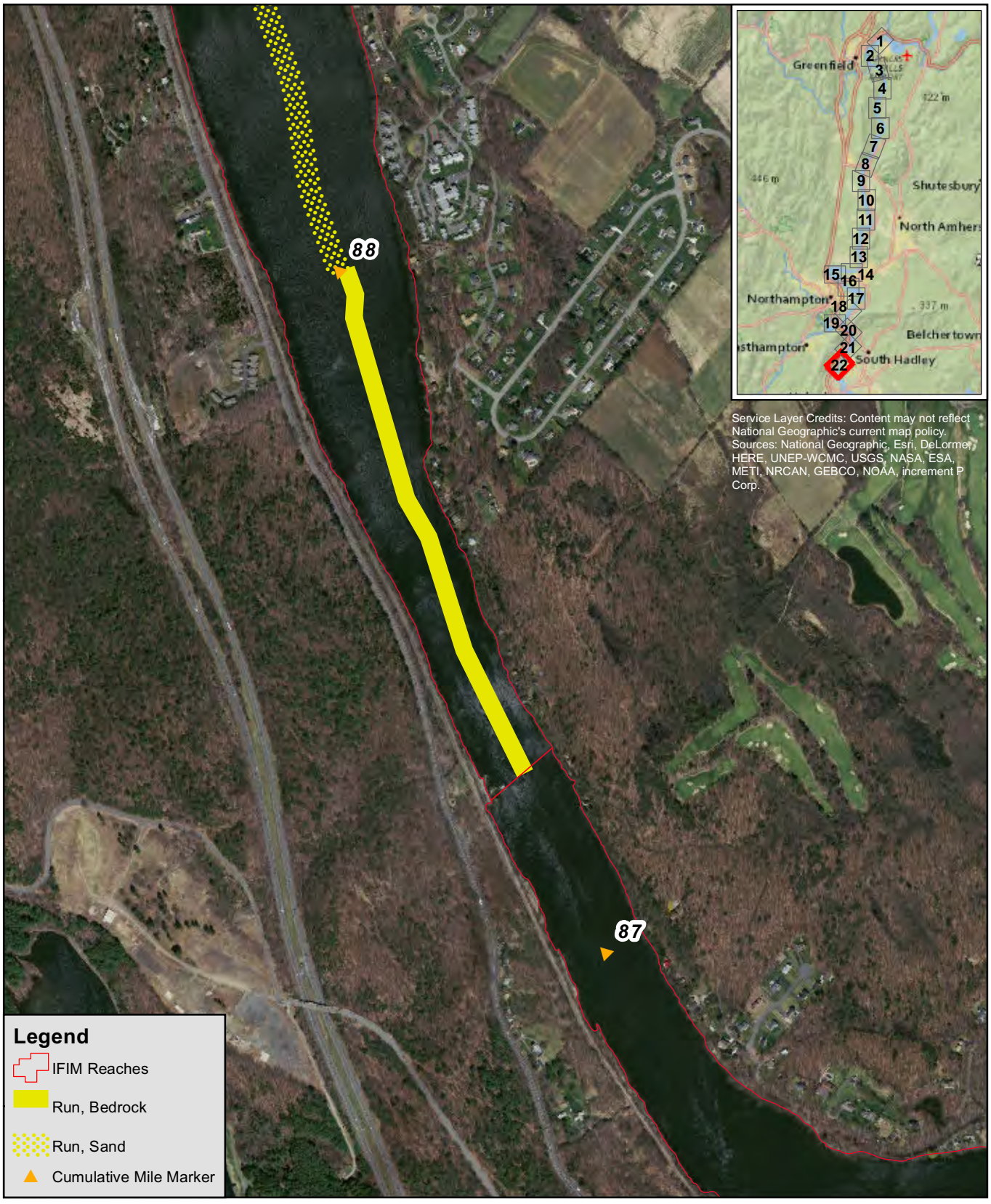

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0 500 1,000 2,000 Feet

Figure 3.3.3.1-3
Downstream Mesohabitat
Linear Habitat Classification
Map 22

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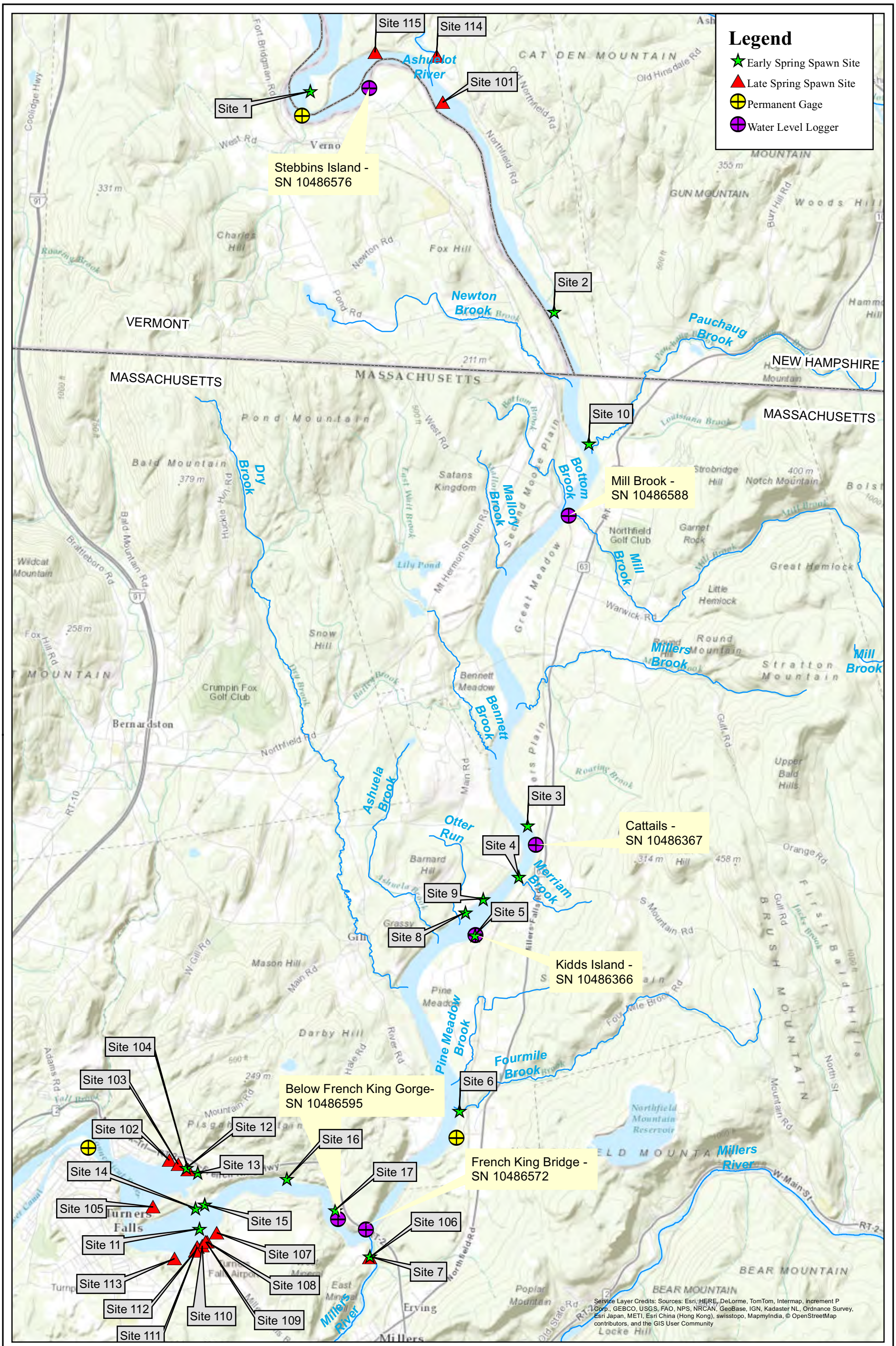

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0 0.5 1 2 Miles

Figure 3.3.3.1.2-1: Locations of Spawning Sites Identified During Early and Late Spring Littoral Zone Surveys

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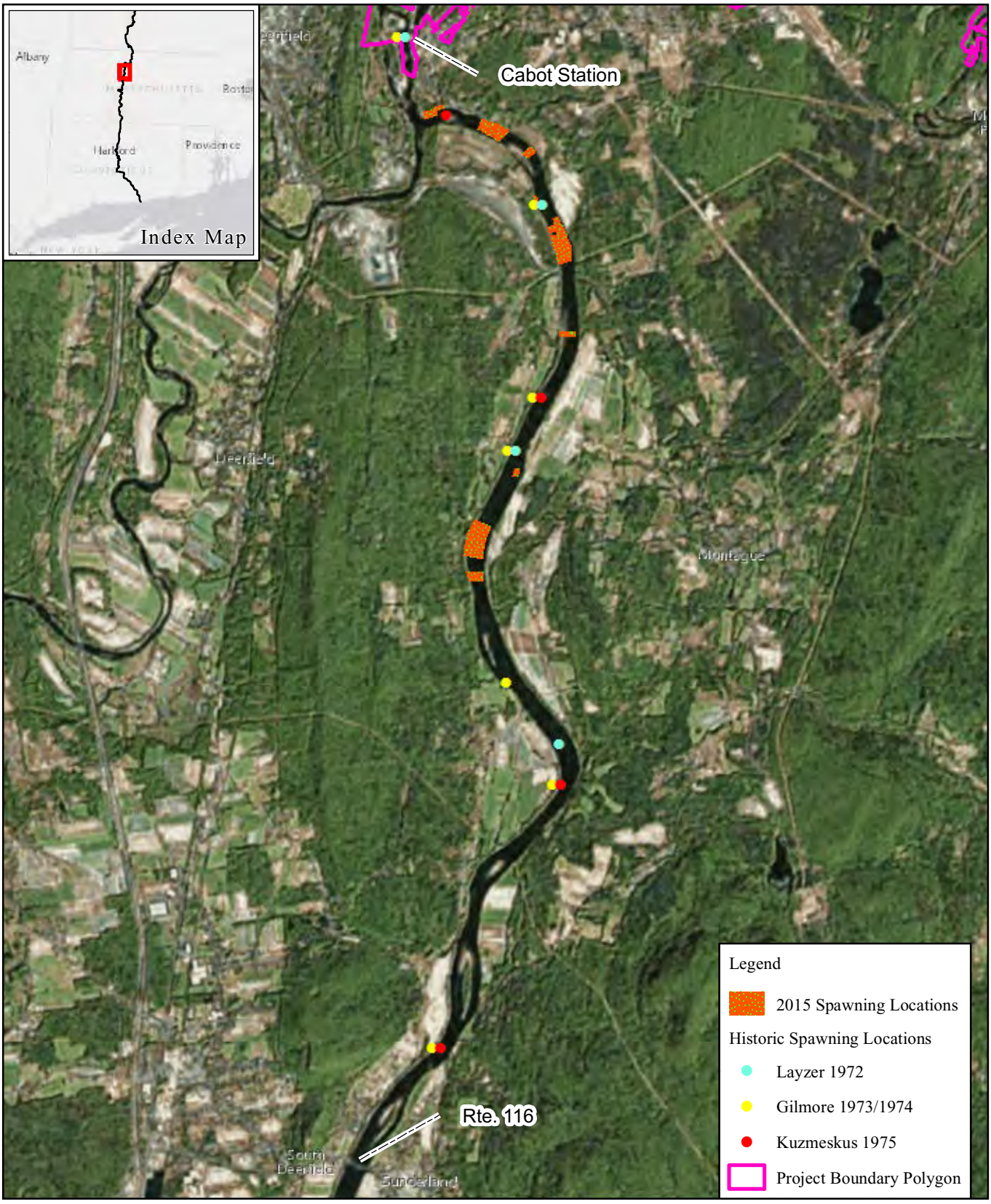

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Figure 3.3.3.1.2-2
Locations of Observed Shad Spawning Areas between Cabot Station and Route 116 Bridge

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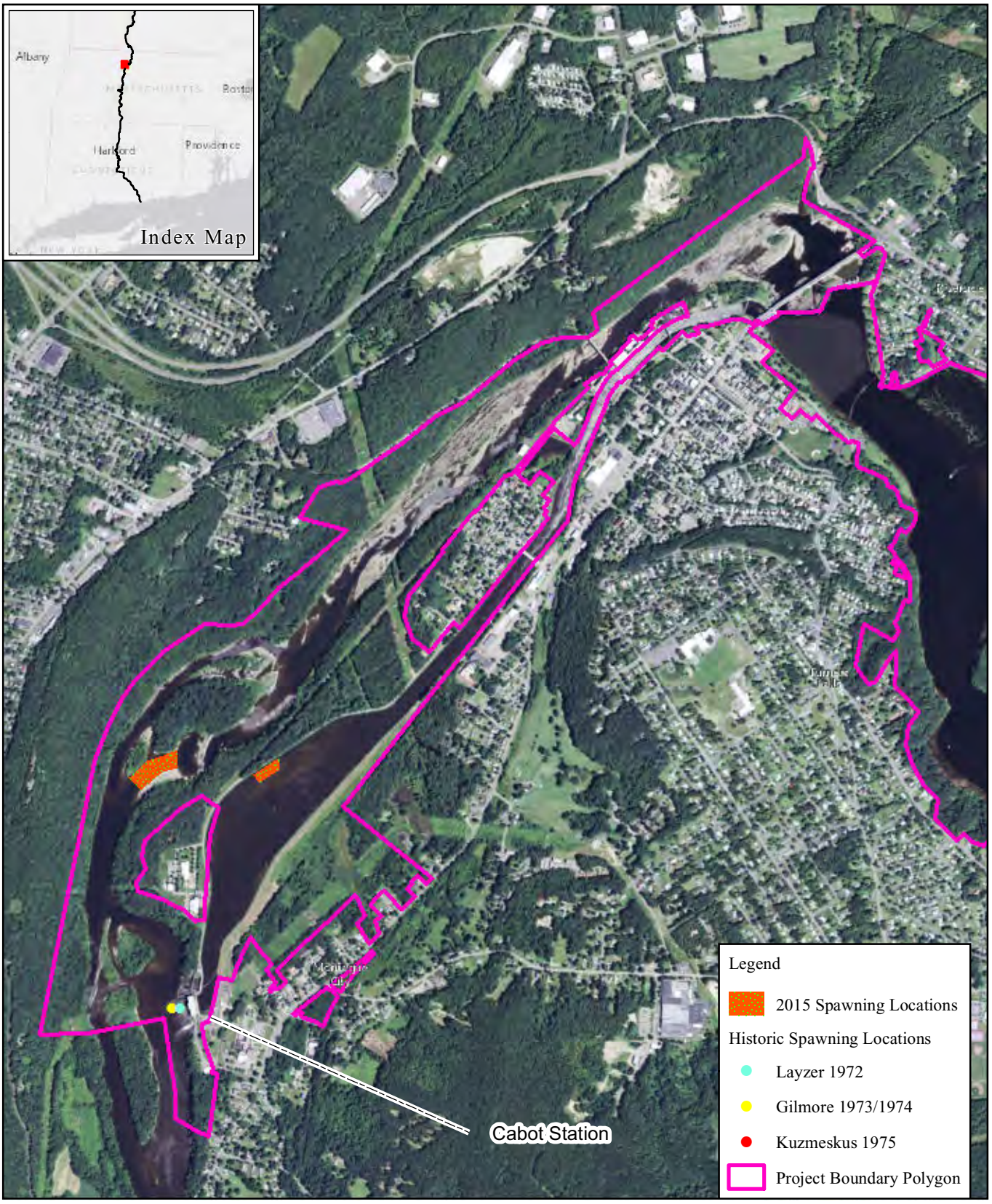

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0 0.15 0.3 0.6
Miles

Figure 3.3.3.1.2-3
Locations of Observed Shad Spawning Areas in Bypass Reach and Lower Turners Falls Canal

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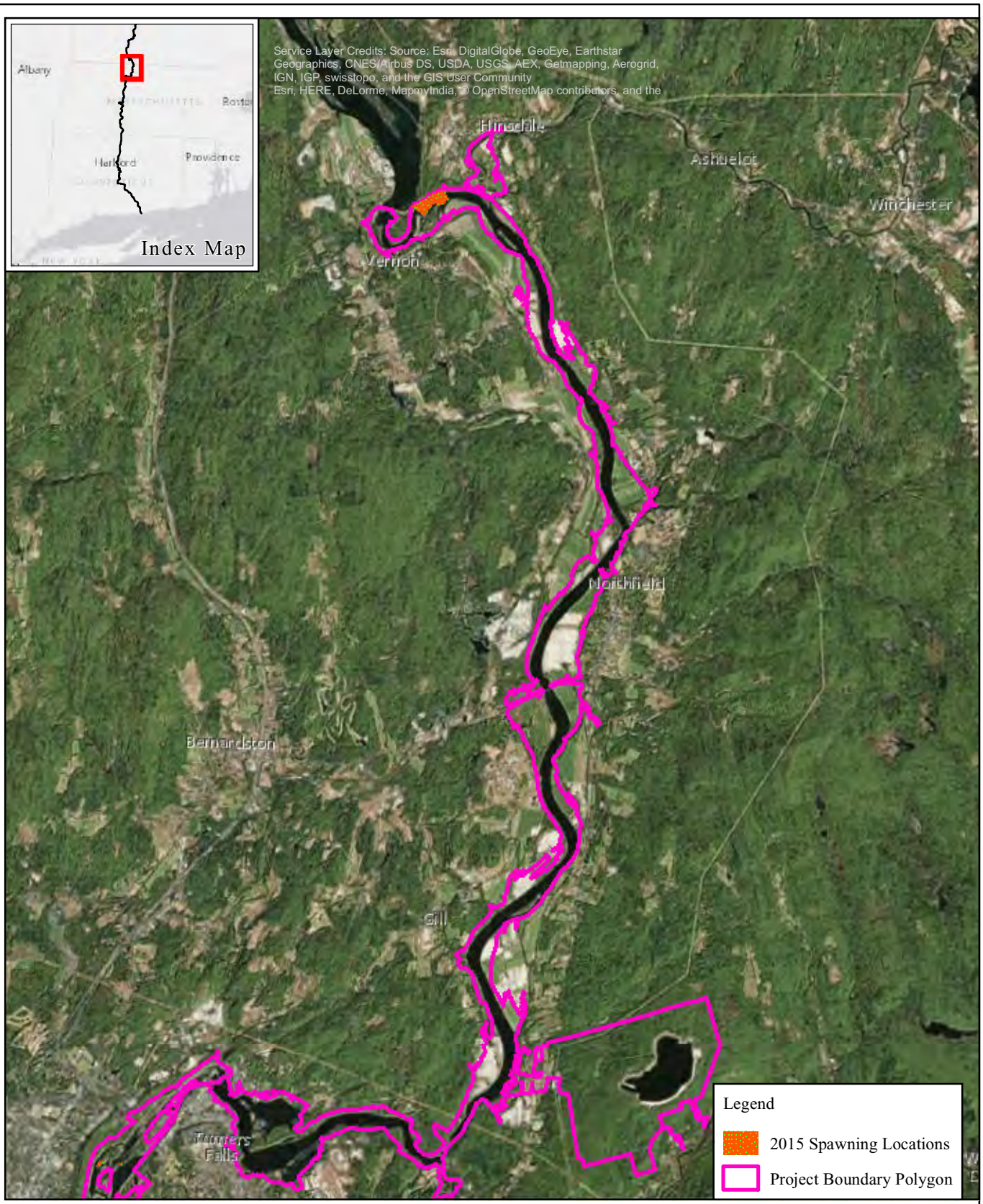

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Exhibit E

N

0 0.75 1.5 3
Miles

Figure 3.3.3.1.2-4
Locations of Observed
Shad Spawning Areas
in Impoundment.

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3.3.4 Terrestrial Resources

The Turners Falls Development and Northfield Mountain Pumped Storage Development provide habitat for a variety of wildlife and botanical species. An understanding of the terrestrial resources in the Project area provides information on the type and quantity of habitat potentially affected by Project operations. Biologists collected information on the distribution of invasive species, characterized habitats, and developed a plant census in 2014 and 2015 to determine if Project operations affect existing wildlife and botanical resources. As part of the relicensing process, three studies were conducted relative to terrestrial resources as follows:

- Study No. 3.4.1 *Baseline Inventory of Terrestrial, Wildlife and Botanical Resources*
- Study No. 3.4.2 *Effects of Northfield Mountain Project-Related Land Management Practices and Recreation use on Terrestrial Habitats*
- Study No. 3.5.1 *Baseline Inventory of Wetland, Riparian and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operation Impacts on Special-Status Species*

A report for Study No. 3.4.2 was filed with FERC on September 14, 2015. The field work for Study Nos. 3.4.1 and 3.5.1 is complete, but reports have not been finalized.

3.3.4.1 Affected Environment

Background

The physiographic settings of the Project, with its relatively large tracts of undisturbed terrestrial habitats, provide a wide variety of habitats for terrestrial wildlife. There are a considerable number of parks and conservation lands in and around the Project area. Notable areas include (but are not limited to); Connecticut River Greenway State Park, Westwood Wildlife Sanctuary, Rocky Mt. Park, King Phillips Hill, Brush Mt. Conservation area, Pauchaug Brook area, Bennett Meadow area, Cabot Woods, and the Northfield State Forest. FirstLight also manages recreational resources at the Project as part of their FERC license and agreement with the State of Massachusetts. The Northfield Mountain Pumped Storage Development has many recreational features (e.g., a trail system with over 26 miles of trails, observation area, picnic areas) that are inherently attractive. Public recreation sites can affect wildlife behavior (both attracting and displacing) and impact botanical resources (e.g., trampling vegetation, causing erosion along trails, and spreading invasive species).

The study area for the Turners Falls Development and the Northfield Mountain Pumped Storage Development covers the following areas:

- Upland areas along the TFI including areas within the Project Boundary and areas up to 200 feet from shore where the Project Boundary is along the shoreline;
- Upland areas adjacent to the bypass reach, defined as extending from the Turners Falls Dam to the Cabot Station tailrace;
- The Connecticut River from the Cabot Station tailrace to the Route 116 Bridge in Sunderland; and
- Approximately 2,011 acres of land of Northfield Mountain, of which approximately 405-407 acres is the Upper Reservoir.

FERC Relicensing Studies

As noted above, FirstLight has conducted several studies to gather information necessary to understand the potential effects of land management practices and recreational use on wildlife and botanical resources within the Northfield Mountain Pumped Storage Development and the TFI study area. The goal of these

studies is to characterize and describe the terrestrial wildlife and botanical resources that use representative upland habitats within and adjacent to the Project Boundary. Specific objectives are:

- Survey and inventory overall upland wildlife habitats;
- Note the occurrence of wildlife sighting during the course of the surveys;
- Survey and inventory vegetation communities and land use; and
- Survey and inventory the nature and extent of upland invasive, exotic vegetation species.

Wildlife

Mammals

Table 3.3.4.1-1 provides a list of the 35 mammal species that were directly and indirectly observed in the Project area during 2014 field surveys, as well as species that are likely to exist in the study area. The list of mammals likely to occur is inferred from available habitat types documented in the study area cross referenced with life history of mammals that are known to occur within the region as referenced by DeGraaf and Yamasaki (2001). The diverse vegetated communities within the study area provide a range of habitat niches for species typical of the highlands of central to western Massachusetts and the Connecticut River valley. The majority of the species are habitat generalists with a known tolerance for habitat modifications and adaptations.

Some of the furbearing animals that are known to inhabit study area include beaver, red fox, gray fox, muskrat, Virginia opossum, and striped skunk. These wildlife species reside in many different habitat types such as woodland, wetland, scrub-shrub or early successional areas, and grassland areas. Use of these areas may shift during different life stages and/or times or year.

Reptiles and amphibians

Of the MADFW 45 inland native species of amphibians and reptiles that are known to occur in Massachusetts (Cardoza & Mirick, 2009), a total of 23 amphibians and reptiles were observed during 2014 field surveys or are likely to occur within the study area. Included are nine frogs and toads, four salamanders, three turtles, and seven snakes. These inland native species include terrestrial and semi-aquatic amphibians and reptiles. A list of reptiles and amphibians recorded or likely to occur in the study area is provided in Table 3.3.4.1-2.

Avian Species

The Connecticut River provides important habitat to a variety of bird species. During the spring and summer, many species (including those observed during this survey) breed and nest along the river. In spring and fall, the river is a major migratory flyway, and, generally, in the winter, it provides habitat for species of waterfowl that nest further north. Throughout the year the river is a source of food for foraging birds.

Sixty-four (64) species of birds were observed on or near the river (Table 3.3.4.1-3). Most species were found in the surrounding upland floodplain, rather than utilizing aquatic habitat. Species associated with the river include: Double-crested Cormorant, Canada Goose, Common Merganser, Mallard, Mute Swan, Wood Duck, Bank Swallow, Northern Rough-winged Swallow, Spotted Sandpiper, and Belted Kingfisher. Fifty-nine (59) species of birds were observed within the study area of Northfield Mountain (Table 3.3.4.1-3). The Northwest Slope had the greatest species richness, with 47 species, while the Northeast Slope had only 17 observed species. This is likely a reflection on the relative sizes of the various sections, rather than differing habitats. A few open habitat species occurred only in the mown areas and power line Right of Ways of the Northwest Slope, but the majority number of species were found in more than one slope section (e.g., Ovenbird).

Vegetative Communities

The region encompassing the study area is characterized by a diversity of terrestrial botanical resources that are influenced by geological features, soil type, hydrology, climate, and historic and current land use. Biologists documented 403 plant species within the study area in 2014 and 2015. An overall plant census list of all recorded plant species identified during the 2014 and 2015 field season is provided in Table 3.3.4.1-4. Field surveys were conducted in September 2015 to confirm vegetative communities. . One plant community, the calcareous rock cliff community, was identified during survey work, but this habitat was not mapped as the aerial signature and habitat size did not allow for identification using available aerial imagery. Four disturbed or mostly unvegetated cover types; agricultural, development, bypass reach, and transmission right of way, were mapped, but these are not described by the Natural Heritage and Endangered Species Program (NHESP). Located in the Connecticut River valley, with adjacent high elevations of Northfield Mountain, the study area has characteristics of both Northeastern Highlands and Northeastern Coastal Zone ecoregions (Swain & Kersey, 2011).

The Connecticut River, during its course between Vernon Dam and Turners Falls Dam, regains the appearance of a river even though it is impounded. The wide and fertile plains on both sides of the Connecticut River are terminated by terraces rising to forest upland country to the east and west. Examples of geologic and geomorphic features influencing the area's botanical communities include:

- the Connecticut River valley and remnant floodplains;
- the confluence of the Connecticut River and major tributaries (e.g., Millers River);
- bedrock and alluvial islands within the Connecticut River; and
- the high elevations of Northfield Mountain.

The primary upland plant communities (Table 3.3.4.1-5) include:

- Remnant / transitional flood plain forest
- Northern hardwoods-hemlock-white pine forest
- Successional northern hardwood forest
- Hemlock ravine
- White pine - oak forest
- Calcareous rock cliff (not mapped)
- Circumneutral rock cliff (not mapped),
- Oak - hickory forest,
- Agricultural lands (not described by NHESP)
- Bypass Reach (not described by the NHESP)
- Development (not described by NHESP)
- Right of way (not described by NHESP)

Remnant/Transitional Floodplain Forests

Soils in this zone generally experience annual flooding and are either silt loams or very fine sandy loams, and soil mottling is generally preset within two feet of the soil surface. A surface organic layer is typically absent. Silver maple, sycamore, cottonwood, red maple, ash, American elm, and willow are the dominate tree species. A shrub layer is generally lacking; however, saplings of overstory trees are common. The herbaceous layer is typically an even mixture of wood-nettle, ostrich fern, sensitive fern and false nettle. Within the study area, these limited floodplain forests are the dominate forest type present along the main stem of the Connecticut River, islands, and its major tributaries (Figure 3.3.4.1-1).

Northern Hardwoods-Hemlock-White Pine Forest

Northern hardwoods - hemlock - white pine forest is the dominant vegetated community along the shoreline from Barton Cove upstream to the French King Bridge and on the northwestern and northeastern slopes of

Northfield Mountain. This forest type is associated with a closed canopy forest of a mixture of deciduous and evergreen trees, with sparse shrub and herbaceous layers (Figure 3.3.4.1-3). The forest is dominated by a mix of sugar maple, American beech, yellow birch, and red oak in variable proportions, with eastern hemlock and white pine intermingled throughout. American beech tend to dominate on drier location wetlands. Black cherry, white birch, red maple, and other early successional tree species are often scattered, with occurrences in the subcanopy with stripped maple, and sometimes ironwood. The shrub layer is usually open, with clumps of hobblebush, honeysuckle and Japanese barberry. The diverse but sparse herb layer includes Christmas fern, Canada mayflower, club mosses, asters, and false nettle.

Successional Northern Hardwoods

Successional northern hardwoods in the study area vary from forest communities with thick young sprouts and little diversity to mature, diversifying forests with undergrowth of more shade-tolerant trees. The canopy is seldom completely closed and undergrowth may be dense or open. Areas of successional forest are associated with past disturbance such as cutting or blow-down / storm damage. Aspen, white birch, black birch, red maple, and /or black cherry tend to be common throughout the community. The understory of more mature successional forests is comprised of young, more shade-tolerant trees (typically less than 10" at diameter at breast height). Shrubs and herbaceous species are variable, and includes species common to edge habitat and open areas such as sumac, goldenrod, Joe-pye weed and blackberry (Figure 3.3.4.1-2). Successional northern hardwood forests are found intermingled throughout the study area and are typical of transition areas and edge habitat around developed areas and agricultural lands.

Hemlock Ravine

Hemlock ravine communities are dominated by the dense overstory canopies of eastern hemlock trees. These cool moist habitats are located in topographic draws and drainage ways in the landscape. In the project area, this heavily shaded habitat is characterized by little growth in the understory. The forest floor typically has little vegetation and is covered by needles, twigs, and small branches of hemlocks. Occasionally deciduous trees that grow along with hemlock occur at very low percentages and include; a mixture of oak species, (red, white and black), yellow birch, and red maple. Generally, the shrub layer is sparse, with occasional individuals of the canopy species and small patches of mountain laurel. Hemlock ravines communities attract wildlife that depend on mature dense evergreen forests and typically host a variety of songbirds that nest high in the canopy. Several hemlock forested areas and ravines are found along hillsides and lowlands at Barton Cove campgrounds and throughout the northern and southern slopes of Northfield Mountain (Figure 3.3.4.1-4)

White Pine- Oak Forest

The white-pine oak forests within the study area are limited. The forest has a partial closed canopy with sporadic understory shrub coverage. The overstory is dominated by white pine and red oak with the shrub layer dominated by red maple, low bush blue berry, and mountain laurel. Herbaceous vegetation varies, but includes bracken fern, Canada mayflower, and wintergreen. This habitat is ideal for generalist species such as gray squirrels, short-tailed shrews, voles, and chipmunks. Common birds within this habitat may include Red-eyed Vireo, Brown Creeper, Hermit Thrushes and Red Tailed Hawks. White pine – oak forests are found at lower elevations of the northwest and southern slope of Northfield Mountain (Figure 3.3.4.1-5).

Calcareous Rock Cliff Community

Rock Cliff Communities all occur on a more or less vertical bedrock cliff faces. They have extremely sparse scattered vascular plants on ledges and in crevices. Calcareous rock cliffs have vegetation that is more distinct and specific to the habitat. Purple cliff brake, maidenhair spleenwort, blunt-lobed cliff-fern, and columbine are characteristic of calcareous cliffs. Of these species, purple cliff brake and columbine were both seen within the project area. Surrounding vegetation tends to be northern hardwood forest. This is a

more uncommon community found throughout Massachusetts and is host to several unusual plants. A Calcareous Rock Cliff community exists on the western bank of the TFI extending upstream and downstream of the French King Bridge (Figure 3.3.4.1-6).

Circumneutral Rock Cliff Community

This community type is found along the summit and higher elevations of the southeastern slope of Northfield Mountain. Rose ledge and the Farley ledges are notable examples where sparse, scattered vascular plants are found in ledges and small crevices within vertical cliff faces. Lichens are occasionally dense on cliff faces. These communities can be variable in moisture, but generally consist of areas of significant rock outcroppings that are well shaded by trees of the surrounding forest. Species of dry open areas, including pale corydalis, bearberry, plantain-leaved pussytoes, columbine, marginal wood-fern little bluestem grass, ebony spleenwort, Rusty cliff-fern, and mosses. In the area, chestnut oak, scrub oak, and witch hazel are sporadically observed. These cliff areas can provide nesting habitats for Ravens. Few to no mammals, reptiles or amphibians would be expected on these steep slope faces (Figure 3.3.4.1-7).

Oak – Hickory Forest

This community consists of hardwood forests dominated by a mixture of oaks, with hickories mixed in at a lower density. The canopy is dominated by one or several oak species including red oak, white oak, and black oak. Mixed in are lower densities of one or several hickory species. Other trees include ash, birch, sassafras, and red maple. The subcanopy commonly includes ironwood, flowering dogwood, shadbush, chestnut, and witch-hazel. Low shrubs are common and often diverse; blueberries, dogwoods, and viburnums are characteristically present. The herbaceous layer is also richer than in many oak forests. Plants typical of the herbaceous layer include hepatica, goldenrod, tick-trefoil, wild sarsaparilla, and false Solomon's seal. This variable forest community is found at higher elevations on the Northfield Mountain range, most notably in a strip of deciduous forest between the northwestern slope and southeast slope, and adjacent to the upper elevations to Rose ledge (Figure 3.3.4.1-8).

Agricultural Lands

Land use along the corridor of the Connecticut River is primarily rural and agricultural. In the study area, approximately 25% of the land use is classified as agricultural/open field habitat. These lands are managed and go through several vegetative changes within a growing season. The edge habitat of agricultural lands can be vulnerable to the introduction of invasive species. Invasive species also favor these edges as a result of abundant sunlight which promotes favorable growing conditions. Most agricultural land within the study area is a mosaic of various croplands, with few lands used for active livestock pasture. There were relatively few instances where agricultural fields were cleared to the river's edge. Typically, there exists a narrow buffer of forested land which offers erosion protection along the shoreline (Figure 3.3.4.1-9).

Bypass Reach

The bypass reach is approximately 2.7 miles long. Fall River, located near the head of the bypass channel, discharges into the bypass reach. Station No. 1 discharges into the bypass reach approximately 0.9 miles downstream of the Turners Falls Dam. The bypass is a unique habitat comprised of a mosaic of high energy shoreline and exposed bedrock. The eastern side of the bypass is occupied by historic industrial developments with numerous discharge locations that supported the historic industries that were built on the canal. The western side of the bypass is steeply sloping woodlands of Rocky Mountain Park. Rocky Mountain Park is part of the Pocumtuck Ridge, and is the northernmost subrange of the Metacomet Ridge mountain range of southern New England known for its continuous high cliffs, scenic vistas, and microclimate ecosystems containing species common to the northern hardwoods ecosystem types. Hemlock crowd narrow ravines, blocking sunlight and creating damp, cool growing conditions with associated cool climate plant species. Talus slopes are especially rich in nutrients and support several calcium-loving plants

uncommon in the region. The Massachusetts Audubon Society considers the Rocky Mountain section of Pocumtuck Ridge exceptionally rich in its diversity of bird species, and an especially important area for migratory, breeding, and wintering birds (Figure 3.3.4.1-10).

Development

Portions of the upland habitat within the study area are dominated by maintained spaces (i.e., residential, commercial, or transportation corridors) and sporadic shrub or overstory vegetation, such as solitary white pines or other species. The primary vegetation in these areas is comprised of shrub and herbaceous layer vegetation. Herbaceous vegetation is dominated by mowed areas of Kentucky bluegrass. Shrub layer vegetation may include glossy buckthorn, Russian olive, and several species of northern hardwood saplings.

Right-of-Way

This community was identified within the portion of the study area that is crossed by electric transmission right-of-ways. These areas are maintained by periodic vegetation management which limits the growth of large woody vegetation. The dominant communities are shrub and herbaceous communities. Shrub layer vegetation is dominated by white pine saplings, glossy buckthorn, red cedar, and meadowsweet. The herbaceous community is extensive and includes several weedy species such as chicory, mullein, and pearly everlasting. Additional herbaceous vegetation includes bracken fern, sensitive fern, Joe pye weed, and milkweed. Portions of these areas include gravel access roads (Figure 3.3.4.1-11).

Wetlands

Biologists led by a Professional Wetland Scientist field-verified NWI mapped wetlands within the study area. These areas were not formally delineated, but the boundaries were refined to provide a better level of detail. Thirty (30) NWI mapped wetlands were field verified, and an additional 18 non-NWI mapped wetlands were also identified and mapped. Dominant wetland communities within the study area include:

- Hemlock swamp
- Red maple swamp
- Woodland vernal pool

Hemlock Swamp

Hemlock is a major or co-dominate canopy species in hemlock swamps within the study area. In some cases, hemlock forms dense stands, but more commonly hemlock is associated with a mixture of white pine, red maple and yellow birch. The understory tends to be sparse to moderately vegetated with highbush blueberry, winterberry, and mountain laurel. Ferns are common, especially cinnamon fern, along with a hummocky floor covered with sphagnum moss. Notable hemlock swamp habitat is found down gradient of the Farley ledges situated in a well -defined saddle in the landscape. These areas can provide year round habitat and breeding (i.e. vernal pools) for amphibian species (Figure 3.3.4.1-12).

Red Maple Swamp

Red maple is usually strongly dominate in the overstory of red maple swamps in the study area and can often provide up to 90% of the canopy cover. A variable mixture of subordinate tree species co-occurs with red maple, including yellow birch, black gum, white ash, white pine, elm, hemlock, pin oak, and swamp white oak. The shrub layer of red maple swamps is usually dense and well developed with greater than 50 percent cover, but it can be variable. Sweet pepperbush highbush blueberry, winterberry, spicebush, alder and viburnum species often dominant the shrub stratum. The herbaceous stratum can be variable, but ferns are unusually abundant. Cinnamon fern is common with other ferns including but not limited to; sensitive fern, royal fern and marsh fern. Gaminoides are common, mixed in with a variety of other herbaceous

species commonly including; skunk cabbage, false hellebore, spotted touch-me-not, swamp dewberry, and marsh marigold (Figure 3.3.4.1-13).

Woodland Vernal Pool

Woodland vernal pools are typically small, shallow depressions that are isolated from other surface waters. They usually flood in spring and sometimes in fall, and generally hold water for a minimum of two months but are dry in summer. Because vernal pools are temporary bodies of water, they do not support fish populations. When dry, woodland vernal pools can be often be recognized by a layer of water-stained gray leaves covering the pool's basin and distinct waterline marks on the base of tree buttresses. These temporarily flooded areas provide important breeding habitat for amphibians. Due to prolonged standing water, woodland vernal pools often have sparse-to-little shrub and herbaceous vegetation within the pool basin. Red maple and hemlock, along with lesser quantities of various wetland tree species, are found in the canopy cover, similar to hemlock swamp and red maple swamp communities. Vernal pools are tracked as a separate community type because of the important habitat they provide for amphibians and invertebrates.

Biologists located and documented 13 woodland vernal pools in the Northfield Mountain study area (Figure 3.3.4.1-14) and one vernal pool along the Turner Falls impoundment (Table 3.3.4.1-6). Commonly observed egg masses of obligate vernal pool indicator species included spotted salamanders and wood frogs. Wood frogs and four local species of mole salamanders have evolved breeding strategies intolerant of fish predation on their eggs and larvae; the lack of fish populations is essential to the breeding success of these species. Other amphibian species use vernal pools but they do not depend on them including American toads, green frogs, and red-spotted newts. It should be noted that green frogs and red-spotted newts feed on obligate vernal pool species eggs and larval and can have negative effects on other amphibian population dynamics. Vernal pools also support a diverse invertebrate fauna, including obligate indicator species like fairy shrimp which complete their entire life cycle in vernal pools (Burne, 2001).

Invasive Species

Biologists identified 25 invasive plants in the Northfield Mountain and Turner Falls study area including; MIPAG listed non-native invasive plants, one MIPAG watch list species (coltsfoot), one USDA Forestry Service early detection species (Spotted knapweed), and, for consistency with other studies, European alder (see Table 3.3.4.1-7)). Locations of invasive species within the study area observed during 2014 field reconnaissance surveys are shown in Figure 3.3.4.1-15. This figure illustrates the relative abundance and distribution of invasive plants along the impoundment using estimated cover classes of <5%, 6-25%, 26-50%, > 50%. The following five (5) exotic and invasive plant species were found to be common within the study area during the 2014 field 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 impoundment north of Pauchaug Brook where the impoundment transitions to a more dynamic riverine environment. In the upper reaches of the impoundment, 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 that abut 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 impoundment

3.3.4.2 Environmental Effects

The occurrence and distribution of wildlife and botanical resources in the study area are generally unrelated to the Turners Falls Development and Northfield Mountain Pumped Storage Development and/or Project operations. There is no evidence of any on-going adverse effects on upland wildlife and botanical resources. The majority of invasive species found at the Projects are upland species that occur outside the range of water level fluctuations that occur as part of day-to-day project operations. However, fluctuating water levels from project operations may cause disturbances allowing the establishment of invasives such as common reed and Japanese knotweed. Recreational activities at the Turners Falls Development and Northfield Mountain Pumped Storage Development do not appear to cause extensive harm on wildlife, but may include temporary displacement of some species. In some cases, wildlife which utilizes the shoreline may be temporarily impacted as water levels rise and fall, but generally these species are able to move freely. Wildlife as well as botanical resources within the study area may be negatively affected by vegetation management and maintenance of development lands around the TFI, the Northfield Mountain reservoir and the maintenance of development-related access ways. As such, there is some potential for ground disturbing activities (i.e., land clearing construction activities) which may result in the spread or propagation of invasive species as well as degradation of existing habitat. In addition, recreational facilities (i.e., boat launches) may allow for the movement or introduction of invasive vegetation (both terrestrial and aquatic). However, such effects would be minimized through vegetation management planning.

3.3.4.3 Cumulative Effects

Operation and maintenance of the Northfield Mountain Pumped Storage Development and Turners Falls Development may, to a limited degree, have a cumulative effect on the spread of invasive species. Commercial, residential and agricultural development within and adjacent to the Project boundaries potentially introduce invasive species to terrestrial habitat within the Project boundaries. Other potential vectors for invasive species include a transmission line right-of-way maintained by Eversource in the western portion of the Northfield Mountain study area, the Northfield Mountain trail system, which includes over 25 miles of trail, and recreational activities (e.g. boating) within the impoundment that could disturb the shoreline or bring in aquatic invasives from other locations. Vegetation management and fluctuating water levels associated with the operation and maintenance of the Northfield Mountain Pumped Storage Development and Turners Falls Development may supplement these non-Project related sources of invasive species.

3.3.4.4 Proposed Environmental Measures

Wildlife, as well as botanical resources, within the study area may be negatively affected by vegetation management and maintenance of development lands around the Turners Falls impoundment and the maintenance of development-related access ways. As such, there is some potential for ground disturbing activities (i.e., land clearing construction activities) that may result in the spread or propagation of invasive species. In addition, recreational facilities (i.e., boat launches) may allow for the movement or introduction of invasive vegetation (both terrestrial and aquatic). Such effects can be minimized through construction related vegetation management planning.

3.3.4.5 Unavoidable Adverse Impacts

Activities associated with vegetation management and maintenance of power canal associated support structures and development-related access ways have the potential to propagate or spread invasive botanical species. The vegetation management area around the Upper Reservoir on Northfield Mountain, which includes some mowed sections of land immediately outside of the Protected Fenced Zone, is maintained for safety and surveillance as part of Northfield Mountain Pumped Storage Development Dam Safety Surveillance and Monitoring Program. Generally, this vegetation management area provides lower quality

wildlife habitat compared to the undeveloped portions of the study area. It is around these managed zones and edge habitats of the Northfield Mountain Pumped Storage Development that invasive species are more prevalent, and there is less diversity in the habitat.

Table 3.3.4.1-1: List of Mammals Observed or Likely to Occur in Study Area

Common Name	Scientific Name
Beaver*	*Castor canadensis*
Black bear**	*Ursus americanus*
Bobcat	*Felix rufus*
Coyote**	*Canis latrans*
Deer mouse	*Peromyscus maniculatus*
Eastern chipmunk*	*Tamias striatus*
Eastern mole	*Scalopus aquaticus*
Fisher	*Martes pennanti*
Gray fox	*Urocyon cinereoargenteus*
Gray squirrel*	*Sciurus carolinensis*
Hairy-tailed mole	*Parascalops breweri*
Hoary bat	*Lasiurus cinereus*
House mouse	*Mus musculus*
Long-tailed shrew	*Sorex dispar*
Masked shrew	*Sorex cinereus*
Meadow jumping mouse	*Zapus hudsonius*
Meadow vole	*Microtus pennsylvanicus*
Muskrat*	*Ondatra zibethicus*
New England cottontail	*Sylvilagus transitionalis*
Northern short-tailed shrew	*Blarina brevicauda*
Norway rat	*Rattus norvegicus*
Porcupine**	*Erethizon dorsatum*
Raccoon*	*Procyon lotor*
Red bat	*Lasiurus borealis*
Red fox**	*Vulpes*
Red squirrel*	*Tamiasciurus hudsonicus*
Silver-haired bat	*Lasionycteris noctivagans*
Star-nosed mole	*Condylura cristata*
Striped skunk	*Mephitis*
Virginia oppossum*	*Didelphis virginiana*
White-footed mouse	*Peromyscus leucopus*
White-tailed deer*	*Odocoileus virginianus*
Woodchuck	*Marmota monax*
Woodland jumping mouse	*Napaeozapus insignis*
Woodland vole	*Microtus pinetorum*

* Denotes Direct Observation

**Denotes Indirect Observation

Table 3.3.4.1-2: List of Reptiles and Amphibians Observed or Likely to Occur in Study Area

Common Name	Scientific Name
Frogs & Toads	
American bullfrog*	*Lithobates catesbeiana*
American toad*	*Anaxyrus americanus*
Fowler's toad	*Bufo fowleri*
Gray treefrog	*Hyla versicolor*
Green frog*	*Lithobates clamitans*
Northern leopard frog	*Lithobates pipiens*
Pickerel frog*	*Lithobates palustris*
Spring peeper*	*Pseudacris crucifer*
Wood frog*	*Lithobates sylvatica*
Salamanders	
Eastern-red-backed salamander*	*Plethodon cinereus*
Northern dusky salamander*	*Desmognathus fuscus*
Red-spotted newt*	*Notophthalmus viridescens*
Spotted salamander*	*Ambystoma maculatum*
Snakes	
Common ribbon snake	*Thamnophis sauritus*
Eastern garter snake*	*Thamnophis sirtalis*
Eastern ratsnake	*Pantherophis alleghaniensis*
Northern black racer	*Coluber constrictor*
Northern red-bellied snake	*Storeria occipitomaculata*
Northern ring-necked snake	*Diadophis punctatus edwardsii*
Northern watersnake*	*Nerodia sipedon*
Turtles	
Painted turtle*	*Chrysemys picta*
Snapping turtle*	*Chelydra serpentina*
Spotted turtle*	*Clemmys guttata*

*Denotes direct observation

Table 3.3.4.1-3: Avian Species Found in the Study Area

Common Name	Scientific Name	TF[1]	Northfield Mountain					
			Total area	NW Slope	NE Slope	SE Slope	SW Slope	Reservoir
American Crow	*Corvus brachyrhynchos*	X	X	X		X		X
American Goldfinch	*Carduelis tristis*	X	X	X		X		
American Redstart	*Setophaga ruticilla*	X	X	X		X		
American Robin	*Turdus migratorius*	X	X	X		X		X
Bald Eagle	*Haliaeetus leucocephalus*	X	X					X
Baltimore Oriole	*Icterus galbula*	X						
Bank Swallow	*Riparia*	X	X					X
Barn Swallow	*Hirundo rustica*	X						
Belted Kingfisher	*Megaceryle alcyon*	X						
Black and White Warbler	*Mniotilta varia*	X	X	X	X	X	X	
Black-billed Cuckoo	*Coccyzus erythropthalmus*	X	X	X				
Blackburnian Warbler	*Setophaga fusca*		X	X	X	X		
Blacked-capped Chickadee	*Poecile atricapillus*	X	X	X		X	X	
Black-throated Blue Warbler	*Setophaga caerulescens*		X	X	X	X	X	
Black-throated Green Warbler	*Setophaga virens*	X	X	X	X	X	X	
Blue Jay	*Cyanocitta cristata*	X	X	X	X	X	X	
Blue-headed Vireo	*Vireo solitarius*		X	X		X	X	
Blue-winged Warbler	*Vermivora cyanoptera*	X						
Broad-winged Hawk	*Buteo platypterus*	X						
Brown Creeper	*Certhia americana*		X	X		X		
Brown-headed Cowbird	*Molothrus ater*	X						
Canada Goose	*Branta canadensis*	X						
Cedar Waxwing	*Bombycilla cedrorum*	X	X	X	X		X	X
Chestnut-sided Warbler	*Setophaga pensylvanica*	X	X	X				

Common Name	Scientific Name	TF[1]	Northfield Mountain					
			Total area	NW Slope	NE Slope	SE Slope	SW Slope	Reservoir
Chimney Swift	*Chaetura pelagica*	X						
Chipping Sparrow	*Spizella passerina*		X	X		X	X	X
Common Grackle	*Quiscalus quiscula*	X						
Common Merganser	*Mergus merganser*	X						
Common Raven	*Corvus corax*	X	X			X		
Common Yellowthroat	*Geothlypis trichas*	X	X	X				X
Coopers Hawk	*Accipiter cooperii*	X						
Double-crested Cormorant	*Phalacrocorax auritus*	X						
Downy Woodpecker	*Picoides pubescens*	X	X	X				
Easten Wood-Pewee	*Contopus virens*		X	X	X	X	X	
Eastern Bluebird	*Sialia sialis*		X					X
Eastern Kingbird	*Tyrannus tyrannus*	X						
Eastern Phoebe	*Sayornis phoebe*	X	X	X	X	X	X	
Eastern Towhee	*Pipilo erythrophthalmus*		X	X				
European Starling	*Sturnus vulgaris*		X	X				
Field Sparrow	*Spizella pusilla*		X					X
Gray Catbird	*Dumetella carolinensis*	X	X	X				
Great Blue Heron	*Ardea herodias*	X						
Great Crested Flycatcher	*Myiarchus crinitus*	X	X	X		X	X	
Greater Yellowlegs	*Tringa melanoleuca*	X						
Green Heron	*Butorides virescens*	X						
Hairy Woodpecker	*Leuconotopicus villosus*		X	X		X	X	
Hermit Thrush	*Catharus guttatus*		X	X		X	X	
Indigo Bunting	*Passerina cyanea*	X	X	X	X	X		X

Common Name	Scientific Name	TF[1]	Northfield Mountain					
			Total area	NW Slope	NE Slope	SE Slope	SW Slope	Reservoir
Killdeer	*Charadrius vociferus*	X	X					X
Least Flycatcher	*Empidonax minimus*	X						
Louisiana Waterthrush	*Parkesia motacilla*	X						
Mallard	*Anas platyrhynchos*	X						
Mute Swan	*Cygnus olor*	X						
Northern Cardinal	*Cardinalis cardinalis*	X	X	X				
Northern Mockingbird	*Mimus polyglottos*		X	X				
Northern Rough-winged Swallow	*Stelgidopteryx serripennis*	X						
Nothern Flicker	*Colaptes auratus*		X				X	X
Orchard Oriole	*Icterus spurius*	X						
Osprey	*Pandion haliaetus*	X						
Oven Bird	*Seiurus aurocapilla*		X	X	X	X	X	
Peregrine Falcon	*Falco peregrinus*		X			X		
Pileated Woodpecker	*Hylatomus pileatus*	X	X	X	X	X	X	
Pine Warbler	*Setophaga pinus*		X	X		X	X	
Prairie Warbler	*Setophaga discolor*		X	X				
Red-breasted Nuthatch	*Sitta canadensis*		X	X		X		
Red-eyed Vireo	*Vireo olivaceus*	X	X	X	X	X	X	X
Red-tailed Hawk	*Buteo jamaicensis*	X	X		X	X		
Red-winged Blackbird	*Agelaius phoeniceus*	X						
Rock Pigeon	*Columba livia*	X						
Rose-breasted Grosbeak	*Pheucticus ludovicianus*		X	X		X		
Ruby-throated Hummingbird	*Archilochus colubris*		X	X			X	
Scarlet Tanager	*Piranga olivacea*	X	X	X	X	X	X	
Song Sparrow	*Melospiza melodia*	X	X	X				X

Common Name	Scientific Name	TF[1]	Northfield Mountain					
			Total area	NW Slope	NE Slope	SE Slope	SW Slope	Reservoir
Spotted Sandpiper	*Actitis macularius*	X	X					X
Tree Swallow	*Tachycineta bicolor*	X	X					X
Tufted Titmouse	*Baeolophus bicolor*	X	X	X		X	X	
Turkey Vulture	*Cathartes aura*	X	X	X				X
Veery	*Catharus fuscescens*	X	X	X	X	X	X	
Warbling Vireo	*Vireo gilvus*	X						
White-breasted Nuthatch	*Sitta carolinensis*	X	X	X	X	X	X	
Wild Turkey	*Meleagris gallopavo*		X	X		X	X	X
Winter Wren	*Troglodytes hiemalis*		X	X		X		
Wood Duck	*Aix sponsa*	X						
Wood Thrush	*Hylocichla mustelina*	X	X	X	X	X	X	
Yellow Warbler	*Setophaga petechia*	X						
Yellow-bellied Sapsucker	*Sphyrapicus varius*	X	X			X	X	
Yellow-billed Cuckoo	*Coccyzus americanus*	X						
Yellow-throated Vireo	*Vireo flavifrons*		X	X				
Total Number Observed		**64**	**59**	**47**	**17**	**36**	**26**	**18**

[1]TF= Turners Falls Impoundment (Includes the shoreline of TFI, the Bypass Reach, and below Cabot Station to the Route 116 Bridge in Sunderland)

Table 3.3.4.1-4: Botanical Species Found in the Study Area

Common Name	Scientific Name	NFM[1]	TF[2]
alternate-leaved dogwood	*Cornus alternifolia*		X
American basswood	*Tilia americana*		X
American beech	*Fagus grandifolia*	X	X
American bulrush	*Scirpus pungens*		X
American chestnut	*Castanea dentata*	X	
American elm	*Ulmus americana*		X
American hazelnut	*Corylus americana*	X	
American hornbeam	*Carpinus caroliniana*	X	X
American pokeweed	*Phytolacca americana*	X	
American speedwell	*Veronica americana*		X
American witch-hazel	*Hamamelis virginiana*	X	X
anise-scented goldenrod	*Solidago odora*		X
arrow arum	*Peltandra virginica*		X
arrow-leaved tearthumb	*Polygonum sagittatum*		X
arrowwood	*Viburnum dentatum*		X
Asian bush honeysuckle	*Lonicera sp.*	X	
Asiatic cayflower	*Commelina communis*		X
asparagus	*Asparagus officinalis*		X
autumn olive	*Elaeagnus umbellata***	X	X
balsam fir	*Abies balsamea*	X	
barberpole sedge	*Scirpus microcarpus*	X	
bearberry	*Arctostaphylos uva-ursi*	X	
bedstraw	*Gallium spp.*		X
bee balm	*Monarda didyma*		X
big bluestem	*Andropogon gerardii*		X
big-star sedge	*Carex rosea*		X
bigtooth aspen	*Populus grandidentata*	X	
bird's-foot trefoil	*Lotus corniculatus*	X	
bitter dock	*Rumex dotusifolis*		X
bittersweet nightshade	*Solanum dulcamara*	X	X
black birch	*Betula lenta*	X	X
black cherry	*Prunus serotina*		X
black chokeberry	*Aronia melanocarpa*		X
black chokeberry	*Pyrus melanocarpa*		X
black gum	*Nyssa sylvatica*		X
black locust	*Robinia pseudoacacia***		X
black oak	*Quercus velutina*	X	X
black swallow-wort	*Cynanchum louiseae***		X
black-eyed Susan	*Rudbeckia hirta*	X	X
bladder campion	*Silene sp.*	X	

Common Name	Scientific Name	NFM[1]	TF[2]
bladder sedge	*Carex intumescens*	X	
bloodroot	*Sanguinaria canadensis*		X
blue flag iris	*Iris versicolor*	X	X
blue vervain	*Verbena hastata*		X
blue-eyed grass	*Sisyrinchium angustifolium*	X	
bluejoint grass	*Calamagrostis canadensis*		X
blue-stemmed goldenrod	*Solidago caesia*		X
bluets	*Houstonia sp.*		X
blunt spikerush	*Elocharis obtusa*		X
blunt-lobed cliff-fern	*Woodsia obtusa*		X
boneset	*Eupatorium perfoliatum*	X	X
box elder	*Acer negundo*	X	
bracken fern	*Pteridium aquilinum*	X	X
broad-leaved cattail	*Typha latifolia*		X
broad-leaved dock	*Rumex obtusifolius*		X
broom sedge	*Carex scoparia*	X	
burning bush	*Euonymus alatus***	X	X
burred	*Sparganium americanum*		X
bush honeysuckle	*Diervilla lonicera*	X	X
butter-and-eggs	*Linaria vulgaris*	X	X
buttonbush	*Cephalanthus occidentalis*		X
calico aster	*Symphyotrichum lateriflorum*		X
Canada mayflower	*Maianthemum canadense*	X	X
Canada rush	*Juncus canadensis*		X
Canada St. John's wort	*Hypericum canadense*	X	
Canada thistle	*Cirsium arvense*		X
Canada yew	*Taxus canadensis*		X
cardinal flower	*Lobelia cardinalis*		X
carrion flower	*Smilax herbacea*		X
chestnut oak	*Quercus prinus*	X	
chickweed	*Stellaria media*		X
chokecherry	*Prunus virginiana*	X	
christmas fern	*Polystichum acrostichoides*	X	X
cinnamon fern	*Osmundastrum cinnamomeum*	X	X
clammy everlasting	*Gnaphalium macounii*		X
clasping dogbane	*Apocynun cannabinum*		X
clearweed	*Pilea pumila*		X
climbling bittersweet	*Celastrus scandens*		X
club moss	*Huperzia sp.*	X	
coltsfoot	*Tussilago farfara****	X	X
common blackberry	*Rubus allegheniensis*		X

Common Name	Scientific Name	NFM[1]	TF[2]
common buckthorn	*Rhamnus cathartica***		X
common burdock	*Arctium minus*	X	X
common chicory	*Cichorium intybus*	X	X
common cinquefoil	*Potentilla simplex*	X	X
common cocklebur	*Xanthium chinense*		X
common cow-wheat	*Melampyrum pratense*	X	
common dewberry	*Rubus flagellaris*	X	X
common evening primrose	*Oenothera biennis*		X
common greenbrier	*Smilax rotundifolia*		X
common jewelweed	*Impatiens capensis*	X	X
common milkweed	*Asclepias syriaca*	X	X
common mugwort	*Artemisia vulgaris*		X
common mullein	*Verbascum thapsus*	X	X
common plantain	*Plantago major*	X	
common ragweed	*Ambrosia artemisiifolia*	X	X
common reed	*Phragmites australis***	X	X
common shadbush	*Amelanchier arborea*		X
common spikerush	*Elocharis palustris*		X
common water plantain	*Alisma subcordatum*		X
common woodsorrell	*Oxalis montata*		X
cow vetch	*Vicia cracca*	X	X
creeping jenny	*Lysimachia nummularia***		X
creeping speawort	*Ranunculus reptans*		X
curled dock	*Rumex crispus*	X	
dandelion	*Taraxacum officinale*		X
daylily	*Hemerocallis sp.*	X	
deer berry	*Vaccinium staminium*		X
deer-tongue grass	*Dichanthelium clandestinum*	X	X
deptford pink	*Dianthus armeria*	X	
devil's begger-ticks	*Bidens frondosa*	X	X
Dewey's sedge	*Carex deweyana*		X
downy rattlesnake plantain	*Goodyera pubescens*	X	X
early lowbush blueberry	*Vaccinium vacillans*	X	
eastern cottonwood	*Populus deltoides*	X	X
eastern hemlock	*Tsuga canadensis*	X	X
eastern serviceberry	*Amelanchier canadensis*	X	X
eastern teaberry	*Gaultheria procumbens*	X	X
eastern white pine	*Pinus strobus*	X	X
ebony spleenwort	*Asplenium platyneuron*	X	X
elderberry	*Sambucus canadensis*		X
enchanter's nightshade	*Circaea lutetiana*	X	X

Common Name	Scientific Name	NFM[1]	TF[2]
European alder	*Alnus glutinosa***	X	
false baby's breath	*Galium mollugo*		X
false dragonhead	*Physostegia virginiana*		X
false hellebore	*Veratrum viride*	X	X
false indigo	*Amorpha fruticosa*		
false nettle	*Boehmeria cylindrical*		X
false Solomon's seal	*Maianthemum racemosum*	X	X
field penny-cress	*Thlaspi arvense*	X	
field pepperweed	*Lepidium campestre*	X	
flattened oatgrass	*Danthonia compressa*		X
flat-top goldentop	*Euthamia graminifolia*	X	
flat-top white aster	*Doellingeria umbellata*		X
fleabane	*Erigeron spp.*	X	X
flowering dogwood	*Cornus florida*		X
foam flower	*Tiarella cordifolia*	X	X
forget-me-not	*Myostis scorpiodes*		X
fox grape	*Vitis labrusca*		X
fringe loosestrife	*Lysimachia ciliata*		X
fringed sedge	*Carex crinita*	X	
garlic mustard	*Alliaria petiolate***		X
gaywings	*Polygala paucifolia*		X
giant goldenrod	*Solidago gigantica*		X
glossy buckthorn	*Frangula alnus***	X	X
golden Alexander's	*Zizua ayrea*		X
golden club	*Orontium aquaticum*		X
golden ragwort	*Senecio aureus*		X
goldenrod	*Solidago spp.*	X	X
goldthread	*Coptis trifolia*	X	X
gray birch	*Betula populifolia*	X	
gray goldenrod	*Solidago nemoralis*		X
great blue lobelia	*Lobelia siphilitca**		X
great Solomon's seal	*Polygonatum canaliculatum*		X
green ash	*Fraxinus pennsylvanica*	X	X
green bulrush	*Scirpus atrovirens*	X	
green milkweed	*Asclepias viridiflora*		X
ground ivy	*Glechoma hederacea*	X	X
groundnut	*Apios americana*		X
ground pine	*Lycopodium obscurum*	X	X
hair-cap moss	*Polytrichum juniperinum*		X
hairy bush clover	*Lespedeza hirta*	X	
hairy Solomon's seal	*Polygonatum pubescens*		X

Common Name	Scientific Name	NFM[1]	TF[2]
harebell	*Campanula rotundifolia*		X
hawkweed	*Hieracium caespitosum*	X	
hawthorn	*Crataegus sp.*		X
hay-scented fern	*Dennstaendtia punctilobula*	X	
heart-leaved aster	*Aster cordifolius*		X
hepatica	*Hepatica nobilis*	X	
highbush blueberry	*Vaccinium corymbosum*	X	X
hispid buttercup	*Ranunculus hispidus*		X
hoary vervain	*Verbena stricta*		X
hobblebush	*Viburnum lantanoides*	X	X
hog peanut	*Amphicarpaea bracteata*	X	X
hop hornbeam	*Ostrya virginiana*		X
hop trefoil	*Trifolium campestre*	X	
Indian cucumber	*Medeola virginiana*	X	X
Indian grass	*Sorghastrum nutans*		X
Indian pipe	*Monotropa uniflora*	X	X
Indian tobacco	*Lobelia inflata*		X
intermediate spike-sedge	*Eleocharis intermedia**		X
interrupted fern	*Osmunda claytoniana*	X	X
Jack in the pulpit	*Arisaema triphyllum*		X
Japanese barberry	*Berberis thunbergii***	X	X
Japanese honeysuckle	*Lonicera japonica***		X
Japanese knotweed	*Fallopia japonica***	X	X
Japanese privet	*Ligustrum obtusifolium*		X
Japanese stiltgrass	*Microstegium vimineum****		X
Jerusalum artichoke	*Helianthus tuberosus*		X
joe-pye weed	*Eupatorium purpureum*	X	X
jump seed	*Tovara virginiana*		X
Kalm's lovelia	*Lobelia kalmii*		X
large cocklebur	*Xanthium strumarium*		X
larger bur marigold	*Bidens laevis*		X
leafy spurge	*Euphorbia esula***		X
lesser celandine	*Ranunculus ficaria***		X
lily-of-the-valley	*Convallaria majalis*		X
little bluestem grass	*Schizachyrium scoparium*	X	
long-bracted orchis	*Habernaria viridis*		X
lowbush blueberry	*Vaccinium angustifolium*	X	X
mad dog skullcap	*Scutellaria lateriflora*		X
maiden-hair fern	*Adiantum pedatum*		X
maidenhair spleenwort	*Asplenium trichomanes*		X
mannagrass	*Glyceria sp.*	X	

Common Name	Scientific Name	NFM[1]	TF[2]
maple-leaf viburnum	*Viburnum acerifolium*	X	
marginal wood-fern	*Dryopteris marginalis*	X	
marsh fern	*Thelypteris palustris*	X	X
marsh grass of Parnassus	*Parnassia alustris*		X
marsh horsetail	*Equisetum palustre*	X	
marsh marigold	*Caltha palustris*	X	X
marsh speedwell	*Veronica scutellata*		X
marshpepper knotweed	*Polygonum hydropiper*		X
mayapple	*Podophyllum peltatum*		X
mint	*Mentha arvensis*		X
monkey flower	*Mimulus guttatus*		X
morning glory	*Ipomoea purpurea*		X
Morrow's honeysuckle	*Lonicera morrowii***		X
mountain alder	*Alnus virdis ssp. crispa**		X
mountain laurel	*Kalmia latifolia*	X	X
mouse-ear-chickweed	*Cerastium vulgatum*		X
multiflora rose	*Rosa multiflora***	X	X
naked-flowered tick trefoil	*Desmondium nudiflorum*		X
nannyberry	*Viburnum lentago*		X
narrowleaf cattail	*Typha angustifolia*	X	
New England aster	*Symphyotrichum novae-angliae*		X
New England sedge	*Carex novae-angliae*		X
New York aster	*Symphyotrichum novi-belgii*		X
New York fern	*Thelypteris noveboracensis*	X	
nodding smartweed	*Polygonum lapathifolium*		X
northern bayberry	*Myrica pensylvanica*		X
northern bugleweed	*Lycopus uniflorus*	X	X
northern catalpa	*Catalpa speciosa*		X
northern red oak	*Quercus rubra*	X	X
Norway maple	*Acer platanoides***		X
Norwegian cinquefoil	*Potentilla norvgica*		X
Olney's three-square bulrush	*Schoenoplectus americanus*	X	
orangegrass	*Hypericum gentianoides*	X	
Oriental bittersweet	*Celastrus orbiculatus***	X	X
ostrich fern	*Matteuccia struthiopteris*	X	X
oxeye daisy	*Leucanthemum vulgare*	X	
pale corydalis	*Corydalis sempervirens*	X	
panicled aster	*Symphyotrichum simplex*		X
partridge berry	*Mitchella repens*	X	X
path rush	*Juncus tenuis*		X
pearly everlasting	*Anaphalis margaritacea*		X

Common Name	Scientific Name	NFM[1]	TF[2]
pickerelweed	*Pontederia cordata*		X
pin cushion moss	*Leucobryum albidum*		X
pin oak	*Quercus palustris*	X	
pinkweed	*Polygonum pensylvanicum*		X
pippsissewa	*Chimaphila umbellata*		X
plae dogwood	*Cornus obliqua*		X
plantain-leaved pussytoes	*Antennaria plantaginifolia*	X	
plantain-leaved sedge	*Carex plantaginea*		X
poison ivy	*Toxicodendron radicans*	X	X
purple chokeberry	*Pyrus floribunda*		X
purple cliff brake	*Pellaea atropurpurea*		X
purple leaved willow herb	*Epilobium ciliatum*		X
purple loosestrife	*Lythrum salicaria***	X	X
purple osier willow	*Salix pupurea*		X
purple virgin's bower	*Clematis verticillaris*		X
purple-flowering raspberry	*Rubus odoratus*		X
quaking aspen	*Populus tremuloides*	X	
Queen Anne's lace	*Daucus carota*	X	X
quillwort	*Isotes spp.*		X
rabbit-foot clover	*Trifolium arvense*		X
red cedar	*Juniperus virginiana*	X	
red chokeberry	*Pyrus arbutifolia*		X
red clover	*Trifolium pratense*	X	X
red fescue	*Festuca rubra*		X
red maple	*Acer rubrum*	X	X
red mullberry	*Morus rubra*		X
red pine	*Pinus resinosa*		X
red trillium	*Trillium erectum*	X	
red-osier dogwood	*Cornus stolonifera*		X
reed canary grass	*Phalaris arundinacea***		X
Rhododendron	*Rhododendron sp.*	X	
rice cutgrass	*Leersia oryzoides*		X
river bank grape	*Vitis riparia*	X	X
river birch	*Betula nigra*		X
rock polypody	*Polypodium virginianum*	X	X
rough bedstraw	*Galium asprellum*	X	
rough-fruited cinquefoil	*Potentilla recta*	X	
rough-leaved goldenrod	*Solidago patula*		X
round-leaved dogwood	*Cornus rugosa*		X
rough-stemmed goldenrod	*Solidago rugosa*		X
round-lobed hepatica	*Hepatica americana*		X

Common Name	Scientific Name	NFM[1]	TF[2]
royal fern	*Osmunda regalis*	X	X
Russian olive	*Elagnus angustifloia*		X
Rusty cliff-fern	*Woodsia ilvensis*	X	
sand violet	*Viola adunca*		X
sandbar cherry	*Prunus pumila var. depressa**		X
sandbar willow	*Salix exigua**		X
sassafras	*Sassafras albidum*	X	X
saxifrage	*Saxifraga spp.*		X
scouring rush	*Equisetum hyemale*	X	
scrub oak	*Quercus ilicifolia*		X
scrub- oak	*Quercus ilicifolia*	X	
seedbox	*Ludwigia alternifloria*		X
self-heal	*Prunella vulgaris*	X	X
sensitive fern	*Onoclea sensibilis*	X	X
shagbark hickory	*Carya ovata*	X	
shallow sedge	*Carex lurida*	X	
shaved sedge	*Carex tonsa*		X
sheep laurel	*Kalmia angustifolia*	X	
silky dogwood	*Cornus amomum*	X	X
silver maple	*Acer saccharinum*		X
silver rod	*Solidago bicolor*		X
silver vein	*Parthenocissus henryana*		X
skunk cabbage	*Symplocarpus foetidus*		X
slender gerardia	*Agalinis tenuifolia*		X
slender-leaved goldenrod	*Solidago tenuifolia*		X
smartweed	*Polygonum sp.*	X	X
Smith's club sedge	*Schoenoplectus smithii*		X
smooth alder	*Alnus serrulata*		X
smooth sumac	*Rhus glabra*	X	
soft rush	*Juncus effusus*	X	X
soft-stem bulrush	*Schoenoplectus tabernaemontani*		X
speckled alder	*Alnus incana*	X	X
sphagnum	*Sphagnum sp.*	X	
spinulose woodfern	*Dryopteris carthusiana*	X	
spotted joe-pyeweed	*Eupatorium maculatum*		X
spotted knapweed	*Centaurea maculosa***	X	
spreading dogbane	*Apocynum androsaemifolium*	X	X
squashberry	*Viburnum edule*	X	
St. John's wort	*Hypericum perforatum*		X
staghorn sumac	*Rhus typhina*	X	X
starflower	*Trientalis borealis*	X	X

Common Name	Scientific Name	NFM[1]	TF[2]
steeplebush	*Spiraea tomentosa*	X	X
stiff aster	*Ionactis linariifolius*		X
stinging nettle	*Urtica dioica*		X
striped maple	*Acer pensylvanicum*	X	X
striped wintergreen	*Chimaphila maculata*	X	X
sugar maple	*Acer saccharum*		X
swamp azalea	*Rhodoendron viscosum*		X
swamp candles	*Lysimachia terrestris*		X
swamp dewberry	*Rubus hispidus*	X	X
swamp honeysuckle	*Lonicera oblongifolia*	X	
swamp rose	*Rosa palustris*	X	
swamp white oak	*Quercus bicolor*	X	
sweet fern	*Comptonia peregrina*	X	X
sweet flag	*Acorus calamus*	X	X
sweetgale	*Myrica gale*		X
switchgrass	*Panicum vigatum*		X
sycamore	*Platanus occidentalis*		X
tall blue lettuce	*Lactuca biennis*		X
tall meadow rue	*Thalictrum puescens*		X
tall rattlesnake root	*Prenanthes altissima*		X
Tartarian honeysuckle	*Lonicera tatarica****		X
thimbleberry	*Rubus parviflorus*		X
three seed mercury	*Acalypha rhomboidea*		X
three-way sedge	*Dulichium arundinaceum*		X
tick-trefoil	*Desmondium glutinosum*	X	
tiger lily	*Lilum tigrinum*		
tower mustard	*Arabis glabra*	X	
Tradescant's aster	*Symphyotrichum tradescantii*		X
trillium	*Trillium sp.*	X	
turtle head	*Chelone glabra*		X
tussock sedge	*Carex stricta*		X
twig rush	*Cladium sp.*		X
twisted stalk	*Streptopus amplexifolis*	X	
tyme-leaved speedwell	*Veronica serphyllifolia*		X
upland white aster	*Oligoneuron album**		X
violet	*Viola sp.*	X	X
viper's bugloss	*Echium vulgare*	X	
Virginia creeper	*Parthenocissus quinquefolia*	X	X
virgin's bower	*Clematis virginiana*	X	X
water hemlock	*Cicuta maculata*		X
water horehound	*Lycopus americanus*	X	X

Common Name	Scientific Name	NFM[1]	TF[2]
water horsetail	*Equisetum fluviatile*		X
water parsnip	*Sium suave*	X	X
water pennywort	*Hydrocotyle sp.*	X	
water-chestnut	*Trapa natans*		X
watercress	*Nasturtium officinale*		X
white ash	*Fraxinus americana*		X
white avens	*Geum canadense*		X
white birch	*Betula papyrifera*	X	X
white clover	*Trifolium repens*	X	
white meadowsweet	*Spiraea alba var. latifolia*	X	X
white oak	*Quercus alba*	X	
white ricegrass	*Leersia virginica*		X
white snakeroot	*Ageratina altissima*		X
white sweet clover	*Melilotus albus*	X	X
white wood aster	*Aster divaricatus*		X
whorled loosestrife	*Lysimachia quadrifolia*	X	X
whorled wood aster	*Oclemena acuminata*		X
wild columbine	*Aquilegia canadinsis*	X	X
wild lettuce	*Lactuca virosa*		X
wild madder	*Rubia peregrina*	X	
wild oats	*Avena fatua*		X
wild oats	*Uvularia sessilifolia*		X
wild raisin	*Viburnum cassinoides*		X
wild sarsaparilla	*Aralia nudicaulis*	X	X
wild stonecrop	*Sedum ternatum*		X
wild strawberry	*Fragaria virginiana*	X	
winterberry	*Ilex verticillata*	X	X
wood nettle	*Laportea canadensis*		X
woodfern	*Dryopteris sp.*		X
woolgrass	*Scirpus cyperinus*		X
yarrow	*Achillea millefolium*	X	X
yellow birch	*Betula alleghaniensis*	X	X
yellow iris	*Iris pseudacorus***	X	
yellow nutsedge	*Cyperus esculentus*		X
yellow woodsorrell	*Oxalis stricta*	X	

[1]NFM= Northfield Mountain Pumped Storage Development Area

[2]TF= Turners Falls Impoundment Study Area(Includes the shoreline of TFI, the Bypass Reach, and below Cabot Station to the Route 116 Bridge in Sunderland)

* Denotes RTE

**Denotes Invasive according to MIPAG

***Denotes Likely Invasive according to MIPAG

Table 3.3.4.1-5: Mapped Habitats, Dominant Vegetation, and Percent Occurrence within the Study Area

Habitat Type	Dominant Overstory[1]	Dominant Shrub[1]	Dominant Herbaceous[1]	NFM[2]		TF[2]	
				Acres	% of Area	Acres	% of Area
Transitional Floodplain Forest	Silver maple (51-75%), sycamore (10-15%), cottonwood (10-15%), red maple (10-15%), ash (5-10%), American elm (5-10%), and willow (5-10%)	Silver maple (trace), sycamore (trace), cottonwood (trace), red maple (trace), ash (trace), American elm (trace), and willow (trace)	wood-nettle (5-10%), ostrich fern (6-25%), sensitive fern (5-10%) and false nettle (5-10%)	0	0	146.4	1.99
Northern hardwoods-hemlock-white pine forest	hemlock (75-100%), yellow birch (10-15%), American beech (5-10%)	hemlock (trace), hobblebush (trace), striped maple (trace)	sarsaparilla (trace), Canada mayflower (trace), wood fern (trace)	127.8	6.4	1468.2	19.95
Successional Northern Hardwood Forest	red maple, American beech, white birch, quaking aspen (51-75%)	striped maple (6-25%) witch hazel (6-25%)	sarsaparilla (6-25%), twisted stalk (6-25%), starflower (6-25%)	666.8	33.2	106.2	1.44
Hemlock Ravine	eastern hemlock (76-100%)	mountain laurel (6-25%)	starflower (trace), wintergreen (trace)	621.5	30.9	40.5	0.55
White Pine - Oak Forest	white pine (75-100%), red oak (6-25%), overcup oak (6-25%)	red maple (25%), low bush blueberry (10%), white oak (10%)	Canada mayflower (6-25%), partridge berry (6-25%)	70.1	3.5	0	0
Agricultural Lands	N/A	N/A	N/A	0	0	1926.2	26.18
Development	white pine (trace)	N/A	Kentucky bluegrass (76-100%)	284.8	14.2	283.9	3.86

Habitat Type	Dominant Overstory[1]	Dominant Shrub[1]	Dominant Herbaceous[1]	NFM[2]		TF[2]	
				Acres	% of Area	Acres	% of Area
Right of Way	N/A	white pine (6-25%), glossy buckthorn (6-25%)	goldenrod spp. (6-25%), interrupted fern (6-25%), sweetfern (6-25%), bracken fern (6-25%), mullein (6-25%)	14.3	0.7	4.3	0.06
Wetlands	See section X	See section X	See section X	N/A	N/A	108.5	1.47
Water	N/A	N/A	N/A	225.5	11.1	3274.2	44.5
Total				**2010.8**	**100**	**7358.4**	**100**

[1]Percent cover will be updated in December 2015 pending results of 2015 field survey
[2]NFM=Northfield Mountain, TF=Turner Falls (Includes the shoreline of Turner Falls Impoundment, the Bypass Reach, and below Cabot Station to the Route 116 Bridge in Sunderland

Table 3.3.4.1-6: Vernal Pool Field Notes

Pool ID	Egg Masses		Pool Dimensions (Feet)	Water Depth (Feet)	Comments
	Spotted Salamander	Wood Frog			
VP-1	0	0	80x30	1.0	Only VP found in TF project area.
VP-2	0	0	200x50	3.0	Spotted salamander (Ambystoma maculatum) spermatophores man-made rock-quarry
VP-3	>66	40	45x72	1.5	
VP-4	25	0	120x30	2.0	
VP-5	50	25	100x40	1.0	
VP-6	32	0	100x45	1.0	
VP-7	25	0	125x75	2.0	
VP-8	18	6	75x40	2.0	
VP-9	12	2	20x20	2.0	
VP-10	12	0	-	3.0	
VP-11	52	18	45x25	2.0	
VP-12	15	>30	-	-	red spotted newts (Notophthalmus viridescens) feeding on egg masses
VP-13	25	>500	250x50	4.0	red spotted newts (Notophthalmus viridescens) feeding on egg masses
VP-14	5	6	120x45	2	

Table 3.3.4.1-7: Invasive species found in the Study Area

Scientific Name	Common Name	Lifeform Type	NFM	TF	Notes
Acer platanoides	Norway maple	Tree		X	Common in woodlands with colluvial soils, grows full sun to full shade dispersed by water, wind and vehicles
Alliaria petiolate	Garlic mustard	Biennial Herb		X	Widespread, grows full sun to full shade, spreads by seed, especially in wooded areas
*Alnus glutinosa****	European alder	Shrub	X		Rapidly growing shrub that establishes monspecific stands displacing natives
Berberis thunbergii	Japanese barberry	Shrub	X	X	Wooded uplands and wetlands, grows in full sun to full shade, spread by birds, forms dense stands
Celastrus orbiculatus	Oriental bittersweet	Perennial vine	X	X	Grows in full sun to partial shade, berries spread by birds and humans
*Centaurea maculosa***	Spotted knapweed	Perennial herb	X	X	Occurs in full sun, spreads rapidly in artificial corridors, agricultural fields, and margins.
Cynanchum louiseae	Black swallow-wort	Perennial vine		X	Grows in full sun to partial shade, forms dense stands, deadly to Monarch butterfly larvae
Elaeagnus umbellata	Autumn olive	Shrub	X	X	Grows in full sun, berries spread by birds, aggressive in open areas
Euonymus alatus	Burning bush	Shrub	X	X	Capable of germinating in full sun to full shade. Escapes from cultivation and can form dense thickets and dominate the understory
Euphorbia esula	Leafy spurge	Perennial herb		X	Aggressive, grows in full sun, occurs in grasslands
Fallopia Japonica	Japanese knotweed	Perennial Herb-subshrub	X	X	Widespread, grows in full sun to full shade, spreads vegetatively and by seed, forms dense thickets
Frangula alnus	Glossy buckthorn	Shrub-tree	X		Occurs in uplands and wetlands, grows in full sun to full shade, forms thickets
Iris pseudacorus	Yellow iris	Perennial herb	X		Occurs in wetland habitat, grows in full sun to partial shade, out-competes native plant communities.
Lonicera japonica	Japanese honeysuckle	Perennial vine	X	X	Widespread, grows full sun to full shade, climbs vegetation, seeds dispersed by birds

Scientific Name	Common Name	Lifeform Type	NFM	TF	Notes
Lonicera morrowii	Morrow's honeysuckle	Shrub		X	Widespread, grows full sun to full shade, dispersed by birds, can hybridize with other honeysuckle species
Lysimachia nummularia	Creeping jenny	Perennial herb		X	Occurs in uplands and wetlands, grows in full sun to full shade, forms dense mats
Lythrum salicaria	Purple loosestrife	Perennial herb	X	X	Occurs in uplands and wetlands, grows in full sun to partial shade, high seed production, overtakes wetlands
Phalaris arundinacea	Reed canary grass	Perennial grass		X	Occurs in uplands and wetlands, grows full sun to partial shade, can form large colonies, common in agricultural settings
Phragmities australis	Common reed	Perennial grass	X	X	Grows in uplands and wetlands, full sun to full shade, forms dense stands, flourishes in disturbed areas
Ranunculus ficaria	Lesser celandine	Perennial herb		X	Occurs in lowland and upland woods, grows in full sun to full shade, spreads vegetatively and by seed, forms dense stands
Rhamnus cathartica	Common buckthorn	Shrub-tree		X	Occurs in uplands and wetlands, grows in full sun to full shade.
Robinia pseudoacacia	Black locust	Tree		X	Occurs in uplands, grows full sun to full shade, aggressive in areas with sandy soils
Rosa multiflora	Multiflora rose	Shrub	X	X	Widespread, grows in full sun to full shade, forms thorny thickets, dispersed by birds.
*Tussilago farfara**	Coltsfoot	Perennial herb	X		Occurs in lowland and upland woods, grows in full sun to full shade, spreads vegetatively and by seed, forms dense stands
Trapa natans	Water-chestnut	Annual herb		X	Occurs in aquatic habitats, forms dense floating mats on water.

NFM=Northfield Mountain, TF=Turner Falls (Includes the shoreline of Turner Falls Impoundment, the Bypass Reach, and below Cabot Station to the Route 116 Bridge in Sunderland)

*MIPAG watch list species
** USDA Forestry Service early detection species (not on MIPAG list)
*** Not on MIPAG list, but noted for consistency with other studies

Figure 3.3.4.1-1: Example of Remnant Floodplain Forest Along Shoreline Downstream of Cabot

Figure 3.3.4.1-2: Example of Successional Northern Hardwoods

Figure 3.3.4.1-3: Example of Northern Hardwoods-Hemlock-White Pine Forest on Northwest Slope of Northfield Mountain

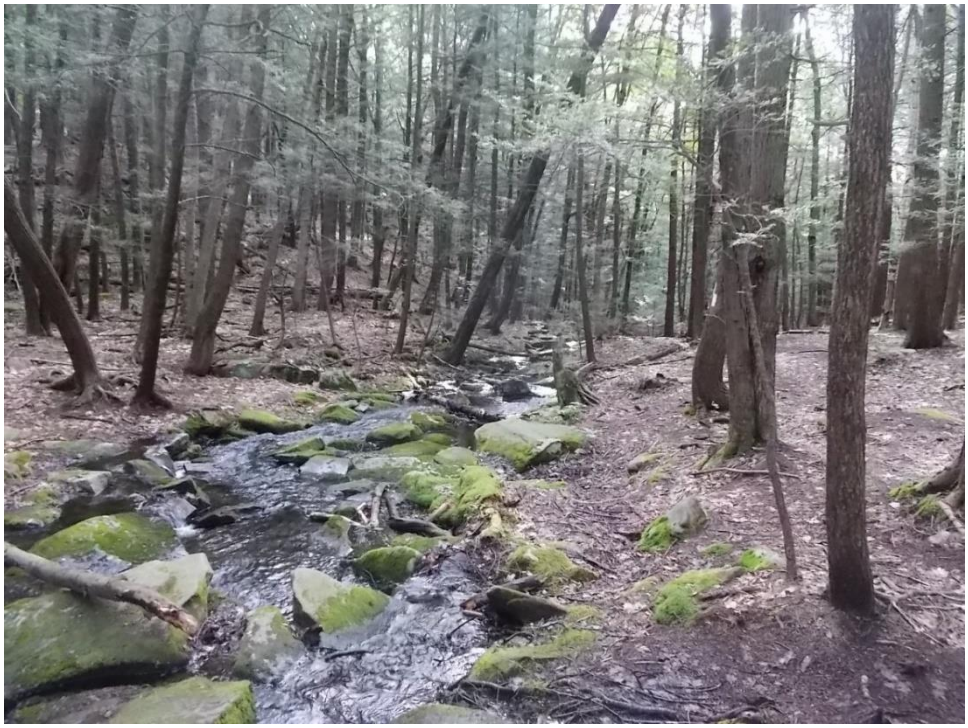


Figure 3.3.4.1-4: Example of Hemlock Ravine Community

Figure 3.3.4.1-5: View through the interior of the white pine-oak forest

Figure 3.3.4.1-6: Calcareous Cliff Habitat

Figure 3.3.4.1-7: Circumneutral Rock Cliff Community- Farley Ledges (formed from granitic gneiss)

Figure 3.3.4.1-8: Example of Oak - Hickory Forest

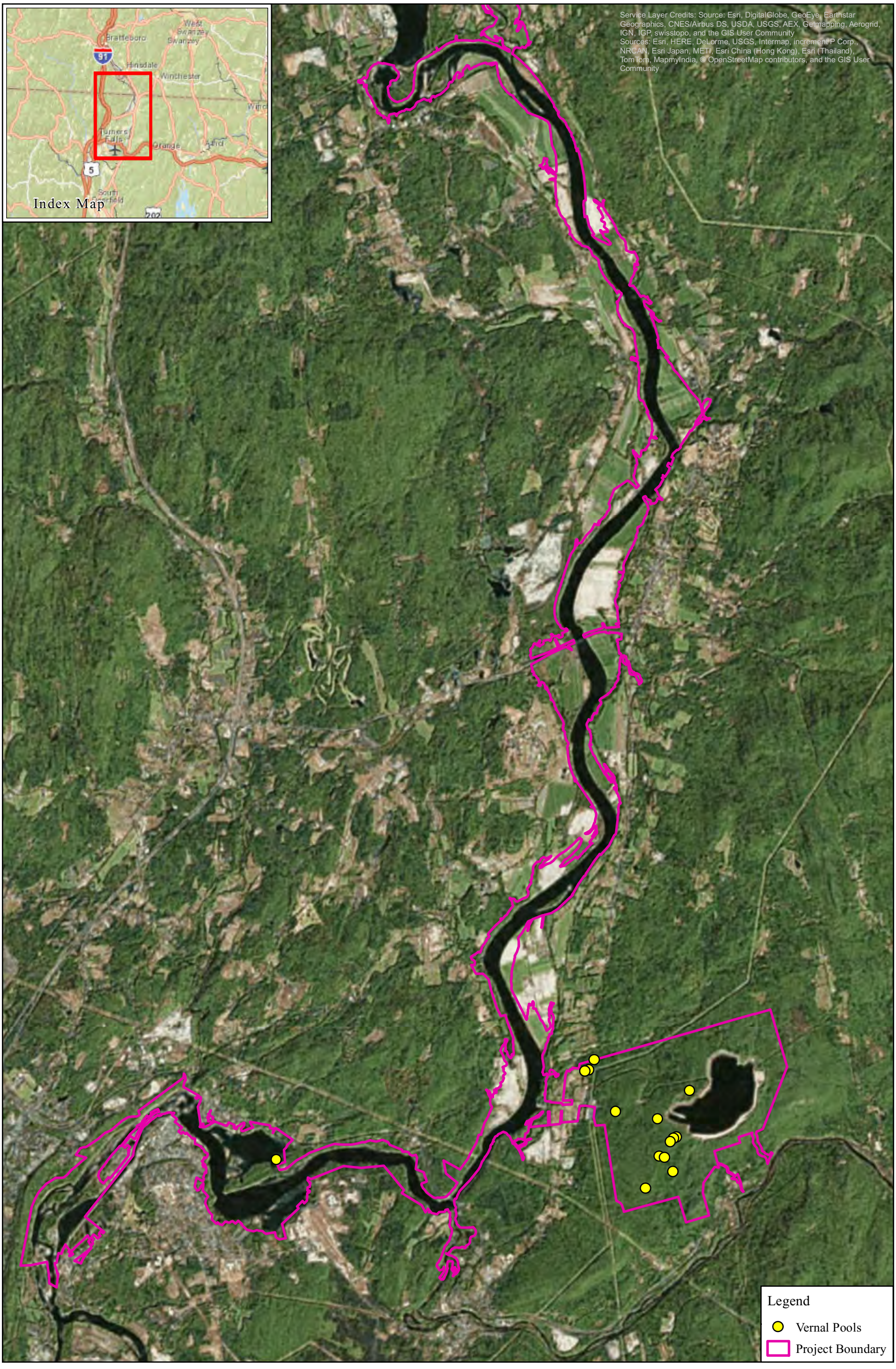
Figure 3.3.4.1-9: Example of Agricultural Land in the Study Area

Figure 3.3.4.1-10: Typical Habitat of Bypass During Low-Flow in Late Summer

Figure 3.3.4.1-11: Representative View of the Right-of-Way Community.

Figure 3.3.4.1-12: Example of Hemlock Swamp Near the Base of the Farley Ledges

Figure 3.3.4.1-13: Example of Red Maple Swamp on Southeast Slope of Northfield Mountain



FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

N

0 0.5 1 2 Miles

Figure 3.3.4-1-14
Locations of Identified
Vernal Pools

Path: W:\gis\maps\dla\figure_3_3_4_1-14.mxd

VERNON DAM

FRENCH KING BRIDGE

SUNDERLAND BRIDGE

SUNDERLAND BRIDGE

Index Map

Legend

Invasive Species

- A. glutinosa
- B. thunbergii
- C. maculosa
- C. orbiculatus
- E. umbellata
- F. alnus
- F. japonica
- L. japonica
- L. salicaria
- M. albus
- P. australis
- R. multiflora
- S. purpurea
- T. natans
- C. louiseae
- E. alatus
- M. vimineum
- P. perfoliata
- V. minor

Shoreline Invasive Species Coverage

- <5%
- 5-25%
- 25-50%
- >50%

FirstLight GDF SUEZ

N

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Turners Falls Hydroelectric Project No. 1889

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Exhibit E

0 0.75 1.5 3 Miles

Figure 3.3.4.1-15
Locations of Identified
Invasive Plants

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3.3.5 Threatened and Endangered Species

In 2011, the following Federal and state agencies were contacted regarding the potential presence of rare, threatened, and endangered (RTE) species and critical habitats within the Turners Falls Development and Northfield Mountain Pumped Storage Development boundaries:

- USFWS
- NMFS
- NHESP
- Vermont Fish and Wildlife Department (VTFWD)
- New Hampshire Fish and Game Department (NHFGD)

NHESP provided a list of state-listed species known or likely to occur in the vicinity of the Turners Falls Development and Northfield Mountain Pumped Storage Development area in a letter dated October 27, 2011. Following the submittal of the Draft Modified Study Plan (No. 3.5.1 *Baseline Inventory of Wetland, Riparian, and Littoral Habitat in the Turners Falls Impoundment and Assessment of Operation Impact on Special Status Species*) to the NHESP in December of 2013, comments were received and incorporated in to the Revised Study Plan (FirstLight, 2013). The Revised Study Plan, which included surveys for identified special concern species at the Turners Falls Development and Northfield Mountain Pumped Storage Development, was completed throughout 2014 and 2015.

FERC Relicensing Studies

FirstLight has conducted several studies to gather information necessary to understand the potential effects of land management practices and recreational use on protected resources within the Northfield Mountain Pumped Storage Development and the Turner Falls Development study area. The goal of these studies is to characterize and describe both the extent of protected resources within the Project as well as potential effects:

- Survey and inventory identified protected and sensitive species;
- Note the occurrence of additional sensitive species during the course of the surveys;
- Complete fine scale data collection related to the elevation of specific species (i.e., vascular plants and tiger beetles) to identify potential impacts related to water level fluctuations.

3.3.5.1 Affected Environment

Background

Protected species within the Project area include vascular plants, vertebrate animals, and invertebrate animals.

At a November 1, 2013 meeting, NHESP provided FirstLight with a list of 10 sensitive plant species of concern (target plants) known to occur or have historical records of occurrence within or near the vicinity of the Project between Vernon Dam and the Route 116 Bridge in Sunderland. NHESP targeted these state-listed plant species as having the highest likelihood of experiencing potential effects due to Project operations - specifically related to inundation (including depth, timing and duration).

Pursuant to the NHESP Data Release Agreement (NHESP File #11-30121) dated November 13, 2013, NHESP provided FirstLight with a list of specific locations where the above listed sensitive plant species have been observed or where NHESP has historical records of occurrences. For some locations NHESP has spatial data they have provided to FirstLight to better focus survey efforts. Pursuant to the data release agreement, FirstLight is not permitted to disclose the specific location of the plant specimens in publicly available documents.

Vascular Plants

Field surveys completed in 2014 and 2015, and based on coordination with the NHESP, identified eight of the ten plant species identified by the NHESP within the TFI, bypass reach, and downstream section to the Sunderland Bridge (Table 3.3.5.1-1). One additional species, great blue lobelia, was also identified. The bypass reach, which is dominated by exposed bedrock was the preferred location for all species identified during the survey work. Habitat within the bypass reach, which includes ledges, exposed bedrock, cobbles, and occasional sandy areas, is ideal for the majority of the species. In most cases mapped polygons includes dense populations ranging from a few to several thousand individuals. The bypass reach was the only location where great blue lobelia was identified (FirstLight, 2015a). A location overview for all mapped species in shown in Figure 3.3.5.1-1.

A topographic survey was completed in 2015 to examine elevation preferences for occupied suitable habitat in relation to current water level fluctuations. In addition, suitable, unoccupied habitat was also surveyed. A total of 15 transects were surveyed for topographic elevation and species density. Transects were selected in areas containing occupied and unoccupied habitat. Analysis of elevation and water level data will be completed in December, 2015. \

Mountain Alder

The mountain alder is a shrub which may reach approximately 12 feet in height, similar to other alders. It has toothed leaves generally with 6-9 main veins. The range of the mountain alder extends from Canada south to northern New England, and in Massachusetts the species is primarily found on exposed ledges, boulders, and cobble bars. Often these habitats coincide with high energy rivers. The primary threat to this species is from disturbance of habitat as well as competition from exotic species such as Japanese knotweed. Within the Project area, mountain alder is primarily found within the bypass reach, a typical example of the habitat present in the bypass reach is shown in Figure 3.3.5.1-2. Eight polygons of mountain alder (Figure 3.3.5.1-1) were mapped within the bypass reach in 2014, these polygons included approximately 73 individuals. Two remaining populations of the species were mapped at the northern extent of the impoundment, just below Vernon Dam. These populations were surveyed in 2015 to examine preferred elevations as well as to determine population density. Density for the surveyed populations, identified near Vernon Dam was calculated as 0.07 stems/m² with one individual identified in a single plot. Analysis of elevation and water level data will be completed by December, 2015. Habitat for the upper impoundment populations was similar to the bypass reach and consisted of exposed ledges, large cobbles, and bedrock. Associated species included speckled alder, smooth alder, dogbane, and scrub oak.

Intermediate Spike Sedge

The intermediate spike sedge is a small densely tufted annual herb with very wiry stems. The primary aid to identification of this species is to examine the achene, which is hard and nut-like. The achene for the intermediate spike sedge matures in mid to late summer and is three-sided with a narrow tubercle. Habitat for the intermediate spike sedge includes marshes and freshwater mudflats, or areas with muddy substrates. Potential threats to this species are unknown, and based on habitat preference the species is generally found in the proximity of freshwater (i.e., streams, rivers, and ponds). The NHESP has noted that regular water level fluctuations may benefit the species as it maintains the exposed muddy habitat preferred by the species (NHESP, 2009). The species was only identified in one location, the Pauchaug Boat Launch, in the Project area during survey work completed in 2014 and 2015 (Figure 3.3.5.1-1). Identification in the field was completed by NHESP approved botanist Steve Johnson (J. Leddick, personal communication, December 2, 2013). The species was first identified in 2014, in an area of exposed sand and mud (Figure 3.3.5.1-3). In 2015, the species was not located, but several transects were established at the location. Analysis of elevation and water level data will be completed in December, 2015. In general, the entire shoreline ranges from elevation 187.72 to 187.87 feet. In 2014, the intermediate spike rush was located at the transition from

exposed substrate to vegetation at the normal high-water line. Associated species include joe-pye weed, jewel weed, monkey flower, woolgrass, and, at higher elevations, spiny cocklebur (FirstLight, 2015a).

Frank's Lovegrass

Frank's lovegrass, a state species of concern, is an annual herb with repeatedly branched, erect culms, narrow blades (5-13 cm long and 1-3 mm wide), and small, ovate spikelets that are typically 3-5 flowered. This grass typically flowers from August through September. Frank's lovegrass is found along sandy riverbanks and sand bars and has been found only along the Housatonic and Connecticut Rivers in Massachusetts (NHESP, 2015). No observations of frank's love grass were recorded in 2014, however a single clump was identified next to the walking trail along the shoreline just south of the Pauchaug Boat Launch in 2015 (Figure 3.3.5.1-1).

Ovate Spike-sedge

The ovate spike-sedge is an annual grass that grows in low (2-6 inches) tufts. The straight, ascending stems are deep green and have a single, tight cluster of inconspicuous flowers (a "spike") at the apex. The stems do not have leaf blades but do have leaf sheaths surrounding the stem. The ovate spike-sedge is often found growing on sandy freshwater margins. This species was not observed during the 2014 survey; however, one clump was recorded on the sandy shore south of the Pauchaug Boat Launch in 2015 (Figure 3.3.5.1-1). Associated species include soft-stemmed spike-sedge, threeway sedge, buttonbush, soft rush, and common bur-reed (NHESP, 2015b).

Great Blue Lobelia

The great blue lobelia is a tall, showy perennial wildflower that inhabits circumneutral wetlands and transitional habitats. The species generally prefers open areas or areas of partial shade. While this species is listed, the plant was formerly cultivated and continues to be popular in gardening, and therefore some populations are likely introduced. A single stem of this species was located within the bypass reach in 2014. The plant was located within the exposed rocky habitat common to the area. Associated plant species include American water-horehound, purple loosestrife, smartweed, New York aster, and Tradescant's aster (FirstLight, 2015a).

Upland White Aster

The upland white aster is a small composite plant that flowers from July into early September. The species prefers rocky outcrops of sandstone, shale, or limestone. It is commonly found growing in cracks or fissures in bedrock outcrops. The upland white aster requires significant sunlight exposure and shading may be a threat. In addition, as the species is often located along exposed river banks, water level and recreational activities may pose threats to the species. Within the Project area, a number of polygons of upland white aster were mapped in 2014 in the bypass reach (Figure 3.3.5.1-1). Based on stem counts within these polygons, in excess of 638 individual plants were located within this area. The bypass reach is ideal habitat which includes exposed areas of bedrock (Figure 3.3.5.1-4). In addition, several smaller populations were identified within the TFI. In 2015, elevation transects at locations in the TFI were surveyed. These locations included both occupied and unoccupied habitats. Population mean densities were estimated at 1.36 stems/m^2 across each of five transects surveyed (FirstLight, 2015a). Associated species include big bluestem, dogbane, flat-top white aster, monkey flower, and joe-pye weed.

Sandbar Cherry

The sandbar cherry is member of the rose family and is a low growing shrub that can form mats up to 6 feet in breadth. The species, in Massachusetts, rarely grows above three feet in height. The species prefers flood-scoured areas, often along islands and shores. Habitat is generally dominated by cobble, gravel, and sloping rock at or near the floodline. In 2014, approximately 1,400 individuals were identified within several

mapped polygons in the bypass reach (Figure 3.3.5.1-1). The habitat within this area, as described above, is ideal for species which prefer regularly scoured habitat. Figure 3.3.5-5 shows a typical view of sandbar cherry within the bypass reach. In addition, the species was identified on several islands below the bypass reach as well as the upstream extent of the TFI, below Vernon Dam (Figure 3.3.5.1-1). These smaller island populations were surveyed in 2015, the survey included occupied and unoccupied suitable habitat. Mean density for two of the transect locations was calculated as 1.33 stems/m², these locations were associated with larger islands. Mean density for the northern most population (just below Vernon Dam) was calculated at 0.17 stems/m². Associated species include mountain alder, dogbane, cottonwood, sycamore, sandbar willow, black willow, and big bluestem.

Sandbar Willow

The sandbar willow is a small shrub, ranging from 5-10 feet in height, which forms interconnected thickets. In Massachusetts, the willow is commonly found on islands, sandbars, and beaches within the flood zone. It prefers sandy, gravely, or rocky substrates which are subjected to annual inundation by high water. The plants are usually low and sprawling, and in the Connecticut River drainage stems are generally less than six feet in height. The primary threat to this species is a scarcity of habitat, which is related to shoreline development. The species prefers habitat which is tied closely to the annual flood regimes and disturbance from water level fluctuations. Survey work completed in 2014 identified the sandbar willow in several locations (Figure 3.3.5.1-1). The species occupies several areas within the bypass reach as well as on islands near Sunderland and to the north near the Vernon Dam. All these habitats share common characteristics in that all are dominated by cobble and rock and are within actively flooded habitats. Mean density varied by transect location, and ranged from 0.13 stems/m² to 0.77 stems/m². Across three transects mean density was 0.44 stems/m². Figure 3.3.5.1-6 shows a representative view of the typical willow habitat on First Island (near the Sunderland Bridge). Associated species include dogbane, purple loosestrife, black willow, blue vervain, and big bluestem.

Tradescant's Aster

The Tradescant's aster is a small, white-rayed aster that rarely grows more than one and a half feet in height. It is often found with a basal rosette of leaves and a cluster of erect stems. This aster is typically found rooted in fissures and cracks of rocky stream shores or river banks. These habitats are generally subjected to flooding throughout the year. The plant flowers late in the summer, when water levels are normally lower. Due to the dynamic nature of the Tradescant's preferred habitat, invasion by exotic species or damage from development are uncommon. The primary threats are modification of flood regimes that would allow the establishment of other species, and occasional invasive plant species such as spotted knapweed (*Centaurea maculata*) and purple loosestrife, which have been found in Tradscant's aster's habitat. Surveys completed in 2014 identified the aster as occurring throughout the bypass reach as well as a few discrete patches; one occurring on the rock face just downstream from the French King Bridge and a few near the confluence with the Deerfield River (Figure 3.3.5.1-1). Populations within the bypass, mapped in 2014, are quite robust and approximately 16,770 stems were counted during fieldwork (Figure 3.3.5.1-7). The smaller patches, located near the confluence with the Deerfield River, were surveyed in 2015. Density of the Tradescant's aster at this location is calculated at 1.03 stems/m². In all locations, the habitat was dominated by exposed bedrock, boulders, and large cobbles. Associated species include mountain alder, big bluestem, dogbane, purple loosestrife, and seedbox (FirstLight, 2015a).

Vertebrate Species

Birds

Five state-listed RTE bird species were identified as potentially occurring within the Project area by NHESP. During field surveys completed along the Connecticut River and Northfield Mountain, two of the

five species were identified as occurring within the Project area. Table 3.3.5.1-2 lists the potentially occurring species as well as those identified in the Project.

Bald Eagle

The enforcement of federal endangered species laws and regulations and improved controls of herbicides and pesticides on agricultural lands have aided in the recovery of this species. While the species was removed from endangered species status, the Bald Eagle is still protected by the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act. It winters along the Connecticut River in the Turners Falls Project and Northfield Mountain Pumped Storage Development area. In 2001, the USFWS documented a nesting pair of Bald Eagles on Barton Island in Barton Cove, approximately five miles downstream of the Northfield Mountain Pumped Storage Development (FERC, 2001) and slightly upstream of the Turners Falls Dam. Bald Eagles also nest on Kidd's Island in the impoundment. Bald Eagles are known to perch in riverbank trees and forage over the Connecticut River in the Turners Falls Development and Northfield Mountain Pumped Storage Development vicinity. Several Bald Eagles, adults and juveniles, have been observed perching or foraging in the impoundment and Northfield Mountain in both 2014 and 2015, and three occupied Bald Eagle nests were located within the study area. These nests are found downstream on Third Island, Barton Island in Barton Cove, and along the east bank of the impoundment across from Stebbins Island in the upper reaches of the impoundment (FirstLight, 2015a).

Peregrine Falcon

There are 14 known Peregrine Falcon historic cliff nesting sites in Massachusetts. Today, two known occupied nesting sites are located downstream of the Turners Falls Development and Northfield Mountain Pumped Storage Development area at Mount Tom and Mount Sugarloaf (NHESP, 2007). Females begin breeding at age two or three, whereas males may breed as early as age one. Females typically lay four eggs in early April. The eggs will incubate over 28 days; by seven weeks after hatching (in mid-June), the juvenile chicks have fledged. Fledglings are fully independent of their parents by August. Peregrine falcons do not typically migrate for the winter season, with the exception of those that nest in the far north (e.g., in Labrador or Greenland).

Peregrine Falcons are not known to nest at the Turners Falls Development and Northfield Mountain Pumped Storage Development, but are known to have nests down river of the Turners Falls Development and Northfield Mountain Pumped Storage Development at Mount Tom and Mount Sugarloaf and could potentially utilize the Turners Falls Development and Northfield Mountain Pumped Storage Development area for foraging. A Peregrine Falcon was observed on the south eastern slope of Northfield Mountain in 2014.

Shortnose Sturgeon

The Shortnose Sturgeon is a federally-listed endangered species that occurs in the Connecticut River and is discussed with other migratory fish species in Section 3.3.3.1.2.

Mammals

No special status mammals were identified during consultation with state and federal agencies. However, on April 2, 2015 the northern long-eared bat (*Myotis septentrionalis*) was listed as federally threatened, and the USFWS published an interim final rule under section 4(d) of the ESA to exempt certain activities from the incidental take prohibitions of the ESA. The listing and interim final rule became effective on May 4, 2015. The primary reason for the listing of this species is the dramatic population decline which has resulted from the spread of white-nose syndrome. The northern long-eared bat overwinters in caves or old mines with high humidity and stable temperatures. During the summer the bats will roost in large diameter trees, preferring those with exfoliating bark. Reproduction begins in late summer or fall, with delayed implantation resulting in pupping in the following spring. The Project area includes old growth hemlock,

shagbark hickory, silver maple, and several other species which are large in diameter and possess bark characteristics which could provide potential summer roosting habitat for the northern long-eared bat. During the 2014 and 2015 field work, this species was not observed in the Project area.

Herptiles

Consultation with the NHESP in 2011 (MDFW, 2011) identified two state threatened and three special concern herptile species that may occur within the Project area (Table 3.3.5.1-3). While specific survey methodologies for herptiles were not included as part of studies completed in 2014 and 2015, special care was taken during habitat, vegetation, wetland, and vernal pool mapping activities to opportunistically search for species. Several vernal pools and wetlands were mapped during fieldwork completed in 2014 and additional vegetation survey work occurred in 2015; no rare reptile or amphibian species were observed. While the species were not observed, it is likely that they occur within the Project area as a number of ephemeral pools were mapped and identified, particularly in the vicinity of Northfield Mountain.

Invertebrate Species

NHESP identified nine state listed endangered and threatened species of invertebrates at the Northfield Mountain Pumped Storage Development and Turners Falls Development (Table 3.3.5.1-4). In 2014 and 2015, detailed studies were completed to document and analyze potential impacts to both tiger beetle populations, dragonflies, and freshwater mussels.

Clubtail Dragonflies

Clubtail dragonflies are large members of the taxon Anisotera and the family Gomphidae. They are so named for their club shaped abdomen terminus. Clubtails are a semi-aquatic insect in which the juvenile nymph inhabits aquatic habitat in streams, rivers, lakes and ponds. Breeding generally occurs in the spring and summer months with females depositing the fertilized eggs into the water. Nymphs emerge from the water on exposed rocks, woody debris, and emergent vegetation in the spring and undergo a metamorphosis into the adult, flighted stage, a process called eclosion.

Qualitative and quantitative surveys were performed in 2014-2015 (Study 3.3.10) to characterize the assemblage structure and emergence/eclosure behavior of odonates in the project area. In 2014, odonate larvae and exuviae were surveyed between the Turners Falls Dam and the Route 116 Bridge in Sunderland, and in the TFI near Barton's Cove, to establish a qualitative baseline for the odonate assemblage in these areas (Phase 1). Biologists conducted qualitative surveys of odonate larvae and exuviae at four areas (5 sites) between the Turners Falls Dam and the Route 116 Bridge in Sunderland, and one area (3 sites) in the TFI near Barton Cove.

Surveys were conducted on June 2, 6, 9, and 20 (2014). Table 3.3.5.1-5 lists the genera and species collected at each site. *Epitheca princeps*, a species common in lentic habitats, was the most common species collected at Sites 1-3. These sites in the lowermost portion of the TFI (Barton Cove) contain mostly lentic habitat with submerged and emergent vegetation. Sites 4-8 were generally more lotic; dominant taxa in these samples included *Gomphus sp*. (mostly *G. vastus*), *Ophiogomphus* (mostly *G. rupinsulensis*), *N. yamaskenensis*, *Boyeria vinosa*, and *Macromia illinoiensis*. There was very little variation in the odonate assemblage among sites 4-8. Species-level identification of some of the Gomphidae, especially *Gomphus sp*. and *Ophiogomphus sp*., is incomplete; this report will be updated when these data become available. Most of the target state-listed species for Sites 4-8 were in the genus *Gomphus*. Based on historic survey data, which were generally more complete for the TFI, several uncommon species likely occur in these areas but were undetected in 2014.

Habitat parameters were recorded at each site. The most common habitat feature of nearshore areas and streambanks was a muddy slope of varying steepness, with lesser and variable amounts of sand, gravel, or cobble. Upslope, this mud transitioned into the riparian zone that was typically vegetated with trees

(especially silver maple), low terrestrial herbaceous vegetation, moss, and vines, and contained varying amounts of large woody debris and detritus. The odonate surveys were typically done during periods of low flow, therefore relatively large amounts of the muddy bank were exposed and the distance from the water line to the interface between aquatic and terrestrial habitat was relatively great.

Less common nearshore habitat types included aquatic emergent vegetation and rock. Aquatic emergent vegetation was prevalent only in the more lentic habitats of Barton Cove (Site 1) and on the other side of Campground Point (Site 3). Elsewhere, aquatic emergent vegetation was either absent, or existed as a very sparse fringe of species that can tolerate daily exposure. Submerged aquatic vegetation, especially Vallisneria, was common in some areas but typically only as a narrow band in deeper waters.

Bare rock, an emergence substrate for odonates, is uncommon in the Connecticut River between the Deerfield River confluence and Route 116 Bridge. There are some isolated ledge outcrops, and the bridge abutments and areas near bridges often contained higher amounts of "unnatural" rock. The most "natural" rock is located in the Turners Falls bypass reach.

The results of the 2014 survey were used to develop a field monitoring plan for Phase 2 of the relicensing study, which involved quantitative surveys and behavior observations, was conducted in 2015. Concurrence on the monitoring locations and for the field methods was reached during an April 28, 2015 meeting with NHESP.

A final report presenting the results of the 2015 survey is due to be filed with FERC by March 1, 2016. A summary follows. FirstLight conducted quantitative surveys at five sites in the Connecticut River; the sites are listed below and shown in Figure 3.3.5.1-8.

1. Barton's Cove (Gill)
2. Rock Dam in the bypass reach (Montague)
3. Area from bike path bridge to Montague City Road, opposite the Deerfield River confluence (Montague)
4. DFW conservation lands on the eastern shore upstream from the Sawmill River confluence (Montague)
5. Eastern shore near the Route 116 Bridge (Sunderland)

At each site, FirstLight established six transects that were oriented perpendicular to the river and spanned the continuum from the water's edge into the upland terrestrial vegetation. Within and among the five sites, transects were established to provide adequate representation of available habitat type (such as natural vegetation, gradually sloping mud/sand, and rock) and of varying bank slopes (i.e., steep versus shallow). Each transect was three meters wide, and extended upslope from the water's edge a minimum of 12 meters (longer in some cases).

Surveys for emerging larvae, exuviae, and tenerals were conducted at each transect approximately every two weeks beginning on May 26 and ending on September 3, 2015.

Biologists looked for larvae exiting the water or crawling on land, and focused on single individuals as they crawled upslope and came to rest to begin the eclosure process. The most critical period was the time from when larvae began to eclose to when the teneral's wings hardened and the adult flew away. Biologists used a stopwatch to record the duration of this process. Several of these events were recorded using time-lapse photography. For each exuvia (i.e., post-eclosure), the vertical height above the water's surface, the horizontal distance from the water's edge, and its eclosure structure/substrate was recorded. Each exuvia was collected, stored in individual vials, labeled with site information and date, and will be identified to species in the laboratory. Up to 10 teneral/exuvia pairs, per species, were collected for identification purposes. Results will be incorporated into the final license application upon completion of data analyses and reporting.

Freshwater Mussels

Turners Falls Impoundment and Bypass Reach

In 2011, a freshwater mussel survey was conducted in a 20-mile reach of the TFI, and a 3.5-mile reach from Turners Falls Dam to the confluence with the Deerfield River (2.7 of the 3.5 miles is in the bypass reach), as well as 2.1 miles of the power canal (Biodrawversity, 2012). The objective of the survey was to assess the distribution, abundance and habitat of freshwater mussels. The impoundment and bypass reach surveys were conducted during low flow in August and the power canal survey was conducted during the September canal drawdown. Five freshwater mussel species were found, including the Eastern Elliptio, Alewife Floater, Eastern Lampmussel, Eastern Floater, and Triangle Floater. The Eastern Elliptio was found at 96.2 percent of the 52 sites sampled and was 100 to 1,000 times more abundant than other species. Over 400 Alewife Floaters were found with the highest densities in the upstream end of the impoundment. Of the few Eastern Lampmussel that were found, they were mostly found in the TFI and not in the bypass reach or Power Canal. A total of eight Eastern Floaters were found in the Impoundment and in the power canal. One Triangle Floater was found near the mouth of the Deerfield River. Mussels were found in a wide range of water depths, flow conditions, and substrate conditions.

Freshwater mussels are an important part of the benthic fauna in the impoundment, bypass reach, and power canal. The Eastern Elliptio is the dominant species forming expansive beds along much of the impoundment. The Alewife Floater was broadly distributed in the survey area but in low densities in the canal, bypass reach, and lower two-thirds of the Impoundment. The Eastern Lampmussel was found in limited numbers throughout the survey area. The Triangle Floater was listed as Special Concern in Massachusetts until 2012 when it was removed from the list. Triangle Floaters are numerous in many Connecticut River tributaries including the Ashuelot and Millers Rivers which flow into the TFI. No state listed or federally threatened or endangered mussel species were found during the survey.

Connecticut River from Deerfield River confluence downstream to Sunderland Bridge

FirstLight conducted a quantitative survey and habitat assessment of freshwater mussels in 2014 in the Connecticut River from Cabot Station downstream to the Route 116 Bridge in Sunderland (relicensing study 3.3.16). The objectives of the survey were to delineate populations of state-listed mussels and suitable habitat; characterize the distribution, abundance, demographics, and habitat use of these populations; and to identify potential habitat for state-listed species based on their habitat preferences. The target species included Yellow Lampmussel, Eastern Pondmussel, Tidewater Mucket and Dwarf Wedgemussel (federally-listed).

In July and August, biologists conducted semi-quantitative (i.e., timed qualitative) surveys and habitat measurements at 26 sites in the study area. No live target mussel species were found. One old relic Yellow Lampmussel shell was found near Second Island. Eastern Elliptio was the only live mussel species found during the survey. At most sites, thousands or even tens of thousands of Eastern Elliptio were observed, and they occupied a wide range of depth, flow, and substrate conditions.

The mussel community in the reach from Cabot Station to the Route 116 Bridge appears to be strongly dominated by Eastern Elliptio, as no live mussels of other species were found. Eastern Elliptio are common to abundant in a wide range of habitat types, and the presence of a relatively high proportion of juveniles (which are usually underrepresented in qualitative surveys) suggests recruitment success is high.

The presence of more than 30 Alewife Floater shells suggest that live Alewife Floater may also exist within this reach, but at very low population densities and possibly confined to small patches that were undetected in the 2014 survey. Only old relict shells of Yellow Lampmussel (1) and Eastern Lampmussel (2) were found, which is consistent with results of the few reports (NHESP data) in this reach in recent years. To our knowledge, live Eastern Lampmussel and Yellow Lampmussel have never been documented in this reach,

nor have Tidewater Mucket or Eastern Pondmussel. Dwarf Wedgemussel were not found in 2014, and the most recent report of Dwarf Wedgemussel in this reach was from ~1978 (shell only).

Water depths were variable; some areas (near islands and point bars) were very shallow or dewatered during low flow conditions, but maximum depths at survey sites ranged from 6-25 feet. Water velocity was usually light to moderate (typically in the range of 0.1 to 0.3 m/s), and flow refugia were present at nearly all sites, even where moderate to strong velocities were prevalent. Substrate was characterized by co-dominance of sand, gravel, and cobble, and extensive sandbars were present. Silt, sand, aquatic vegetation, and organic material (detritus and coarse wood) were common closer to shorelines and in flow refugia.

Orange Swallow Moth

Field surveys for the listed orange swallow moth were completed in 2015. Results of these surveys will be available in December, 2015.

Tiger Beetles

A November 1, 2013 meeting, which included representatives of the USFWS and the Massachusetts Natural Heritage and Endangered Species Program (NHESP), part of MADFW, included discussion related to methods used for evaluating rare plants and special status species. On November 8, 2013, FERC ordered that the modified revised study plan shall be submitted by January 13, 2014. This section describes the results of data collected as part of Revised Study Plan, which included agency comments received on August 29, 2013.

Cobble Stone Tiger Beetle

One historic area of suitable cobblestone tiger beetle habitat occurs on the east bank of the Connecticut River near the confluence with the Deerfield River. Suitable habitat was found along the cobble shoreline downstream of Cabot Station, between the Route 2 Bridge and the Montague Wastewater Treatment Plant. Figure 3.3.5.1-9 shows a representative view of the suitable habitat. Based on site visits conducted in 2014 by Chris Davis (NHESP approved expert), no tiger beetles were observed. The site was visited twice during the 2014 field season. A search for additional, suitable habitat, was completed by boat as Chris Davis and field technicians searched from Cabot Station to the Oxbow state boat launch in Holyoke, MA. No additional suitable habitat was identified within this reach.

Puritan Tiger Beetle

Puritan tiger beetles are known to be present at Rainbow Beach, and surveys completed in August of 2014 confirmed the presence of Puritan tiger beetles. Chris Davis holds a collectors permit from the USFWS, and on August 8, 2014, two adult male Puritan tiger beetles were identified (Figure 3.3.5.1-10). Larval habitat for the Puritan tiger beetle is generally 10-20% vegetative cover with the remaining areas un-vegetated. A representative view of available habitat at Rainbow Beach is shown in Figure 3.3.5.1-11. Larval habitat at Rainbow Beach occurs throughout the area. In 2013, and based on several years of mark and recapture data, the population of Puritan tiger beetles at Rainbow Beach was estimated at 21 individuals. Common tiger beetle populations at the same location are estimated at approximately 3-5 thousand individuals.

In 2014, a topographic survey was completed at Rainbow Beach and North Bank. Elevation data at these survey transects was collected with a Real Time Kinematic (RTK) survey unit. Twenty-four transects were established in beetle habitat at Rainbow Beach and four transects were established at North Bank (Figure 3.3.5.1-11). Transects extended from the edge of water to the upper limit of beetle habitat. Elevations within the beetle habitat ranged from 100.8 feet at the lower limit to 115.9 feet at the upper limit, at both Sites. Water level monitoring, conducted in 2012, across from Rainbow Beach showed fluctuations of the water

surface ranged from approximately 107 feet in May to a low of approximately 99 feet in summer. For most of the summer months (June-September) the water surface was maintained between 99 and 102 feet (FirstLight, 2015b).

3.3.5.2 Environmental Effects

Vascular Plants

A number of protected vascular plants have been mapped within the Turners Falls Development area as well as on islands downstream of the Project to the Sunderland Bridge. All the species identified tend to prefer habitats within or near the floodzone. Elevation data collected in August of 2015 will be used to compare water levels derived from hydraulic modeling. The analysis of this data is being completed during the fall of 2015 and will be included in the final study report and license application completed in December 2015.

Vertebrate Species

Given the nature and scope of Project operations, no adverse effects on terrestrial vertebrate species are anticipated. In the event that minimal tree removal may be necessary for maintenance activities, FirstLight would follow USFWS's published conservation measures to avoid effects to the northern long-eared bat. Protected birds within the project are currently utilizing habitat within the Project area and will continue to do so, regardless of project operation. Some minor impacts related to recreational activity on the impoundment, such as temporary dispersal, may occur as a result of boating or hiking. While no rare herptile species were identified within the Project area, it is not expected (should they occur) that they would be negatively impacted by Project operation. Vernal pools identified within the project are not hydraulically connected to the TFI or the Upper Reservoir. There is the potential for impact as a result of ground disturbing or recreational activities. These effects would be minor and are not likely to adversely affect these species.

Invertebrate Species

Clubtail Dragonflies

FirstLight deployed a water level logger (with temperature recording capability) to record data at 15-minute intervals for each quantitative survey reach in order to accurately evaluate water levels, standardize field measurements, and describe temperature in relation to odonate emergence behavior. Temporary water level/temperature loggers were installed at each site for the duration of the quantitative surveys to supplement data from the permanent gages at the Turners Falls Dam and the USGS Montague City gage. The field data will be used to determine if water level fluctuations affect the emergence and eclosure success of state listed odonates.

Freshwater Mussels

FirstLight is in the process of developing binary HSI criteria for all state-listed mussel species documented in the 35-mile reach between Cabot Station and Dinosaur Footprints Reservation. Based on 2014 survey results and prior data, these species include Yellow Lampmussel, Tidewater Mucket, and Eastern Pondmussel.

Using the binary HSI criteria, FirstLight will determine if any binary HSI thresholds are not met under a range of modeled operating conditions. In general the approach includes using the HEC-RAS hydraulic model to simulate the range of operating conditions at Holyoke Dam (WSEL at the dam) and the Turners Falls Project (up to its hydraulic capacity) to determine how operations impact depth, velocity, shear stress and Froude number at model transects near documented state or federally listed mussel beds. If threshold levels are not exceeded in any transects, then no further assessment of documented state and federally listed

mussel beds is proposed. If threshold levels are exceeded, then a more detailed assessment is proposed. Analysis of the hydraulic model will be completed by December, 2015.

Tiger Beetles

Based on the observed water level monitoring completed as part of the Study 3.2.2 Hydraulic Study of Turner Fall Impoundment, Bypass Reach and Below Cabot, it appears that water level fluctuations over the course of the growing season fluctuate at Rainbow Beach and North Bank approximately 7 feet throughout the season with water levels fluctuating approximately 3 feet (99-102 feet) for the majority of the time. Based on the results of a survey, completed in 2014, beetle habitat occurs on Rainbow Beach from the low elevation (100.8 feet) to the high elevation (115.9 feet). It is possible that changing water levels may disperse individuals within the lower portion of the habitat. Additional analysis of the impact of fluctuating water levels using the results from the hydraulic model will be completed in December, 2015. In addition, impacts from recreation at Rainbow Beach are likely to affect both adult and larval beetles. Boat wakes may temporarily and rapidly disperse individuals along the water line and foot traffic from recreators may result in mortality or dispersal. At higher elevations (beginning at approximately elevation 105 feet), dense vegetation growth is limiting the available larval habitat.

3.3.5.3 Cumulative Effects

This section will be developed following completion of the data analyses and reporting for the ongoing studies.

3.3.5.4 Proposed Environmental Measures

There are currently no proposed environmental measures based on the results of completed study reports. Following the completion of the study reports, proposed environmental measures may be reassessed.

3.3.5.5 Unavoidable Adverse Impacts

This section will be developed following completion of the data analyses and reporting for the ongoing studies.

Table 3.3.5.1-1: Massachusetts Listed Vascular Plants Identified Within the Project Area

Scientific Name	Common Name	State (MA) Status	Preferred Habitat
mountain alder	*Alnus viridis ssp. crispa*	Threatened	Exposed ledges/ Boulders/ Cobble Bars
intermediate spike-sedge	*Eleocharis intermedia*	Threatened	Open Sandy Margins
ovate spike-sedge	*Eleocharis ovata*	Endangered	Open Sandy Margins
Frank's lovegrass	*Eragrostis frankii*	Special Concern	Open Sandy Margins
great blue lobelia	*Lobelia siphilitca*	Endangered	Circumneutral wetlands and transitional areas.
upland white aster	*Oligoneuron album*	Endangered	Open Rocky Habitat
sandbar cherry	*Prunus pumila var. depressa*	Threatened	Flooded Scoured Areas of Islands, Shores, & Peninsulas
sandbar willow	*Salix exigua ssp. interior*	Threatened	Island Sandbars, and Sandy Beaches
Tradescant's aster	*Symphyotrichum tradescantii*	Threatened	Rooted Fissures & Cracks of Rocky Streams

Table 3.3.5.1-2: Special Status Bird Species That May Occur or Have Been Observed Within the Project Area

Common Name	Scientific Name	State Status	TF	NM
American Bittern	*Botaurus lentiginosus*	E		
Bald Eagle [1]	*Haliaeetus leucocephalus*	T	X	X
Peregrine Falcon	*Falco Peregrines*	E		X
Grasshopper Sparrow	*Ammodramus savannarum*	T		
Vesper Sparrow	*Pooecetes gramineus*	T		

[1] No longer listed as federally Endangered, but still maintains federal protection under the Bald and Golden Eagle Protection Act.

Table 3.3.5.1-3: Herptile Species Identified by the NHESP That May Occur Within the Project Area

Common Name	Scientific Name	State Status[1]
wood turtle	*Glyptemys insculpta*	SC
eastern box turtle	*Terrapene Carolina*	SC
Jefferson salamander	*Ambystoma jeffersonianum*	SC
marbled salamander	*Ambystoma opacum*	T
easter spadefoot	*Scaphiopus holbrookii*	T

[1]SC= Special Concern, T = Threatened

Table 3.3.5.1-4: Special Status Invertebrate Species Documented Within the Project Area

Common Name	Scientific Name	State Status[1]	Federal Status[1]
spine-crowned clubtail	*Gomphus abbreviates*	SC	-
midland clubtail	*Gomphus fraternus*	E	-
rapids clubtail	*Gomphus quadricolor*	E	-
riverine clubtail	*Stylurus amnicola*	E	-
cobblestone tiger beetle	*Cicindela marginipennis*	E	-
puritan tiger beetle	*Cincindela puritana*	E	T
yellow lampmussel	*Lampsilis cariosa*	E	-
dwarf wedgemussel	*Alasmidonta heterodon*	E	E
orange sallow moth	*Rhodoecia aurantiago*	SC	-

[1]SC= Special Concern, T = Threatened, E= Endangered

Table 3.3.5.1-5: Odonate Species Documented During the Qualitative Surveys of Larvae and Exuviae in June 2014

Species	Survey Site							
	1	2	3	4	5	6	7	8
Arigomphus furcifer		X						
Boyeria vinosa	X			X	X	X	X	X
Epitheca princeps	X	X	X	X	X			
*Gomphus sp.**			X	X	X	X	X	X
Macromia illinoiensis	X	X	X	X	X	X	X	X
Neurocordulia yamaskenensis	X	X	X	X	X	X	X	X
*Ophiogomphus sp**				X	X	X	X	X
Stylurus spiniceps				X	X	X	X	X
Arigomphus furcifer				X				

*Awaiting final species-level identification by Dr. David Wagner, University of Connecticut. Potential Species: *Gomphus fraternus*, *Gomphus ventricosus*, *Gomphus abbreviates*, *Gomphus vastus*, *Dromogomphus spinosus*, *Ophiogomphus rupinsulensis*, *Gomphus spicatus*, *Gomphus exilis*, *Gomphus descriptus*, *Gomphus lividus*

VERNON DAM

Index Map

FRENCH KING BRIDGE

SUNDERLAND BRIDGE

SUNDERLAND BRIDGE

Legend

- Alnus viridis ssp. crispa
- Eleocharis spp. and Eragrostis frankii
- Lobelia siphilitica
- Oligoneuron album
- Pellaea atropurpurea
- Prunus pumila var. depressa
- Salix exigua ssp. interior
- Symphyotrichum tradescantii

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

Draft License Application
Exhibit E

0 0.75 1.5 3 Miles

Figure 3.3.5.1-1
Location of Identified
Rare Plants

Path: W:\gis\maps\dla\figure_3_3_5_1-1.mxd

Figure 3.3.5.1-2: Typical Habitat Found Within the Bypass Reach, Below Turners Falls Dam.

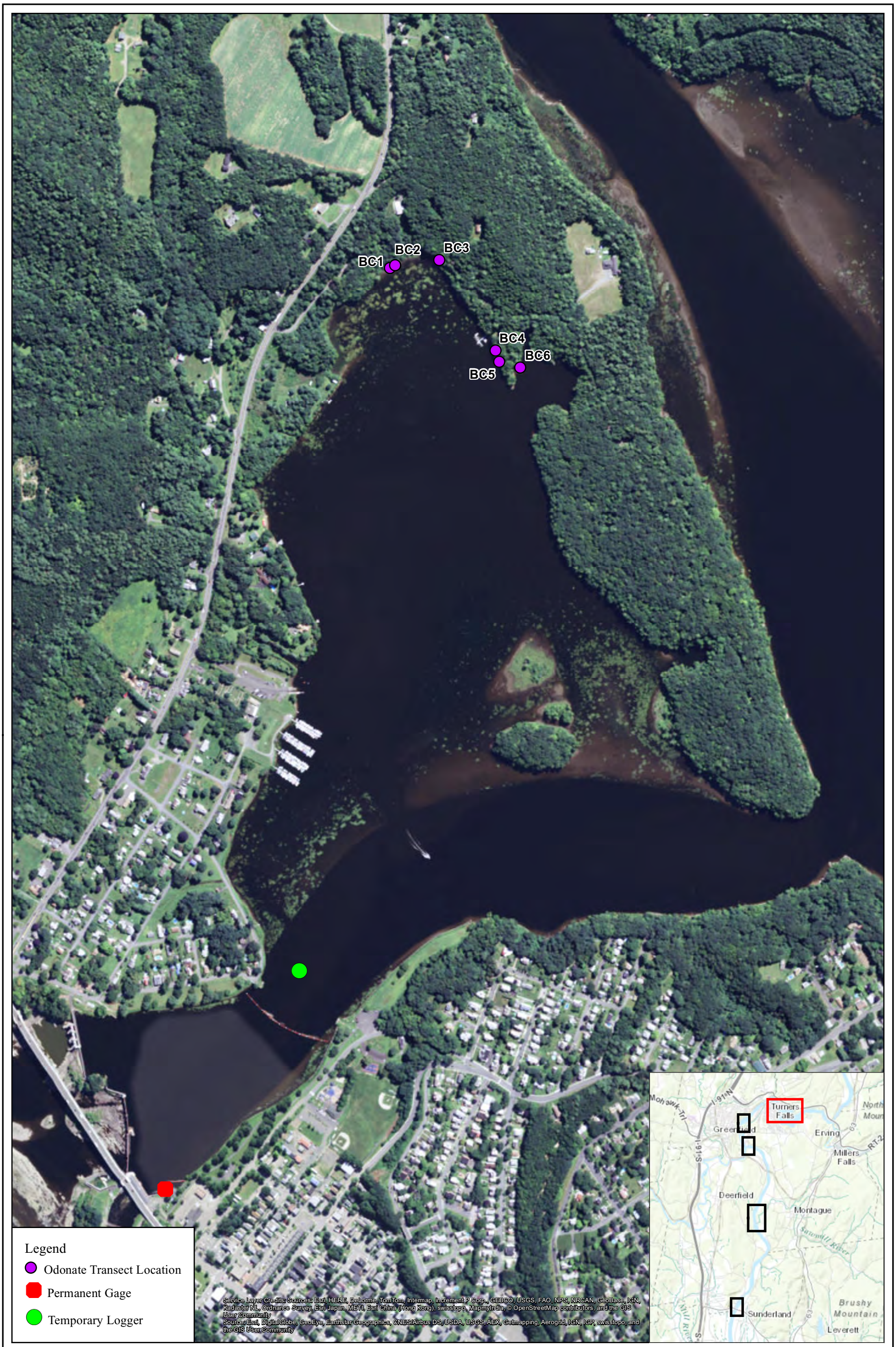
Figure 3.3.5.1-3: View of Typical Shoreline Habitat Near the Pauchaug Boat Launch.

Figure 3.3.5.1-4: Upland White Aster Identified Within the Bypass Reach in 2014.

Figure 3.3.5.1-5: Typical Sandbar Cherry Located Within the Bypass Reach in 2014.

Figure 3.3.5.1-6: View of Typical Habitat for the Sandbar Willow at First Island, near Sunderland Bridge.

Figure 3.3.5.1-7: Typical Tradescant's Aster Habitat Identified Within the Bypass Reach in 2014



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Feet

Figure 3.3.5.1-8
2015 Quantitative Odonate Survey Sites
Site 1 (Bartons Cove)

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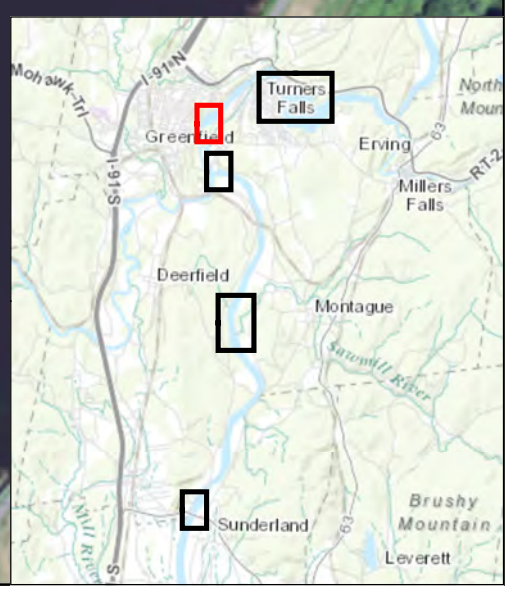
RD6
RD5
RD3
RD4
RD2
RD1

Legend
- Odonate Transect Location
- Permanent Gage
- Temporary Logger

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap contributors, and the GIS User Community
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community



FirstLight GDF SUEZ

N

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Turners Falls Hydroelectric Project No. 1889

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0 150 300 600 Feet

Figure 3.3.5.1-8
2015 Quantitative Odonate Survey Sites
Site 2 (Rock Dam)

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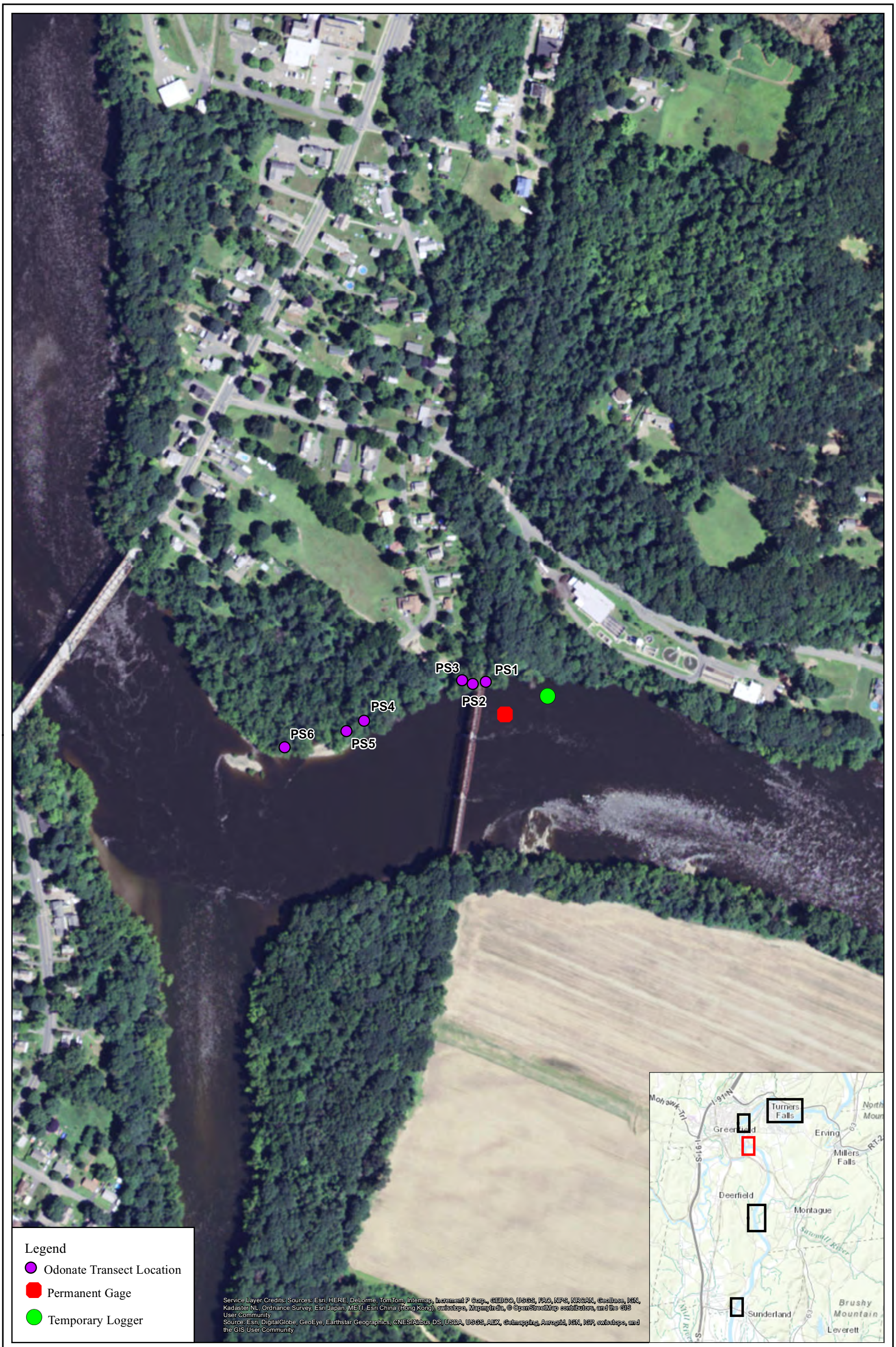

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Feet

Figure 3.3.5.1-8
2015 Quantitative Odonate Survey Sites
Site 3 (Opposite Deerfield River Confluence)

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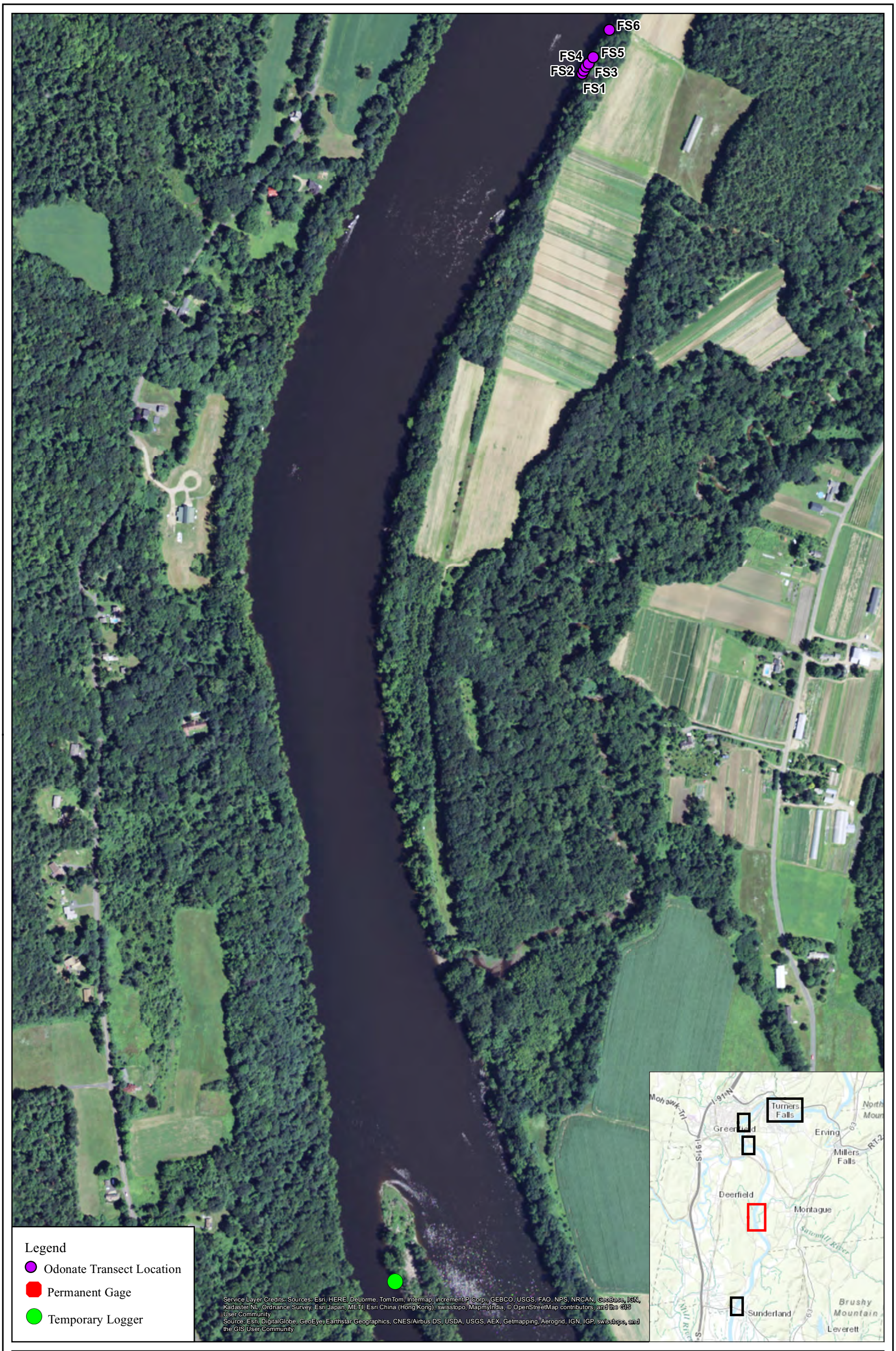

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Exhibit E

0 225 450 900 Feet

Figure 3.3.5.1-8
2015 Quantitative Odonate Survey Sites
Site 4 (Near Sawmill River)

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Exhibit E

N

0 150 300 600
Feet

Figure 3.3.5.1-8
2015 Quantitative Odonate Survey Sites
Site 5 (Near Route 116 Bridge)

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Figure 3.3.5.1-9: Suitable Cobblestone Tiger Beetle Habitat Located Downstream of Cabot Station.

Figure 3.3.5.1-10: Adult male, Puritan Tiger Beetle Identified at Rainbow Beach in 2014.

Figure 3.3.5.1-11: Typical Puritan Tiger Beetle Habitat Observed in 2014 at Rainbow Beach.

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Figure 3.3.5.1-12
Tiger Beetle Elevation Transects

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3.3.6 Recreation Resources

3.3.6.1 Affected Environment

3.3.6.1.1 Regional Recreation

The Northfield Project is situated on the Connecticut River, within the states of Massachusetts (MA), New Hampshire (NH), and Vermont (VT). The majority of the Project lands are located within the county of Franklin, Massachusetts, specifically in the towns of Erving, Gill, Greenfield, Montague, and Northfield. Northern sections of the TFI reach into the towns of Vernon, Vermont and Hinsdale, New Hampshire. Turners Falls Dam is located on mile 122 of the Connecticut River, (above the Long Island Sound) in the towns of Gill and Montague, MA. The TFI is approximately 20 miles long, with 5.7 miles located within the states of NH and VT.

Recreation sites and facilities in the vicinity of the Northfield Mountain Development include hiking trails, fishing access, picnic areas, camping, wildlife management areas, boat launches, hunting, observation areas, and bike trails. There are recreation sites in near proximity to the Project that provide hiking and nature observation opportunities, as well as numerous state lands for hiking, hunting and enjoyment of the outdoors. Some of the nearby recreation sites include the King Philip's Hill Trail, Brush Mountain Conservation Area, Stacy Mountain Preserve and the Erving State Forest. The Connecticut River Greenway State Park in Massachusetts is a linear state park paralleling the river for the 69-mile portion that flows through the state and connects key recreational areas including boat launches and other public lands. The park includes over 12 miles of permanently protected shoreline. The Connecticut River is also a National Blueway; and although the program was dissolved in 2014, the Connecticut River has retained its designation.

There are several other FERC licensed hydroelectric projects located near the Northfield Project that also provide a variety of recreation opportunities for the public. These Projects include the Holyoke Project (FERC No. 2004), approximately 35 miles downstream of the TFI and the Vernon Project (FERC No. 1904), located on the Connecticut River main stem, immediately upstream of the TFI. In addition, the nearby Deerfield Project (FERC No. 2323) is located approximately 2.9 miles downstream of the Turners Falls Dam on the Deerfield River. Recreation resources and opportunities in the general vicinity of the Project are discussed in more detail in FirstLight's Pre-Application Document (PAD) (FirstLight, 2012), and in several of the recreation studies conducted by the Licensee, including Study 3.6.2 Recreation Facilities Inventory and Assessment Report (FirstLight, 2014), 3.6.3 Whitewater Boating Evaluation (FirstLight, 2015a), 3.6.4 Assessment of Day Use and Overnight Facilities Associated with Non-motorized Boating (FirstLight, 2015b), and 3.6.7 Recreation Study at Northfield Mountain, including Assessment of Sufficiency of Trails for Shared Use (FirstLight, 2015d).[36]

In addition to recreation sites and facilities in the vicinity of the Project, there are also whitewater boating opportunities in the region including several reaches of the Deerfield River, the Ashuelot River, the West River, and the Millers River. Some of these opportunities are subject to natural flows while others are supported by scheduled whitewater releases. Whitewater boating opportunities in the Northfield Project region are discussed in detail in Study Report 3.6.3 Whitewater Boating Evaluation (FirstLight, 2015a).

Recreation facilities that provide access to the Project or are immediately adjacent to the Project were inventoried as part of Study 3.6.2 Recreation Facilities Inventory and Assessment Report and Addendum (FirstLight, 2014, 2015c). Existing recreation sites and trails at the Northfield Project are identified on Figure 3.3.6.1.1-1. The current licenses for the Northfield Mountain Pumped Storage Project and Turners Falls Project require FirstLight to operate and maintain certain public recreation facilities at the two

[36] The study reports for these studies can be found on the Northfield Project relicensing website at www.northfieldrelicensing.com. The report for Study No. 3.6.2 was filed with FERC as part of the ISR on September 15, 2014 and an addendum to the report was filed with FERC on June 15, 2015. The reports for Study Nos. 3.6.3, 3.6.4, and 3.6.7 were filed with FERC as part of the USR on September 14, 2015.

projects. These sites are included in the Projects' respective Recreation Plans (Exhibit R) and are therefore considered Project Recreation Sites. In addition to these Project Recreation Sites, there are a number of other public recreation sites located in the immediate vicinity of the Projects, many of which provide access to Project lands and waters. Some of these sites are formal recreation sites that FERC has previously approved as non-project use of project lands. Some of the sites are informal areas where no improvements have been made, and no facilities exist, but where the public is provided access to Project lands and waters and are using that access for recreational purposes. Such areas are common at hydropower projects and often include such activities as informal access paths for shoreline fishing, footpaths to the water's edge for carry-in boat launching, or local swimming holes accessed via footpath, bridge or roadway. The more significant of these informal access areas located within the Project boundary were inventoried as part of Study 3.6.2 Recreation Facilities Inventory and Assessment (FirstLight, 2014).

There are also private recreation facilities at the Project. Private recreation facilities include things such as boat docks, piers, picnic areas, or campsites. Some private facilities are located within the Project boundary, and may be on property owned by FirstLight, and have been approved as "non-project use of project lands" as allowed under the standard land-use articles in the existing FERC licenses. There are a number of such approved facilities and uses on the TFI, mostly associated with residences or camps located along the shoreline of the TFI, some of which are on leased FirstLight lands. There are also a small number of private clubs or organizations that also maintain approved recreation facilities on the TFI. There are no commercially operated recreation facilities at the Northfield Project.

3.3.6.1.2 Project Recreation Sites

Table 3.3.6.1.2-1 lists the Commission approved Project recreation sites for the Northfield Project. Below is a summary of the Commission approved Project sites. Additional information can be found in the Study 3.6.2 Recreation Facilities Inventory and Assessment Report and Addendum (FirstLight, 2014, 2015c).

Bennett Meadow Wildlife Management Area (WMA). Bennett Meadow WMA is located on the western shore of the Connecticut River, south of the Route 10 Bridge in Northfield, MA. The site is owned by FirstLight and is managed by both FirstLight and the Massachusetts Division of Fish and Wildlife (MADFW). While there are no developed recreation facilities, existing agricultural roads provide access for walking and hiking, as well as hunting.

Munn's Ferry Boat Camping Recreation Area (Munn's Ferry). Munn's Ferry is located on the east side of the Connecticut River in Northfield, MA. This site is owned and managed by FirstLight. This site provides four tent campsites with platforms and a single lean-to site, all complete with trash can, picnic table, fire ring, and grill. Pit toilets are available at the site. A dock and bank fishing opportunities are also available at the site.

Boat Tour and Riverview Picnic Area. The Boat Tour and Riverview Picnic Area is accessed by Pine Meadow Road in Northfield, MA. This site is owned and managed by FirstLight and provides a picnic area and riverboat tours. Amenities include nine picnic tables, a pavilion that can be rented for events, as well as restroom facilities that are ADA accessible. There are two parking lots with a total of 54 parking spaces with two ADA signed spaces. Riverboat tours are conducted on the Quinnetukut II. The Quinnetukut II has 44 seats and provides a 12-mile sightseeing trip, guided by an on-board interpreter, through the French King Gorge and Barton Cove portions of the TFI.

Northfield Mountain Tour and Trail Center (NMTTC). Northfield Mountain Tour and Trail Center is located off Rt. 63 in Northfield, MA. FirstLight owns and manages this site. Amenities include an ADA accessible Visitor Center with ADA accessible restrooms, picnic tables, grills, a fire ring, and interpretive displays. There are approximately 25 miles of trails (Northfield Mountain Trail System) accessible from the NMTTC Visitor Center that can be used for hiking, biking, horseback riding, snowshoeing and cross-country skiing. The site has a parking lot with 50 parking spaces and three ADA parking spaces.

Barton Cove Nature Area and Campground. This campground is located north of the Turners Falls Dam in Barton Cove, on Barton Cove Road in Gill, MA. The Nature Area and Campground are owned and managed by FirstLight. The campground has two group campsites, two trailer sites, and 27 tent sites, one of which is considered ADA accessible. Each campsite has a picnic table, fire ring, and garbage can, while the group sites have a grill and additional picnic tables. The Nature Area and Campground has a set of flush toilets, two showers, along with vault and portable restrooms. Bank fishing is available from some campsites.

Barton Cove Canoe and Kayak Rental Area. The Barton Cove Canoe and Kayak Rental Area is located on the northern shore of the Connecticut River, off of Route 2 in Gill, MA. This rental area is owned and managed by FirstLight and offers paddling and picnicking. Site amenities include a gravel carry-in canoe/kayak launch, picnic tables, and a portable toilet. There is also the option for a watercraft rental, which includes a PFD and a paddle or oar. The parking area holds 28 vehicles.

Gatehouse Fishway Viewing Area. The Gatehouse Fishway Viewing Area is located on the north side of 1st Street across from town operated Unity Park in Montague, MA. The viewing area is owned and managed by FirstLight. The site consists of a visitor center which provides the public an opportunity to view fish when the Gatehouse fishway is operating. The first floor of the visitor center is ADA accessible with a closed-circuit TV feed from the viewing window to a TV monitor that allows for ease of access for those with limited mobility. There are interpretive panels to provide information about anadromous fish, along with bathrooms, and benches on the outside of the facility. The site also contains the picnic area on the north site of 1st Street with six (6) picnic tables, five (5) grills, a bike rack, and parking for 29 vehicles.

Turners Falls Branch Canal Area. The Turners Falls Branch Canal Area is located off of Power Street in Montague, MA, This site is owned and managed by FirstLight. The site provides fishing access and has four (4) benches for anglers to use while fishing.

Cabot Woods Fishing Access. Cabot Woods Fishing Access is located on Migratory Way in Montague, MA. This site is owned and managed by FirstLight and is open to day use activities. Amenities at this site include three (3) picnic tables, two (2) parking lots, and many informal angler access trails. The two (2) parking lots provide 17 parking spaces and three (3) ADA parking spaces. The first parking lot is located outside of a gate at the northerly terminus of Migratory Way where it joins G Street. The second lot is located roadside along Migratory Way, inside of the gate.

Turners Falls Canoe Portage. The Turners Falls canoe portage operation provides boaters with a means of circumventing the Turners Falls Dam. Boaters wishing to proceed downriver of Barton Cove call FirstLight for vehicular portage. They are then picked up and driven downstream of the Turners Falls Dam to the Poplar Street Access site in Montague, where they can continue their trip. (The Poplar Street Access is outside of the Project boundary.) Signs explaining the canoe portage operation procedures and providing the portage request call-in number are located at the following recreation sites: Munn's Ferry Boat Camping Recreation Area, Boat Tour and Riverview Picnic Area, Barton Cove Nature Area and Campground, Barton Cove Canoe and Kayak Rental Area, and at the Poplar Street Access site. Instructions are to paddle to the Barton Cove Canoe and Kayak Rental Area, unload gear, and then call (413) 659-3761 to request a pick up. Typically a vehicle for the portage will arrive within 15 to 90 minutes of the telephone call. Barton Cove Canoe and Kayak Rental Area has a phone that boaters can use from Memorial Day through Labor Day. During the off-season, boaters need to use their own phones to make the portage request.

3.3.6.1.3 Other Formal Recreation Sites

Other formal recreation sites that provide access to the Project are summarized below. Most of these sites are fully or partially within the Project boundary, although one site is fully outside the Project boundary. Additional information regarding the recreation sites can be found in the Study 3.6.2 Recreation Facilities Inventory and Assessment Report and Addendum (FirstLight, 2014, 2015c).

Governor Hunt Boat Launch and Picnic Area. This site is located immediately downstream of the Vernon Project dam and is owned and managed by TransCanada, which owns the Vernon Project. While this

recreation site is within the Vernon Project boundary, a portion of the site along the shoreline, which includes the boat launch is also located within the Northfield Project boundary.

Fort Hill Rail Trail. The Fort Hill Rail Trail is a multiple use trail, located in Hinsdale, New Hampshire. The trail is nine miles long and travels from Route 63 along the Connecticut River to the old bridge on Route 119. A small portion (approximately 190 feet) of the trail crosses through the Northfield Project boundary, over the Ashuelot River. The trail is owned and maintained by the State of New Hampshire.

Pauchaug Wildlife Management Area (WMA). The Pauchaug WMA is located on the eastern side of the Connecticut River in Northfield, Massachusetts. This WMA is owned and managed by the Massachusetts Division of Fish and Wildlife (MADFW). The site is open for hunting and is also used for walking/hiking, bird-watching, and bank fishing. The site is located within the Northfield Project boundary. There are no formal amenities within the WMA.

Pauchaug Boat Launch. This site is owned and managed by the MADFW as part of the Pauchaug WMA. The boat launch is located on state owned property on the eastern shore of the Connecticut River, upstream of the Schell Bridge in Northfield, Massachusetts. Facilities at this site include a hard surface boat launch with two launching lanes, parking, informational signage, and portable sanitation (seasonal). This site lies within the Northfield Project boundary.

Northfield Connector Bikeway. The Northfield Connector Bikeway is an 11-mile shared roadway route connecting the Canalside Trail Bike Path with the Town of Northfield. There is a spur off the main route to the Northfield Mountain Trail System. The route travels along the shoulders of existing roads from the East Mineral Road Bridge along Dorsey Road, River Road, Pine Meadows Road, Ferry Road, and finally onto Route 63, in Northfield, Massachusetts. The bikeway is part of the public roadway and signage is maintained by the Franklin Regional Council of Governments. Approximately 4,580 feet of the 11-mile trail passes through the Northfield Project boundary near the NMTTC Visitor Center.

Cabot Camp Access Area. This area is located within the Northfield Project boundary at the end of Mineral Road in Montague, Massachusetts. The site is owned and managed by FirstLight and is open to the public for shoreline access and bank fishing. A parking area which provides parking for approximately 15 vehicles is available at the site.

State Boat Launch. This launch is located upstream of the Turners Falls Dam. A portion of this site is within the Northfield Project boundary, off of Route 2 in Gill, Massachusetts. A portion of this site is owned by FirstLight, and a portion is owned by the Commonwealth of Massachusetts. The boat launch site is managed by the Commonwealth of Massachusetts, and is open to the public free of charge. The site offers boat launching, and bank fishing opportunities. There is a hard surface boat ramp with two launching lanes, a dock and portable sanitation facility (seasonal) at the site.

Canalside Trail Bike Path. This hard surface trail begins within the Gatehouse Fishway Viewing Area and ends at McClelland Farm Road in northeast Deerfield, Massachusetts. The trail is 3.27 miles long, with approximately 1.5 miles within the Northfield Project boundary. The trail runs along the Turners Falls Power Canal in Montague, Massachusetts and along the Connecticut River. The trail property is owned by FirstLight and is leased to and managed by the Massachusetts Department of Environmental Management (now the Massachusetts Department of Conservation and Recreation).

Poplar Street Access Site. The Poplar Street Access site is located outside the Northfield Project boundary, downstream of Cabot Station, on Poplar Street in Montague, Massachusetts. This site is owned by FirstLight and is utilized for carry-in boat access, fishing and as the downstream put-in location for the Canoe Portage. A parking area that can hold approximately 16 vehicles, a FERC Part 8 sign, and a trash can are available at the site.

3.3.6.1.4 Informal Recreation and Access Areas

Informal areas within the Project provide various recreation opportunities. Informal fishing access, whitewater boating access, climbing areas, and camp sites make up a majority of these opportunities. These areas have been created through repeated use by the public and have not been improved by the Licensee or other authorized entities.

Ashuelot River Informal Campsite. The informal campsite is located just downstream of the confluence of the Ashuelot River with the Connecticut River on the east side of the Connecticut River. The site is located on private property and FirstLight maintains flowage rights over the property. The area appears to be used for camping and picnicking.

Schell Bridge Informal Fishing and Swimming Access. The Schell Bridge informal fishing and swimming access is located on the western shore of the Connecticut River just south of the Pauchaug Boat Launch in Northfield, Massachusetts. This site is located partially within the Northfield Project boundary on private property and FirstLight holds flowage rights to the property. The area appears to be used for fishing and swimming.

Informal Multi-Use Access. This informal multi-use access area is located on the western shore of the Connecticut River, in Northfield, Massachusetts, upstream of the Route 10 Bridge. The access area is located on property owned by FirstLight within the Northfield Project boundary. It appears that this access area is used as an informal fishing access and campsite.

Informal Munn's Ferry Fishing Access. This informal access area is partially located within the Project boundary on the west side of the river in Gill, Massachusetts across from the Munn's Ferry Boat Camping Recreation Area. The access area is located on private property and FirstLight has flowage rights for the property. The area appears to be utilized for informal fishing access.

Turners Falls Station No. 1 Fishing Access. Station No. 1 is located in Montague, Massachusetts. The area is owned by FirstLight and is used as an informal fishing access. There is a parking lot associated with Station No. 1, which is maintained by FirstLight.

Turners Falls Dam Downstream Put-in. This informal area is located within the Northfield Project boundary immediately downstream of the Turners Falls Fishway on river left. The area is owned by FirstLight and appears to be used informally for angling and launching of carry-in boats.

Rose Ledge Climbing Area. This area is an informal climbing area located within the Northfield Project boundary on land owned by FirstLight. The area consists of a 40'- 60' cliff line that is used for rock-climbing. There are no formal amenities associated with the Rose Ledge Climbing area. Access to the area is via an informal foot path stemming from the NMTTC Trail System's Lower Ledge Trail. Climbers may park at the parking lot located at the NMTTC. Additional parking for the climbing area is located outside of the Project boundary on private property.

Farley Ledge Climbing Area. This informal climbing area is located partially within the Northfield Project boundary. A loop trail encompasses the climbing ledges associated with Farley Ledge and provides access to the crags. The Western Massachusetts Climbing Coalition (WMCC) owns property that provides parking and access to the loop trail. The total area encompassed by the trail along with the property that provides access to the site is approximately 51 acres. Approximately 46% of this land is located within the Northfield Project boundary. Farley Ledge is part of a larger chain of ledges (Farley Ledges) utilized for rock-climbing. There are no formal amenities associated with this area within the Project boundary. There are three (3) parking areas associated with the climbing area, which are located on private property outside the Project boundary.

3.3.6.1.5 Use at Formal Recreation Sites

FirstLight conducted an in-depth study from January 2014 to December 2014 to assess the type and level of use at formal recreation sites in the Northfield Project (Study 3.6.1 *Recreation Use/User Contact*

Survey).[37] Data collection objectives included the determination of the amount of recreation use and demand at Project recreation sites and user opinions with regard to existing recreation sites and perceived adequacy of recreation facilities. The data regarding the type and amount of use was obtained using spot counts, calibration counts, traffic counters, and when applicable, FirstLight registration data. Using these methods, the study was able to determine the type and amount of use at sites based in recreation days, a recreation day being defined by FERC as each visit by a person to a development for recreational purposes during any portion of a 24-hour period. Data regarding user opinions were obtained through the recreation user survey, the residential abutters' survey, and the Northfield Mountain trail user survey. Spot counts, calibration counts, the recreation user survey, and the Northfield Mountain trail user survey were conducted at parking locations associated with the formal recreation sites.

Based on data collected between January 2014 and December 2014, the total annual recreation use of surveyed recreation sites at the Northfield Project in 2014 was estimated to be 152,769 recreation days. Table 3.3.6.1.5-1 provides a breakdown of estimated use by season. As shown, approximately half of the recreation use occurred during the summer with 50% of recreation days. Recreation use was lowest in winter (10%) with moderate use in spring (16%) and fall (23%)[38].

Table 3.3.6.1.5-2 shows a breakdown of recreation use by activity type per recreation site surveyed. As shown, recreationists participated in a wide variety of activities at the Northfield Project. Project-wide, walking, hiking, and jogging was found to be the most popular recreation activity at the Northfield Project with 30% of recreation days. Motor boating was the second most popular activity (12%), followed by fishing (7%), bike riding (6%), picnicking (5%), climbing (4%), non-motorized boating (4%), cross-country skiing (3%), fishway viewing (3%), and camping (2%).[39] Hunting, ice fishing, ice skating, riding horses, sightseeing and birding received 1% or less of recreation days.

In addition to determining the type and amount of use at each of the surveyed recreation sites, the degree to which each recreation site had the capacity to sustain the recreation activity occurring at a site was estimated. Table 3.3.6.1.5-3 provides a breakdown of percent capacity utilized for each site. Percent capacity was determined by the available amount of parking at each site versus the average number of parking spaces that were occupied during surveys during summer weekends.

Governor Hunt Boat Launch: Annual recreation use at the boat launch was 1,812 recreation days in 2014. The portion of the site within the Northfield Project boundary was estimated to be utilized at 50% of capacity. Motor boating (53%) was the most popular recreation use at the boat launch followed by non-motor boating (15% of the use) and fishing (12% of the use).

Pauchaug Wildlife Management Area (WMA): There were a total 1,005 recreation days spent at the WMA. The site was estimated to be utilized at 1% of capacity. Forty-four percent (44%) of the recreation use at the WMA was for hunting followed by walking, hiking and jogging at 32% of use.

Pauchaug Boat Launch: Annual recreation use at the boat launch was 9,630 recreation days. The site is utilized at 20% of capacity. Motor boating accounted for 49% of the recreation use at this site, followed by fishing at 12% of the use, and non-motorized boating at 10% of the use.

Bennett Meadow Wildlife Management Area (WMA): There were a total 3,729 recreation days spent at the WMA. The site was utilized at 10% capacity. Walking, hiking and jogging accounted for 41% of the use. Hunting was also a popular activity at this site, particularly during the fall, accounting for 25% of the use.

[37] The results from the Recreation Use/User Contact Survey presented herein are preliminary as data are still being analyzed with a final report scheduled to be available by December 31, 2015.
[38] Figures shown do not total to 100% because of rounding.
[39] Bike riding includes both biking on hardened surfaces and mountain biking.

Munn's Ferry Boat Camping Recreation Area: Annual recreation use at the camping area was 1,716 recreation days. The site is utilized at 40% capacity. Motor boating and camping were the most popular uses of this area and accounted for 39% and 30%, respectively.

Boat Tour and Riverview Picnic Area: Annual recreation use at the area was 13,651 recreation days. The site was utilized at 10% capacity. On an annual basis, 20% of the use was for riverboat trips on the Quinnetukutt II (2,733 riverboat trips). During the period that the Quinnetukutt II was operating (June 28 through October 19), it accounted for 43% of use at the site. Other popular recreation activities included walking, hiking, and jogging at 29% of use, followed by picnicking at 18%. Based on data maintained by FirstLight, use of the Quinnetukutt II has declined since the 1980's (FirstLight, 2015d).

Northfield Mountain Tour and Trail Center (NMTTC): The total number of recreation days at the NMTTC during 2014 was 20,024. This included use of the Visitor Center, registered programs, and trail use. Trail use was the most popular recreation activity at the NMTTC, which includes hiking, biking, horseback riding, snowshoeing and cross-country skiing. The NMTTC is utilized at 10% capacity.[40] The NMTTC is discussed in more detail in section 3.3.6.1.6.11.

Cabot Camp Access Area: Annual recreation use at the area was 5,326 recreation days. The site was utilized at 15% capacity. The most popular recreational activities were fishing (26% of the use at the site) and walking, hiking, and jogging (19% of the use).

Barton Cove Nature Area and Campground: The total number of recreation days at the nature area was 7,842, while the campground had a total of 2,963 recreation days. The most popular recreation activities at the nature area were walking, hiking, and jogging and fishing. Camping was the most popular recreation activity at the campground. Based on parking area usage levels, the Nature Area was utilized at 20%. Utilization of the campground was based on campsite use, and was estimated to be utilized at 40%.

Barton Cove Canoe and Kayak Rental Area: Annual recreation use during 2014 at the rental area was 4,455 recreation days. The area was utilized at 25% capacity. Sixty percent (60%) of the use at the site was by individuals who were participating in non-motorized boating. Twelve percent (12%) of the use was picnicking.

State Boat Launch: The total number of recreation days during 2014 at the boat launch was 15,126. While the launch was utilized at 65% on average during summer weekends, there were times when the site was used above 100% capacity, such as fishing tournaments. Boating (motorized at 74% of use and non-motorized boating at 11%) is the most popular recreation activity at this site.

Gatehouse Fishway Viewing Area: Annual recreation use during 2014 at the fishway viewing area was 27,345 recreation days. This includes individuals touring the fishway and utilizing the picnic area along the river. The visitor center associated with the fishway was utilized at 90% capacity. The parking lot serving the Gatehouse Fishway Viewing Area, which includes the picnic area was at 25% capacity. Based on existing use records maintained by FirstLight since the 1980s, visits to the fishway have declined. Walking, hiking, and jogging (36% of use) and fishway viewing (19% of use) were the most popular activities at the site.

Turners Falls Branch Canal Area: The total number of recreation days spent at this area and Turners Falls Station No. 1, combined, in 2014 was 1,264. Parking for this area is available at Turners Falls Station No. 1. Percent capacity utilization at Turners Falls Station No. 1 was 1%. The area was primarily utilized for walking, hiking, and jogging (26% of use), fishing (21% of use), bike riding (21% of use), and cross-country skiing (14% of use).

Cabot Woods Fishing Access: There were a total of 18,230 recreation days spent at the fishing access during 2014. The site was utilized at 25% capacity. The most popular recreation activities included walking, hiking, and jogging (53% of use), fishing (11% of use) and bike riding at 10% of use. There are two parking

[40] This is based on parking lot capacity.

areas associated with the fishing access, as well as 3,100 feet of Migratory Way, which links the two parking areas. This helps to account for the primary use of the access being attributable to walking, hiking, and jogging and bike riding.

Turners Falls Canoe Portage: FirstLight provided a total of nine vehicle portages around the Turners Falls Dam between May 17th, 2014 and September 3rd, 2014. Of these, three vehicle portages were related to camp groups totaling 39 boaters. The remaining six vehicle portages totaled 14 boaters.

Poplar Street Access Site: Annual recreation use during 2014 at this access area was 1,877 recreation days. The site was utilized at 10% capacity for fishing (41% of use), walking, hiking, and jogging (23%), and non-motorized boating (21%).

Of the formal recreation sites for which percent capacity utilization was calculated, only two sites were used at greater than 30% capacity – the State Boat Launch, which was utilized at 65% capacity on summer weekends and the Gatehouse Fishway Viewing Area building, which during the short viewing season had the heaviest utilization at 90%. Six of the formal recreation sites were utilized at 10% of capacity or less. Observed capacity utilization was lowest at Pauchaug Wildlife Management Area (1%) and Turners Falls Branch Canal/Station No. 1 (1%). The other wildlife management area, Bennett Meadows (10%), also has a low level of utilization.

Project-wide, the formal recreation sites have sufficient capacity to meet recreational demands, with several of the sites having significant excess capacity.

3.3.6.1.6 Use of Informal Recreation Areas

Use of the informal recreation areas was estimated based on field observations of compaction, litter and other indicators noted during site visits, as well as spot counts and calibration counts made at Turners Falls Station No. 1 Fishing Access, Rose Ledge parking area, and at Farley Ledge's Wells Street and Route 2 parking lots.[41] It appeared that the majority of the informal recreation areas received low to moderate use with a few exceptions.

Ashuelot River Informal Campsite. This site is located on private property and appears to receive moderate use based on physical improvements and compaction at the site.

Schell Bridge Informal Fishing and Swimming Access. This area appears to see moderate use based on the amount of compaction along the shoreline. Individuals appear to use this area for informal fishing access and swimming.

Informal Multi-Use Access. This informal multi-use access area appears to have been used for informal fishing access and camping. This use appears to vary from moderate to minimal use. Site indicators were compaction and erosion.

Informal Munn's Ferry Fishing Access. The area appears to be utilized for informal fishing access, however this use appears to be minimal based on site indicators such as compaction and vegetation.

Turners Falls Station No. 1 Fishing Access. This area appears to see minimal use based on parking area information that was collected during 2014. The area is used as an informal fishing access.

Turners Falls Dam Downstream Put-in. This area appears to receive minimal use with some individuals participating in kayaking or bank fishing. There was no compaction noted, however the area does appear to receive some unauthorized improvements such as an informal fire ring and graffiti.

Rose Ledge Climbing Area: While the climbing area itself was not surveyed for use, the parking area, which is located on private property outside of the Project boundary, was utilized at 60% capacity.

[41] Turners Falls Station No. 1 Fishing Access is utilized for parking by recreationists utilizing the Turners Falls Branch Canal Area and is discussed in section 3.3.6.1.5.

Farley Ledge Climbing Area: This climbing area appears to receive moderate to heavy use based on compaction and anecdotal information. There are three parking areas associated with Farley Ledge Climbing Area, which are located on lands owned by others outside of the Project boundary. The Route 2 parking area was frequently used and saw utilization of 60% capacity during 2014.[42] The Wells St. parking area saw utilization of 30% capacity during 2014.

3.3.6.1.7 Recreationist's Opinions of Project Recreational Opportunities

As part of Study 3.6.1 *Recreation Use/User Contact Survey*, recreationists were asked their opinions regarding the recreational opportunities offered in connection with the Project. Based on the results of the survey of recreationists, visitors traveled an average of 23 miles to utilize recreation sites within the Northfield Project. The majority (69%) of the recreationists were from 10 or fewer miles away, while 2% of the people traveled 100 or more miles. Respondents overwhelmingly agreed that the overall quality of the Project recreational opportunities was excellent (41%), fair to excellent (44%), or fair (12%). Two percent (2%) of respondents considered the overall quality to be less than fair.[43]

Surveyed visitors were asked to rate their perception of the level of use at the Project on a scale of 1 ("not crowded") to 5 ("extremely crowded"). Recreationists perceived the amount of use at Project recreation sites to be "not crowded" (39%), "somewhat crowded" (21%), and between "not crowded" and "somewhat crowded" (19%). Only six (6) percent perceived the use at the Project sites to be "extremely crowded."

The majority of recreationists (93%) responded that they were satisfied (37%), moderately satisfied (43%), or extremely satisfied (13%) with water levels in the river when asked: Overall, how satisfied were you with the river water level during your trip?

Recreationists were also asked about their levels of satisfaction with the number of facilities at the Project. Ninety-six percent (96%) of recreationists surveyed were satisfied (3), moderately satisfied (4), or extremely satisfied (5) with the number of recreation facilities at the Project. Extremely satisfied (36% of responses) was the most frequently given rating for the number of recreation facilities available. Thirty-one percent (31%) reported being moderately satisfied (4), with 29% being satisfied.

Visitors were asked their opinions of the Project with respect to several recreation attributes and conditions. Parking received very positive responses. Eighty percent (80%) of respondents rated the parking as excellent (46%) or between fair and excellent (35%), while fourteen percent (14%) rated the parking as fair. Facility conditions also received very positive responses, with 42% rating the facility conditions as excellent (the most common response), 40% rating the facility conditions as between fair and excellent, and 14% rating the conditions as fair. Regarding the variety of amenities, 88% rated the existing variety of amenities as fair or better. Only 12% of respondents felt that the variety was poor or between poor and fair. With respect to river access, survey respondents had positive perceptions, with 43% of respondents rating the access to be excellent (the most common response), 36% between fair and excellent, and 14% fair. Restrooms were the one area in which visitors had more mixed responses, with 50% rating the restrooms as fair or better and the remaining 50% rating the restrooms as poor or between poor and fair.

3.3.6.1.8 Residential Abutters' Opinions of Project Recreational Opportunities

As part of Study 3.6.1 Recreation Use/User Contact Survey, a mail survey of the 211 residential landowners abutting the Northfield Project boundary and within the Northfield Project boundary was conducted. While some of these properties directly abut the Connecticut River, there are residences that do not. The residential abutters' survey intended to capture recreation users at the Project who access through private lands, as opposed to through the formal recreation sites at the Project. Of the 211 surveys mailed to residential landowners, 95 surveys (or 45%) were completed and returned. The majority of the residential abutters who

[42] The Route 2 and Wells Street parking areas were surveyed to capture individuals utilizing Farley Ledges. Climbers utilizing the Overflow parking would likely utilize the Route 2 area for access.
[43] Percentages shown do not sum to 100% due to rounding.

responded to the survey were year round residents. The residential abutters were asked: Overall, how satisfied were you with the river water level during your trip? Forty-three percent 43%) responded that they were satisfied, moderately satisfied, or extremely satisfied with water levels in the river; 19% indicated that they were slightly satisfied, while the remaining 39% gave water levels a rating of 1, indicating that they were "not satisfied at all".

Fifty-eight percent of the 95 respondents stated that they access the Connecticut River from their property for recreation purposes. When asked if they ever use the recreation sites associated with the Project, 42 (47%) of the 89 respondents answering the question stated yes. The majority of the respondents (81 of 89) stated that they utilized the Connecticut River or amenities at Northfield Mountain for recreation purposes. Of these respondents, the majority (60%) use the Connecticut River or amenities at Northfield Mountain for recreation purposes approximately 1-25 days per year. Respondents utilized a variety of recreation sites within the Northfield Project boundary including: Barton Cove Nature Area and Campground, the NMTTC, the Gatehouse Fishway Viewing Area, Boat Tour and Riverview Picnic Area, the MA State Boat Launch, and the bike paths. The most popular recreation activities reported by the residents include walking and nature observation, in all four seasons.

3.3.6.1.9 Recreation Use of the Bypass Reach for Whitewater Boating

The bypass reach of the Connecticut River begins at the Turners Falls Dam and extends downstream 2.7 miles to Cabot Station. The bypass reach is created by the power canal, which parallels the river on the east side, and is used to divert river flows to Cabot Station and Station No. 1. Flows in the bypass reach vary depending on time of year, operational needs and constraints, tributary inflows, and weather events. Flows range from leakage to extremely high flows when the river flow exceeds the hydraulic capacity of the power canal (18,000 cfs). Under current operation of the Turners Falls Development, the availability of flow in the bypass reach is dependent on river flows, which are largely determined by hydrologic conditions in the basin and discharge from the upstream hydropower projects on the river.

Under the current FERC license, FirstLight is required to release a continuous minimum flow of 1,433 cfs or inflow, whichever is less below the Turners Falls Development. This is typically maintained through discharges at Cabot Station (located at the downstream terminus of the power canal) and/or Station No. 1 which is located approximately 0.9 miles down the bypassed reach. The FERC license also requires a continuous minimum flow of 200 cfs in the bypassed reach starting on May 1, and increasing to 400 cfs when fish passage starts. This flow is provided through July 15 unless the upstream fish passage season has concluded early, in which case the 400 cfs flow is reduced to 120 cfs to protect Shortnose Sturgeon. The 120 cfs continuous minimum flow is maintained in the bypassed 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 15th.

The 2.7 mile bypass reach from the Turners Falls Dam to Cabot Station exhibits variable boating characteristics that include whitewater features interspersed with longer stretches of flat water or riffles, depending on the flow. The first approximately 2,500 feet of the bypass reach are characterized by a series of rock ledges and outcroppings, which create a whitewater play area under a range of flows. Downstream the reach is characterized by a series of riffles and some flat water just before the Station No. 1 powerhouse, located about 4,000 feet downstream of the Turners Falls Dam. Below Station No. 1 is an area of riffles and small rapids, interspersed with flat water. Approximately 4,000 feet downstream of Station No. 1 is Rawson Island. There are boatable channels on both sides of the island, although the larger left channel contains a feature consisting of a natural bedrock vertical drop in the river gradient known as Rock Dam. The right channel contains a series of riffles and rapids. The remainder of the bypass reach is a mixture of flat water and riffle areas. The bypass reach is accessible to whitewater boaters from three locations: the informal put-in area downstream of Turners Falls Dam, Turners Falls Station No. 1 Fishing Access, and Cabot Woods Fishing Access.

To evaluate the potential of the bypass reach to support whitewater boating, the Licensee conducted a controlled release whitewater boating study (FirstLight, 2015a).

The study was designed to provide information on the boating conditions at various flows in the bypassed reach. A total of six flows (2,500, 3,500, 5,000, 8,000, 10,000 and 13,000 cfs) were evaluated over a three-day period in the summer of 2014. Participants paddled a variety of watercraft including kayaks, closed canoes, open canoes, rafts and a stand-up paddleboard. During the study, boaters utilized the International Scale of River Difficulty to rate whitewater in the bypassed reach under each of the flows. Boaters rated the bypassed reach Class I to Class IV, depending on the type of boat, the level of flow, and the features of the bypassed reach. For most evaluation flows, the Class IV rating was assigned to a single feature, Rock Dam The reach was found to be boatable at all six evaluation flows i.e., between 2,500 cfs and 13,000 cfs.

When Connecticut River flows exceed about 18,000 cfs, the excess flow is likely to be spilled into the bypassed reach, under normal Project operations. Bypass flows above 2,500 cfs naturally occur during the spring but may also occur occasionally during the summer and fall. Based on a review of the hydrologic record (Table 3.3.6.1.9-1), the study found that acceptable boating flows (flows > 2,500 cfs) typically occur in the bypass an estimated 40-45 days a year between April and November, under the existing normal operation of the Project. Additional boating flow days may occur in the bypass reach when the power canal is shut down for maintenance or other reasons.

Current use of the bypassed reach for boating is limited, even though the reach is available for boating during periods of spillage from Turners Falls Dam. This may be indicative of low demand, or may be due to a general lack of knowledge of periods of spill into the bypass reach. Anecdotal information collected from boaters in preparation for the boating study indicated whitewater boaters have run the bypass reach when there is water available but no information specifically correlating bypass flows with recreational boating opportunities in the bypass reach was found. In fact, research found that existing published boating guides (AMC) and other resources (AW national river database) contained very limited information on the bypass reach. This research suggested that although existing USGS gage data are available and can be used to estimate flows in the bypass reach, boaters may not be aware that it exists or do not know how to use it (FirstLight, 2015a).

Although the boaters who participated in the study found the bypass reach to provide an acceptable boating experience for most watercraft, other regional rivers were rated more desirable. Other regional whitewater boating opportunities identified include several reaches of the Deerfield River, the Ashuelot River, the West River and the Millers River (Figure 3.3.6.1.9-1). Scheduled releases occur on the West River, Millers River, and two reaches of the Deerfield River. These releases provide whitewater boating opportunities throughout the recreation season including in the summer and on weekends.

3.3.6.1.10 Recreational Use of the Project for Boating

The TFI is utilized for both motorized and non-motorized boating. Public motorized boating use on the TFI is generally accessed by launching at the Governor Hunt Boat Launch, the State Boat Launch, and Pauchaug Boat Launch, which provide trailered boating access. An estimated 18,470 recreation days, or 12% of the total number of recreation days at the Project, were spent participating in motor boating.

The Project is also used for non-motorized boating, which had an estimated 6,656 recreation days in 2014. Non-motorized boating at the Project is supported through several Project recreation sites. Barton Cove Canoe and Kayak Rental Area rents kayaks and is open from Memorial Day weekend to Labor Day weekend. Hours of operation on weekdays are from 9:00 a.m. to 5:00 p.m., while on weekends the rental area is open from 9:00 a.m. to 6 p.m. A total of 2,681 recreation days were spent participating in non-motorized boating from the Barton Cove Canoe and Kayak Rental Area. In addition, non-motorized boating access within the Northfield Project is available at the Governor Hunt Boat Launch and Picnic Area (operated by TransCanada as part of the Vernon Hydroelectric Project); Pauchaug Boat Launch; the Boat Tour and Riverview Picnic Area; the Cabot Camp Access Area, the Barton Cove Nature Area and Campground; and the State Boat Launch. These sites are located approximately 1.3 to 8.2 miles apart.

The TFI is part of the Connecticut River Paddlers' Trail. According to the National Park Service (NPS) a water trail (paddlers' trail) is defined as a recreational route on a waterway with a network of public access

points supported by broad-based community partnerships. Initially developed in 1992, the Connecticut River Paddlers' Trail is a series of primitive campsites and river access points extending from the headwaters of the Connecticut River to the NH/VT/MA state line. In 2012, partnerships were formed to establish a "southern" trail chapter to extend the river trail to Long Island Sound (FirstLight, 2015b). With respect to the TFI, a 2013 Friends of the Connecticut River Paddlers (FCRPT) report stated that "in general, most access points are well maintained, well-spaced, and are in adequate condition" (Pollock, 2013).

Numerous stakeholders requested a study of Project facilities that support multi-day non-motorized boating trips. In response, Study No. 3.6.4 Assessment of Day Use and Overnight Facilities Associated with Non-Motorized Boats was conducted in 2014 (FirstLight, 2015b). The focus of the study was to determine the number of existing overnight and access facilities that support self-powered boating trips and the adequacy of the spacing. The study also included the feasibility of alternate walkable canoe portages and the need for additional future facilities. The study area was the Connecticut River from Vernon Dam to the Sunderland Bridge (Route 116) in Sunderland, Massachusetts; a distance of approximately 32.5 miles, of which 9.5 miles or river downstream of Cabot Station, which is outside the Project boundary.

There are three existing campsites and, as described above, seven access sites along the 23-river miles between the Turners Falls Dam and the Vernon Dam that can be used by paddlers traversing the Connecticut River Paddlers' Trail. Campsites are located on Stebbins Island (operated by TransCanada as part of the Vernon Hydroelectric Project (FERC No. 1904); and at FirstLight's Munn's Ferry Boat Camping Recreation Area and Barton Cove Nature Area and Campground. The distance between the existing campsites within the Northfield Project boundary ranges from 6.8 to 10.4 miles.

Water access camping is available from Memorial Day through Columbus Day at the Munn's Ferry Boat Camping Recreation Area and from Memorial Day through Labor Day at the Barton Cove Nature Area and Campground. Combined there are a total of 36 campsites along the TFI, five of which are water access only. There are an additional four to five camping areas at Stebbins Island, which is owned by TransCanada. The island is located approximately one (1) mile downstream of Vernon Dam.

Existing camping use at the Munn's Ferry Boat Camping Recreation Area and Barton Cove Nature Area and Campground are below capacity, and annual weekday use has declined over the last five years. Weekend use at Munn's Ferry Boat Camping Recreation Area dropped significantly from 2011 to 2012 but has remained relatively stable since with an occupancy rate of approximately 30% in 2012 - 2014. Weekend use at Barton Cove Nature Area and Campground has declined significantly between 2010 and 2014 from an occupancy rate of 67.1% to 37.6%.

In the reach of river from downstream of the Turners Falls Dam to the Sunderland Bridge, there are three access sites for use by paddlers. One of these is the Poplar Street access located downstream of Cabot Station, which serves as both a take-out location for boaters utilizing the Turners Falls bypassed reach and as a put-in location for the canoe portage and boaters traveling downstream. In addition, access is provided at the Sunderland Bridge Boat Launch, an unimproved boat launch on river left at river mile 32.5 and maintained by the Town of Sunderland and the Sunderland Bridge access on river right at river mile 32.5, which is within a State right-of way. There are no formal campsites in the 9.5 mile stretch of the study area below the Project boundary, although there are several informal campsites on private and state property.

Canoe Portage Use

FirstLight operates and maintains a canoe portage around the Turners Falls Dam during daylight hours for the paddling season, which is typically mid-May to mid-November. The existing canoe portage is comprised of a free vehicular shuttle service from Barton Cove Canoe and Kayak Rental Area to the Poplar Street Access Site. Portage is provided, by request, on an as-needed basis, for groups with four or fewer boats. Larger groups are asked to provide FirstLight with a one month advance notice. A telephone number to arrange a portage is provided on the FirstLight website and is posted on sign kiosks at several of the Project Recreation Sites located on the TFI. The telephone number is also posted in several regional and local recreational guides.

Use of the Turners Falls portage is light. As previously discussed, FirstLight provided a total of nine vehicle portages around Turners Falls Dam between May 17, 2014 and September 3, 2014. Of these, three vehicle portages were related to camp groups totaling 39 boaters. The remaining six vehicle portages totaled 14 boaters.

Study 3.6.4 also examined the feasibility of developing a walkable portage trail around Turners Falls Dam utilizing the Canalside Trail Bike Path and public side streets. It was found, that using existing access areas and side streets would result in a portage of approximately three (3) miles. Overall, the study concluded that the existing vehicle portage provided by FirstLight also provides sufficient portage around Turners Falls Dam (FirstLight, 2015b).

3.3.6.1.11 Recreational Use of the Northfield Mountain Tour and Trail Center

The NMTTC is a four-season facility that provides many on-site recreational opportunities, environmental and educational programs. The NMTTC also serves as a base for management and oversight of other FirstLight Project recreation facilities. Public recreation facilities and amenities at the NMTTC include a Visitor Center, Trail System, Mountain Top Observation Area located on the Upper Reservoir, and a number of additional amenities such as picnic tables, grills, informational kiosks and a yurt.

The NMTTC, is located on Route 63 in Northfield, MA, and offers a variety of public and school programs through the Visitor Center. Public programs are both educational and recreational in nature, and are scheduled and offered year-round, many at no charge to participants. Programs include such activities as guided hikes, animal track identification, and winter tree identification. School programs are scheduled during the school year and offer opportunities for hands-on environmental education and recreation.

Individuals utilize the NMTTC and associated amenities for a variety of activities including hiking, mountain biking, horseback riding, cross-country skiing, snowshoeing and access to informal climbing opportunities. Individuals can also use the hiking trails to reach the Mountain Top Observation Area which has views of the Upper Reservoir.

At the request of stakeholders, FirstLight conducted a study to evaluate the number of existing recreation facilities and amenities associated with the NMTTC including a review of the trail system. Study No. 3.6.7 Recreation Study at Northfield Mountain, Including Assessment of Sufficiency of trails for Shared Use was conducted in 2014. The study found that the NMTTC is a well-utilized regional recreation resource that provides a wide variety of opportunities, programs and amenities, which supported an estimated 20,024 recreation days in 2014 (FirstLight, 2015d). Visitors to the NMTTC participated in environmental and recreation programs, and used the trail network for a variety of recreational activities.

Registration and use records available since the 1980s demonstrate that over the long-term NMTTC environmental program use has declined. This long-term decline appears to reflect a change in interest and participation, and is not a result of reduced program offerings, which have remained relatively constant. Over the past five years, however, with a few exceptions due to unusual circumstances, recreation use associated with the NMTTC, as well as environmental program registrations, have remained relatively consistent.

Surveyed visitors were overwhelmingly satisfied with the amenities provided at the NMTTC. One hundred percent (100%) of respondents to the survey question asking about their overall satisfaction with the NMTTC said they were extremely satisfied (46%), moderately satisfied (33%), or satisfied (21%). Visitors' responses to the question "What did you like most about your recreational experience today?" included "world class touring center", the trails, the Visitor Center exhibits and the variety of programs. Visitors also reported liking most that the NMTTC was not crowded and was quiet. Surveyed visitors were asked to rate the variety of amenities at the NMTTC on a scale of 1 ("poor") to 5 ("Excellent"). Eighty-one percent (81%) of those who responded rated that the variety of amenities available at the NMTTC was a 4 or 5. In addition, there were many more responses to the two positive open-ended questions ("what did you like most about your recreation experience today?" and "what, if anything, enhanced your recreation experience

today?") than responses to the two open-ended negative questions ("what did you like least about your recreation experience today?" and "what, if anything, detracted from your recreation experience today?").

3.3.6.1.12 Recreational Use of the Northfield Mountain Tour and Trail Center Trail System

The NMTTC Trail System is an approximately 25-mile network of trails that supports cross-country skiing, snowshoeing, hiking, biking, and horseback riding. The Trail System includes 28 individually named trails (Figure 3.3.6.1.12-1). The NMTTC Trail Systems receives moderate use, and Study 3.6.7 Recreation Study at Northfield Mountain, Including Assessment of Sufficiency of Trails for Shared Use found that the NMTCC Trail System supported an estimated 16,123 recreation days in 2014 (FirstLight, 2015d). A review of FirstLight records for the period 2010 through 2014 show that, after adjusting for special events and closures in various years, trail use has remained relatively consistent of the 2010-2014 period.

Study 3.6.7 also found that the Trail System is well designed, well maintained and with few exceptions, in good condition. The trails were designed and built to a very high standard at the time that they were constructed in the 1970's. Although the trails were designed primarily for hiking and cross-country skiing, the trail assessment (Study No. 3.6.7) found that the cross-country ski trails are well adapted to handle mountain biking and can also accommodate horseback riding use, while remaining in good condition. The hiking and snowshoe trails are not as suitable for mountain biking or horseback riding use (FirstLight, 2015d).

The vast majority of visitors to the NMTTC Trail System are very satisfied with the number of trails and with the difficulty of the trails. Ninety-four percent (94%) of respondents strongly agreed or agreed that the trails are in good condition, with 95% strongly agreeing or agreeing that the trails are well maintained. Surveyed visitors also disagreed or strongly disagreed (61% of responses) that more trails are needed while another 26% of respondents remained neutral. The majority of respondents (85%) either agreed or strongly agreed that the grooming of winter trails is sufficient. The majority of respondents (96%) also agreed or strongly agreed that the hours of operations are adequate, while the remaining 4% were neutral. When asked how any of the trail variables could be improved, only nine (9) users chose to respond while an additional 23 recreationists chose not to respond.

In addition to the trails provided at the NMTTC System, there are 133 properties with hiking and/or mountain biking trail opportunities within 25 miles of the NMTTC. Of the 133 properties, 64 provide both hiking and mountain bike trails, 62 provide only hiking trails, and seven provide only mountain bike trails. The properties are owned and managed by a variety of federal, state, and local agencies, land trusts, and private entities. All but two of the properties are open to the public on a year-round basis.

3.3.6.2 Environmental Effects

The continued operation of the Northfield Project, as proposed, will have a beneficial effect on existing recreational use of the Project, the recreation opportunities provided by the Project, or use of the Project recreation sites. There are 10 Commission-approved Project recreation sites (listed in Table 3.3.6.1.2-1), which provide the public with a variety of recreational opportunities including boating, fishing, camping, swimming, picnicking, hiking, cross-country skiing, snowshoeing, horseback riding, rock-climbing, and mountain biking.

Recreation-related studies conducted by FirstLight as part of the relicensing process demonstrate that the existing Project recreation sites, combined with other public recreation sites and facilities, as well as informal access areas, provide the public with a diversity of recreation opportunities, and an abundance of options for accessing and utilizing Project lands and waters for recreation. An inventory of both Project and other improved recreation sites found that with few exceptions all of the sites and their associated facilities and amenities are well maintained and are functioning as designed. A survey of site users also found that users felt that the existing sites were generally well operated and maintained. The major recreation facilities at the most popular Project recreation sites received favorable marks from most users, including the Barton Cove Campground, the Barton Cove Canoe and Kayak rental area, the Gatehouse Fishway Viewing Area,

and most notably, the NMTTC and NMTTC Trail System. Continued operation of these Project recreation sites will ensure that the public continues to benefit from the recreational opportunities afforded by Project lands and waters.

The continued operation and maintenance of the existing Project recreation sites is supportive of current recreation use and demand levels. Use surveys conducted as part of Study 3.6.1 demonstrate that current facility capacities do not exceed 50% with two exceptions. The State Boat Launch was utilized at 65% capacity during 2014, while a portion of the Gatehouse Fishway Viewing Area building was utilized at 90 % capacity during the fishway viewing season. However, even these two sites are expected to provide adequate use capacity for the foreseeable future.

The NMTTC is the most popular of the Project recreation sites, and in addition to the facilities and amenities provided at the NMTTC, the Visitors Center also serves as the base of operations for some of the other Project recreation facilities, including the QII riverboat tour, and the fishway viewing area. Study 3.6.7 results found that visitors to the NMTTC consistently gave it favorable marks for its facilities and amenities, as well as for how the facilities are operated and maintained by FirstLight. Continued operation of the NMTTC will continue to provide the region with a recreational resource offering a variety of recreational experiences, including the provisions of educational and recreational programs offered through the NMTTC. Study 3.6.7 results also found that users of the NMTTC Trail system consistently gave it favorable remarks and there were almost no negative comments. Study 3.6.7 found the trails overall, to be well maintained and in good condition. The Trail System will continue to operate year-round and provide hiking, mountain biking and horseback riding opportunities in the spring, summer and fall, as well as skiing and snowshoeing opportunities in the winter. The Trail System will also continue to provide parking and access for those wishing to access the New England National Scenic Trail, and the popular Rose Ledge climbing site. Continued maintenance of the trails by FirstLight will ensure that the trails remain in good repair, functional and sustainable for existing uses well into the future.

Continued operation of the Project, as proposed, including the operation and maintenance of the existing Project recreation sites will also be supportive of the Connecticut River Paddlers' Trail's goals of expanding the Connecticut River Trail to include the TFI and Project areas downstream of Turners Falls Dam. Study 3.6.4 found that existing access and camping opportunities located throughout the TFI are located and spaced consistent with water trail design standards and practices. FirstLight's proposed maintenance of its existing campsites and access areas will ensure that these facilities will be available for water trail users and multi-day through paddlers in the future. FirstLight also proposes to continue to operate the Turners Falls Dam vehicle portage between Barton Cove (take-out) and the Poplar Street Access Site (put-in), as it does currently, which will also support water trail users and through-paddlers.

Continued operation of the Project will also continue to support existing recreational use of the bypassed reach for recreation. The bypassed reach will continue to receive seasonally variable minimum flows (120-400 cfs) during periods of normal Project operation and when river flows are less than the hydraulic capacity of the power canal. Periodically, the bypassed reach will receive significant flows, if the canal is shutdown for maintenance or other reasons, as well as when river flows exceed the hydraulic capacity of the canal (>18,000 cfs). Study 3.6.3 demonstrated that flows of 2,500 cfs or greater occur in the bypassed reach approximately 17% of the time, annually. Study 3.6.3 also demonstrated that the bypassed reach is suitable for whitewater boating at a range of flows (2,500 cfs – 13,000 cfs). Bypassed reach flows in excess of 2,500 cfs, would be expected to occur most frequently in the spring, but can be expected to provide boatable conditions in the bypassed reach approximately 40-45 days between April and November, in an average hydrologic year. Study 3.6.3 also found that there are numerous other regional whitewater boating opportunities, including several reaches of the Deerfield River, the Ashuelot River, the West River, and the Millers River. Some of these boating opportunities are dependent on natural flows but several of these opportunities are available through the recreation season through scheduled flow releases, including reaches on the Deerfield River, the West River, and Millers River. Scheduled releases at these rivers provide regional boaters with significant whitewater boating opportunities, including in the summer and weekends.

Access for whitewater boaters wishing to utilize the bypassed reach is available for "put-in" at an informal area below the Turners Falls Dam, at the Cabot Woods Fishing Site; and for "take-out" at the Station No. 1 Fishing Access and at the Poplar Street Access Site. FirstLight's proposal to continue to operate and maintain these formal sites, and to continue to allow public access to the informal access areas will ensure that the bypassed reach can continue to be utilized for whitewater boating, whenever flow conditions allow.

Continued operation of the Project will also continue to support boating use of the TFI. Boat launching for trailered boats is currently provided at two formal recreation sites: the Pauchaug Boat Launch and the State Boat Launch. The Pauchaug Boat Launch is owned and managed by the Commonwealth of Massachusetts as part of the Pauchaug Wildlife Management Area. The boat launch is located on state property on the eastern shore of the TFI, and within the Project boundary. Both the boat launch and parking lot are maintained by the state. The boat launch itself is a hard surface ramp with two launch lanes. The paved lanes are approximately 50 feet in length and function as intended over the typical range of TFI water levels that occur as a result of normal Project operations. The State Boat Launch site is on property partially owned by the state, and partially by FirstLight, and the site is operated and maintained by the state. The launch at this location is a hard surface ramp with two launch lanes. The launch is approximately 100 feet in length, and functions as intended over the typical range of TFI water levels that occur during normal Project operations. Both boat launches that provide trailered boats access to the TFI would be expected to remain fully functional under the proposed operation of the Project.

The continued operation of the Project will have no impact on the recreational use of the Northfield Mountain Pumped Storage Development's Upper Reservoir. For both safety and security reasons, public recreational use of the Upper Reservoir is currently restricted to the observation platform, which is maintained as part of the NMTTC, and which is accessed via the NMTTC Trail System. There is no boating, fishing or swimming allowed on the Upper Reservoir, and therefore no boat launches or recreation access sites, other than the viewing platform. Because there is no boating allowed on the Project's Upper Reservoir, proposed modifications of the operation of the Upper Reservoir will also have no impact on recreational use of that reservoir.

Existing Project recreation sites and facilities are currently meeting recreation demand and are adequate to meet demand in the reasonably foreseeable future.

3.3.6.3 Cumulative Effects

In Scoping Document 2 FERC identified that recreational uses maybe cumulatively affected by the proposed operation and maintenance of the five Connecticut River Projects. The presence of the dams may have a cumulative effect on recreation for multi-day paddling trips on the Connecticut River. During licensing studies it was determined that the availability and types of recreation facilities along the Connecticut River within the Northfield Project adequately supports multi-day paddling trips and are also consistent with plans for Connecticut River water trail expansion.

3.3.6.4 Proposed Environmental Measures

FirstLight is proposing no changes or modifications to the existing Project recreation sites at this time. FirstLight proposes to develop and implement a Recreation Plan

3.3.6.5 Unavoidable Adverse Impacts

No unavoidable adverse impacts are expected to recreational resources in the Northfield Project.

Table 3.3.6.1.2-1: Commission Approved Recreation Facilities at the Turners Falls Project (FERC No. 1889) and Northfield Mountain Project (FERC No. 2485)

Recreation Site Name	Recreation Facilities
Bennett Meadow Wildlife Management Area	Hunting area
Munn's Ferry Boat Camping Recreation Area	5 Water Access only campsites (4 Tent platform sites and 1 shelter site), pedestrian foot bridge, restroom, picnic area (1 table)
Boat Tour and Riverview Picnic Area	56 vehicle parking spaces (2 ADA + 54 single vehicle spaces), restroom (ADA), , picnic area (12 tables + 2 benches), pedestrian foot bridge, picnic pavilion (8 tables), interpretive boat tour
Northfield Mountain Tour and Trail Center	53 vehicle parking spaces (3 ADA + 50 single vehicle spaces), restroom (ADA), picnic area (7 tables), overlook, visitor center, interpretive sign (11 displays), hunting area, winter area, 22 trails
Barton Cove Nature Area and Campground	26 vehicle parking spaces at the Nature Area and 28 vehicle parking spaces at the Campground, shower house, 2 restroom facilities (ADA), picnic area (15 tables), overlook, interpretive sign (display), walk-in campground with 2 group sites and 29 campsites, nature trail
Barton Cove Canoe and Kayak Rental Area	28 vehicle parking spaces, picnic area (6 tables), canoe and kayak rentals, canoe portage take-out
Gatehouse Fishway Viewing Area	29 vehicle parking spaces (2 ADA + 27 single vehicle spaces), picnic area (6 tables + 5 grills), bike rack, trail, visitor center (ADA accessible), interpretive sign (display)
Turners Falls Branch Canal Area	Overlook with 4 benches
Cabot Woods Fishing Access	19 vehicle parking spaces (2 ADA + 17 single vehicle spaces), informal trails to shoreline, picnic area (3 tables)
Turners Falls Canoe Portage	Trail, canoe portage take-out and put-in, portage procedure

Table 3.3.6.1.5-1: Estimated Use of Surveyed Sites by Season

Recreation Site	Estimated Annual Use (2014)	Estimated Winter Use	Estimated Spring Use	Estimated Summer Use	Estimated Fall Use
Governor Hunt Boat Launch	1,812	13%	11%	67%	9%
Pauchaug WMA	1,005	15%	0%	23%	62%
Pauchaug Boat Launch	9,630	1%	7%	68%	23%
Bennett Meadow WMA	3,729	2%	14%	40%	44%
Munn's Ferry Boat Camping Recreation Area	1,716	0%	0%	84%	16%
Boat Tour and Riverview Picnic Area	13,651	17%	23%	39%	21%
Northfield Mountain Tour and Trail Center	20,024	24%	12%	33%	31%
Cabot Camp Access Area	5,326	4%	10%	62%	24%
Barton Cove Nature Area	7,842	15%	19%	45%	21%
Barton Cove Campground	2,963	0%	5%	92%	3%
Barton Cove Canoe and Kayak Rental Area	4,455	2%	0%	98%	0%
State Boat Launch	15,126	1%	2%	74%	23%
Canalside Trail Bike Path	6,362	1%	13%	54%	31%
Gatehouse Fishway Viewing Area	27,345	7%	28%	46%	20%
Turners Falls Branch Canal/Station No. 1 Fishing Access	1,264	27%	29%	20%	24%
Cabot Woods Fishing Access	18,230	17%	19%	38%	27%
Poplar Street Access	1,877	14%	5%	56%	25%
Rose Ledge Climbing Area Parking	1,790	2%	27%	54%	17%
Farley Ledge Climbing Area—Wells Street Parking	2,390	7%	51%	29%	13%
Farley Ledge Climbing Area—Route 2 Parking	6,232	4%	22%	48%	25%
Total Project Recreation Site Use	152,769	10%	16%	50%	23%

Note: Percentages of estimated use by season at each recreation site may not sum to 100% due to rounding.

Table 3.3.6.1.5-2: Percent of Recreation Use by Activity at Each Site

Recreation Site	Walk/ Hike/ Jogging	Motor Boating	Fishing	Ride Bikes	Picnicking	Climbing	Non-motor boating	Fishway Viewing	Cross-country Ski	Camping	Riverboat	Sight see	Hunt	Birding	Ice Fish	Ride Horses	Snow Shoe	Whitewater boat (Bypass only)	Ice Skate/ Boat	Unidentified Recreation Activity
Governor Hunt Boat Launch/Picnic Area	0%	53%	12%	0%	0%	0%	15%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	19%
Pauchaug WMA	32%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	44%	0%	0%	0%	0%	0%	0%	23%
Pauchaug Boat Launch	4%	49%	12%	0%	1%	0%	10%	0%	0%	0%	0%	2%	2%	0%	0%	0%	0%	0%	0%	20%
Bennett Meadow WMA	41%	0%	1%	0%	1%	0%	1%	0%	0%	0%	0%	4%	25%	0%	0%	0%	0%	0%	0%	27%
Munn's Ferry Boat Camping Recreation Area	0%	39%	0%	0%	5%	0%	9%	0%	0%	30%	0%	0%	0%	0%	0%	0%	0%	0%	0%	18%
Boat Tour and Riverview Picnic Area	29%	3%	2%	2%	18%	0%	1%	0%	0%	0%	20%	1%	0%	0%	0%	0%	0%	0%	0%	24%
Northfield Mountain Tour and Trail Center	49%	0%	0%	0%	0%	0%	0%	0%	17%	0%	0%	1%	0%	0%	0%	3%	1%	0%	0%	29%
Cabot Camp Access Area	19%	1%	26%	2%	1%	0%	1%	0%	0%	0%	0%	8%	0%	0%	0%	0%	0%	3%	0%	39%
Barton Cove Nature Area	31%	0%	23%	6%	5%	0%	4%	0%	0%	0%	0%	1%	0%	1%	9%	0%	0%	0%	1%	19%
Barton Cove Campground	0%	0%	0%	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barton Cove Canoe and Kayak Rental Area	0%	8%	4%	0%	12%	0%	60%	0%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	0%	14%
State Boat Launch	1%	74%	2%	0%	1%	0%	11%	0%	0%	0%	0%	1%	0%	2%	0%	0%	0%	0%	0%	8%
Canalside Trail Bike Path	41%	0%	0%	55%	3%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Gatehouse Fishway Viewing Area[2]	36%	0%	6%	8%	14%	0%	0%	19%	0%	0%	0%	1%	0%	1%	0%	0%	0%	0%	0%	15%
Turners Falls Branch Canal/Station No. 1 Fishing Access	26%	0%	21%	21%	0%	0%	0%	0%	14%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	19%
Cabot Woods Fishing Access	53%	0%	11%	10%	3%	0%	0%	0%	0%	0%	0%	1%	0%	1%	0%	0%	0%	0%	0%	20%
Poplar Street Access	23%	0%	41%	3%	0%	0%	21%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%	0%	11%
Rose Ledge Climbing Area Parking	19%	0%	0%	0%	0%	75%	0%	0%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	0%	4%
Farley Ledge Climbing Area—Wells Street Parking	71%	0%	0%	0%	0%	25%	0%	0%	4%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Farley Ledge Climbing Area—Route 2 Parking	20%	0%	0%	0%	0%	75%	0%	0%	2%	0%	0%	1%	0%	0%	0%	1%	1%	0%	0%	1%
Total Project-Wide Use of the above Sites.	29%	12%	7%	6%	5%	4%	4%	3%	3%	2%	2%	1%	1%	1%	1%	1%	0%	0%	0%	18%

- [2]. *Use includes visitors utilizing the Visitor Center and the associated picnic area, which includes a portion of the Canalside Trail Bike Path.*

Table 3.3.6.1.5-3: Capacity Utilization by Site

Season	Recreation Days	Percent Capacity Utilized
Governor Hunt Boat Launch	1,812	50%
Pauchaug WMA	1,005	1%
Pauchaug Boat Launch	9,630	20%
Bennett Meadow WMA	3,729	10%
Munn's Ferry Boat Camping Recreation Area	1,716	40%
Boat Tour and Riverview Picnic Area	13,651	10%
Northfield Mountain Tour and Trail Center	20,024	10%
Cabot Camp Access Area	5,326	15%
Barton Cove Nature Area	7,842	20%
Barton Cove Campground	2,963	40%
Barton Cove Canoe and Kayak Rental Area	4,455	25%
State Boat Launch	15,126	65%
Canalside Trail Bike Path	6,362	NA
Gatehouse Fishway Viewing Area	27,345	25%
Turners Falls Branch Canal/Station No. 1 Fishing Access	1,264	1%
Cabot Woods Fishing Access	18,230	25%
Poplar Street Access	1,877	10%
Rose Ledge Climbing Area Parking	1,790	60%
Farley Ledge Climbing Area—Wells Street Parking	2,390	30%
Farley Ledge Climbing Area—Route 2 Parking	6,232	60%
Annual Total	152,769	

Table 3.3.6.1.9-1: Percentage by Month and Estimated Number of Days Spill Flows Equal or Exceed Boating Evaluation Flows

Month	Flows Evaluated during the July 2014 Bypass Reach Whitewater Boating Study					
	2,500 cfs		5,000 cfs		10,000 cfs	
	Percent of Time	Estimated Days	Percent Exceeded	Estimated Days	Percent Exceeded	Estimated Days
January	7%	2	5%	2	4%	1
February	6%	2	4%	1	2%	<1
March	29%	9	24%	7	18%	6
April	74%	22	66%	20	54%	16
May	38%	12	31%	10	21%	7
June	8%	2	6%	2	3%	1
July	3%	1	2%	1	1%	<1
August	2%	1	2%	1	1%	<1
September	2%	1	2%	1	1%	<1
October	8%	2	6%	2	4%	1
November	12%	4	9%	3	4%	1
December	17%	5	14%	4	10%	3

Legend

- Project Boundary
- Recreation Site
- Fort Hill Rail Trail
- The Northfield Connector (Site 13)
- Canalside Trail Bike Path (Site 18)
- Canoe Portage (Site 24)
- Northfield Mountain Trail System
- New England Scenic Trail

SITE ID	SITE NAME
1	Governor Hunt Boat Launch/Picnic Area
2	Ashuelot River Informal Campsite
3	Fort Hill Rail Trail Parking
4	Pauchaug Wildlife Management Area
5	Pauchaug Boat Launch
6	Schell Bridge Informal Site
7	Informal Multi-Use Site
8	Bennett Meadow Wildlife Management Area
9	Munn's Ferry Boat Camping Recreation Area
10	Informal Munn's Ferry
11	Boat Tour and Riverview Picnic Area
12	Northfield Mountain Tour and Trail Center
13	Northfield Connector Bikeway
14	Cabot Camp Access Area
15	Barton Cove Nature Area and Campground
16	Barton Cove Canoe and Kayak Rental Area
17	State Boat Launch
18	Canalside Trial Bike Path
19	Unity Park
20	Gatehouse Fishway Viewing Area
21	Turners Falls Branch Canal Area
22	Turners Falls No. 1 Station Fishing Access
23	Cabot Woods Fishing Access
24	Turners Falls Canoe Portage
25	Poplar Street Access Site
26	Turners Falls Dam Downstream Put-in
27	Rose Ledge Climbing Area
28	Farley Ledge Climbing Area

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

N

0 0.5 1 2
Miles

Figure 3.3.6.1.1-1
Existing Recreation Sites
and Facilities

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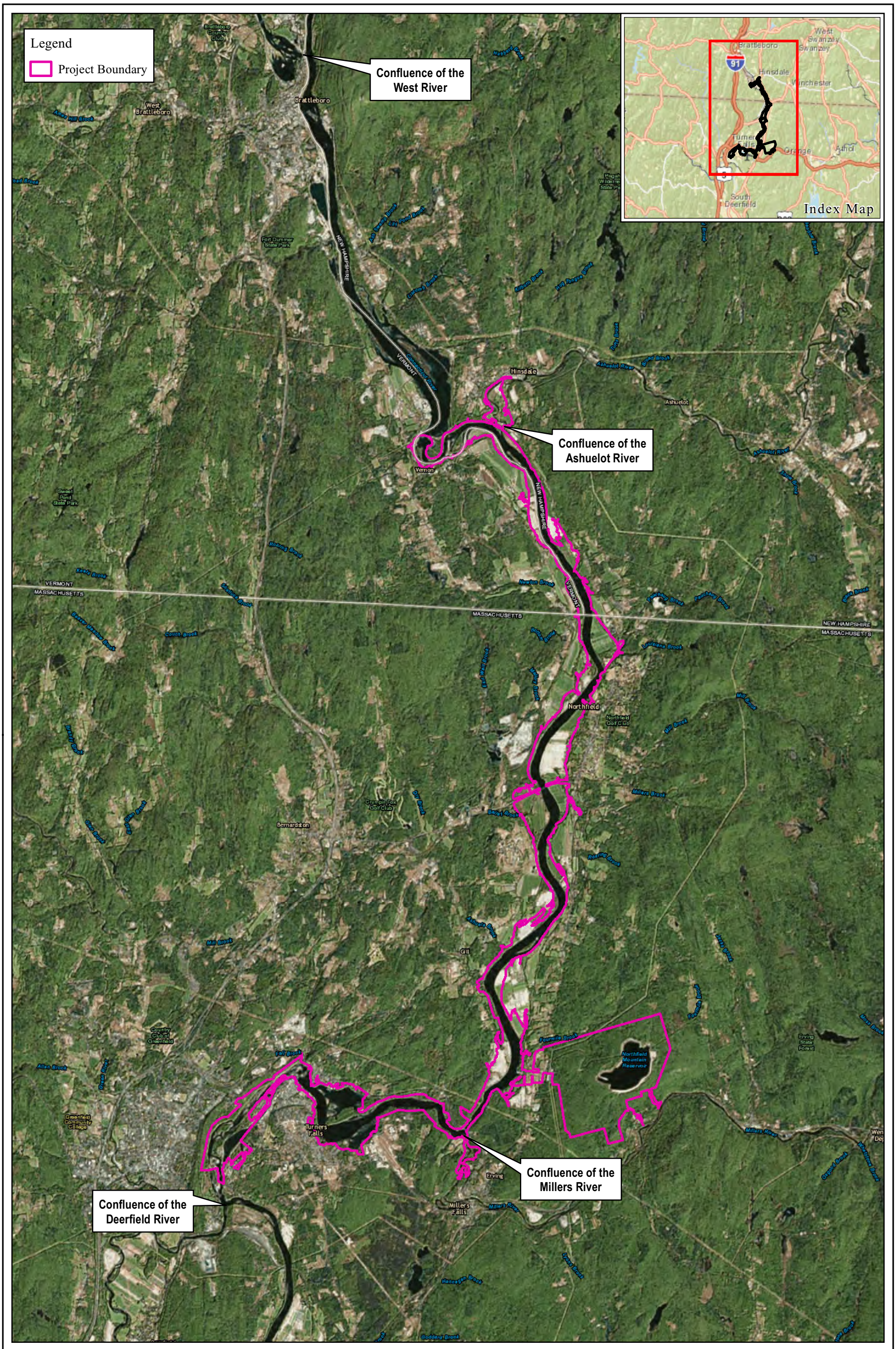

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

0 0.75 1.5 3
Miles

Figure 3.3.6.1.9-1
Regional Rivers Containing Whitewater Boating Opportunities

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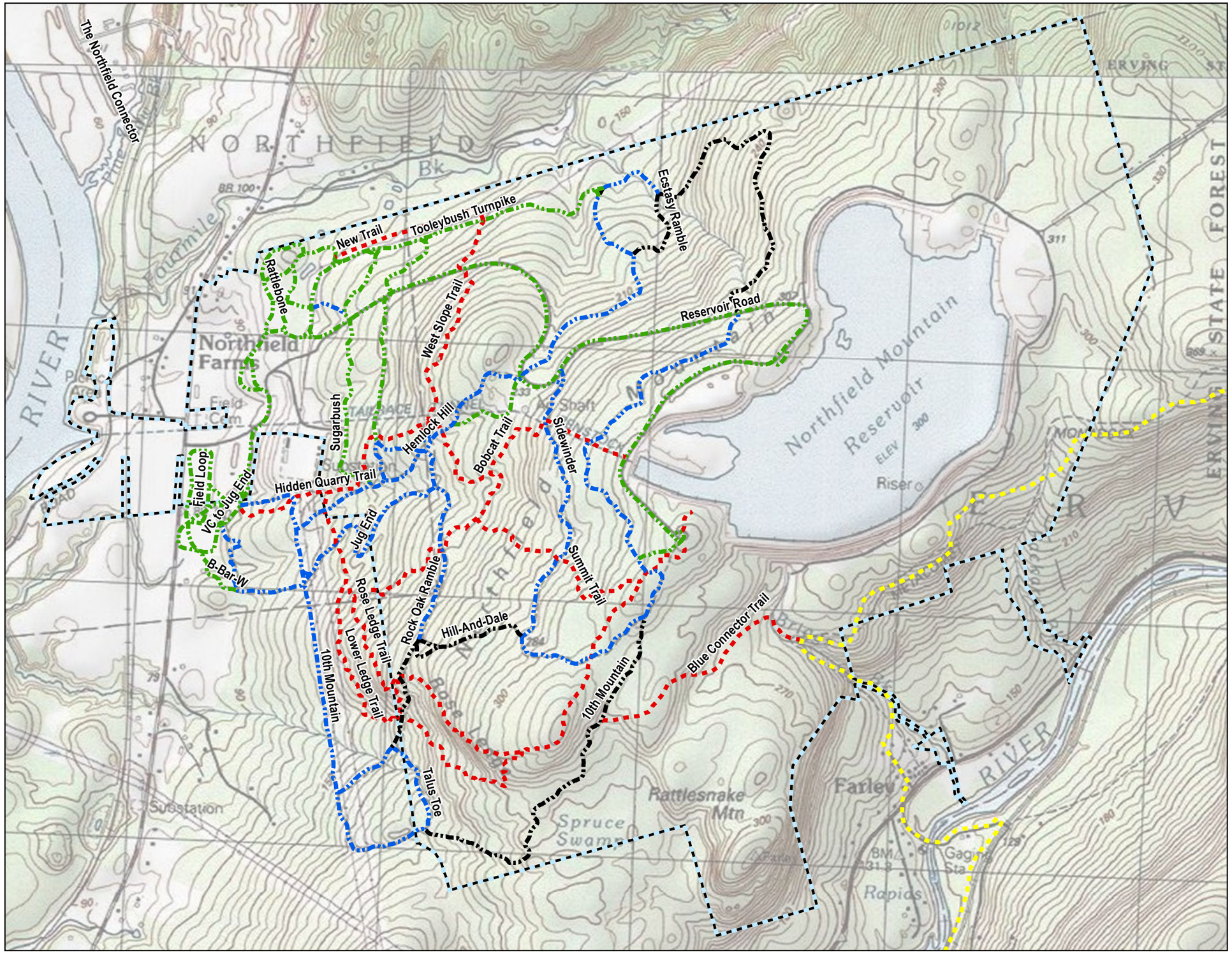

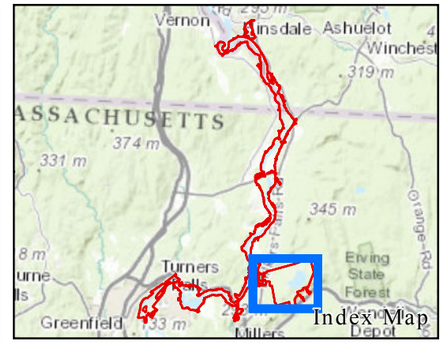

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

Figure 3.3.6.1.12-1
Northfield Mountain Trail System

Legend

Trail Rating
- Most Difficult
- More Difficult
- Easier
- Snowshoeing/Hiking Only
- New England National Scenic Trail
- Northfield Mountain Project Boundary

N

Note:
Blue Connector Trail digitized based on best available imagery.

Service Layer Credits: Sources: Esri, HERE, DeLorme, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, MapmyIndia, © OpenStreetMap

0 625 1,250 2,500 Feet

1 inch = 1,250 feet

FirstLight™
GDF SUEZ

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3.3.7 Land Use

3.3.7.1 Affected Environment

3.3.7.1.1 Project Lands

The Northfield Project is situated on the Connecticut River, within the states of MA, NH, and VT. The Project is comprised of two developments, the Turners Falls Development and the Northfield Mountain Pumped Storage Development. The Turners Falls Dam is located on mile 122 of the Connecticut River, (above the Long Island Sound) in the towns of Gill and Montague, MA. The TFI is approximately 20 miles long, with 5.7 miles located in the towns of Vernon, Vermont and Hinsdale, New Hampshire. The Northfield Mountain Pumped Storage Development is located approximately 5.2 miles upstream of the Turners Falls Dam and utilizes the TFI as its lower reservoir. The upper reservoir is located atop Northfield Mountain to the east of the TFI. With the exception of the northern portion of the TFI extending into Vermont and New Hampshire, Project lands are located within the county of Franklin, Massachusetts, specifically in the towns of Erving, Gill, Greenfield, Montague, and Northfield.

An overview of the existing Project boundary is shown in Figure 3.3.7.1.1-1. As shown, the boundary extends upstream along the Connecticut River approximately 20 miles to TransCanada's Vernon Hydroelectric Project Dam, located in the towns of Vernon, VT, and Hinsdale, NH. The Project extends to the east up to Northfield Mountain, to include the Northfield Mountain Upper Reservoir, north of State Route 2. The Project extends 0.9 miles downstream of the Turners Falls Dam to Cabot Station, a hydroelectric generating facility, which is part of the Turners Falls Development.

The existing Project boundary encompasses 7,246 acres: 2,238 acres of flowed land and 5,008 acres of upland, at minimum flow conditions.[44] When the river is at maximum flow (50 year flood) conditions, there are 3,981 acres of flowed land and 3,265 acres of upland. [45] There are no federal lands within the Project boundary, with the exception of land associated with the Conte Fish Lab, which is owned and operated by the USGS, and which is not necessary for Project purposes. As discussed in more detail in Section 3.3.7.4, FirstLight is proposing to remove the lands associated with the Conte Fish Lab from the existing Project boundary.

The land use in and around the Project boundary consists primarily of recreation, agricultural, and forested lands. There are pockets of developed areas around the Project that consist of roads, industrial buildings and residences. There are also a variety of wetland areas along the banks of the river and in low lying areas within the Project area. There is a distinct difference in land uses between the lands north of the Northfield Mountain Tour and Trail Center (NMTTC) and the lands surrounding the Turners Falls Dam. The land in and around the northern portion of the Project is mostly rural and there is very little developed land. Land that is developed consists of residential areas, roads and farming complexes. The lands surrounding the southern portion of the Project are more developed in nature, consisting primarily of residences and industrial lots with pockets of parks and greenspace. There are recreational use areas that are dispersed throughout the Project area with boat launches, hunting areas and fishing areas.

3.3.7.1.2 Land Use Designation of Lands within the Project Boundary

As part of Study No. 3.6.5 (*Land Use Inventory*), lands within the existing Project boundary were classified and mapped in eight (8) defined land use designations (Figure 3.3.7.1.2-1). National Land Cover Database (NLCD) layers were utilized in combination with Massachusetts Geographic Information System (MassGIS) layers to develop the land use designations. This information was then reviewed and refined by utilizing information gathered from Study No. 3.5.1 *Baseline Inventory of Wetland, Riparian and Littoral Habitat in the TFI, and Assessment of Operational Impacts on Special Status Species*; Study No. 3.4.1

[44] The minimum flow represents the minimum flow required to maintain elevation 176.0 feet throughout the impoundment.
[45] The maximum flow condition represents the 50 year flood scenario of 126,000 cfs.

Baseline Study of Terrestrial Wildlife and Botanical Resources; Study No. 3.7.*1 Phase IA (Reconnaissance) Archaeological Surveys* (Sara *et al*. 2014a and 2014b) and Study No. 3.7.2 *Historic Architectural Resources Survey & National Register Evaluation (MA, NH, VT)* (GSE & TRC, 2014), as appropriate.

The eight (8) land use designations for lands within the Project boundary are:

- **Agricultural – Crops**: generally tilled land used to grow row crops. Boundaries follow the shape of the fields and include associated building (e.g. barns). This category also includes turf farms that grow sod.
- **Agricultural – Pasture/Grass**: Fields and associated facilities (barns and other outbuildings) used for animal grazing and for the growing of grasses for hay.
- **Natural/Undeveloped**: Vacant land, idle agriculture, rock outcrops, and barren areas. Vacant land is not maintained for any evident purpose and it does not support large plant growth. This designation also includes shrub cover, and some immature tress not larger or dense enough to be categorized as forested. It also includes areas that are more permanently shrubby.
- **Developed**: areas with a mixture of constructed materials and vegetation that is mostly in the form of grass.
- **Forested**: areas where tree canopy covers at least 50% of the land. Both coniferous and deciduous forests belong to this class.
- **Wetland**: Areas of vegetation, where the soil or substrate is periodically saturated with or covered with water.
- **Open Water**: areas of open water.
- **Recreation:** Lands managed for developed public recreational facilities and activities. This includes recreational sites described in the report for Study No. 3.6.2 *Recreation Facilities Inventory and Assessment Addendum* (GSE & TRC, 2015b) and recreation facilities managed by private landowners.[46]

Table 3.3.7.1.2-1 provides a summary of the acreages of lands within the existing Project boundary for each land use designation. As shown, the majority of land within the Project boundary is Recreation (1,835 acres), Agricultural-Crops (1,010 acres), and Forested (951 acres).

3.3.7.1.3 Conservation Lands within 200 feet of the Project Boundary

As part of Study No. 3.6.5, conservation protections on lands within the Project boundary and within 200 ft of the Project boundary were identified. Approximately 657 acres of conserved land in the State of Massachusetts were identified as either within the Project boundary or within 200 ft of the Project boundary. This information was obtained from the MassGIS Protected and Recreational Open Space data layer. There were no conserved lands identified within the Project boundary or within 200 ft of the Project boundary in New Hampshire or Vermont. This information was based on data collected from the National Conservation Easement Database. An online search of land trusts and land conservation organizations working in the vicinity of the Projects did not identify any additional conserved lands within the Project's boundaries or within 200 feet of the Projects' boundaries.

3.3.7.1.4 Special Designated Areas

Portions of land within and adjacent to the Project are designated under various national and statewide programs dedicated to promoting outdoor recreation needs, as well as conservation and protection of the natural environment.

[46] Recreation facilities managed by private landowners are the Turners Falls Rod and Gun Club, the Franklin County Boat Club, and Turners Falls Schuetzen Verein.

National Trails System

The National Trail System Act of 1968 authorized creation of a trail system comprised of National Recreational Trail, National Scenic Trails, and National Historic Trails. National Recreation Trails may be designated by the Secretary of Interior or the Secretary of Agriculture to recognize exemplary trails of local and regional significance in response to an application from the trail's managing agency or organization. There is one National Scenic trail that passes through the Project boundary. The New England National Scenic Trail (NET) is a 220-mile hiking trail that travels through 39 communities in Connecticut and Massachusetts. Approximately 6,600 feet of the trail passes through the Northfield Project boundary near the southern edge of the Northfield Mountain Pumped Storage Development's Upper Reservoir. The portion of the NET that lies within the Project boundary is not operated or maintained by FirstLight. However, there is a connector trail that provides access to the NET from the Northfield Mountain Tour and Trail Center (NMTTC) Trail System that is maintained by FirstLight.

Massachusetts Natural Heritage and Endangered Species Program

The Natural Heritage and Endangered Species Program (NHESP) focuses on protecting and conserving vertebrate and invertebrate animals, as well as native plants, that are officially listed as Endangered, Threatened, or of Special Concern in the state of Massachusetts. NHESP gathers and provides information on priority habitat for all rare listed state species of plants and animals. Rattlesnake Mountain, which includes Farley Ledge, sits on the southern border of the Northfield Mountain Pumped Storage Development boundary is identified as priority habitat.

Wild and Scenic Rivers

The Federal government has developed a scenic and wild river program intended to preserve certain rivers with outstanding natural, cultural, and recreational values in a free-flowing condition for the enjoyment of present and future generations. The Project is not located within or adjacent to a river designated as part of the National Wild and Scenic River System.

National Natural Landmarks

The National Natural Landmarks Program administered through the National Parks Service recognizes and encourages the conservation of sites containing outstanding biologic and geologic resources. Though there are National Natural Landmarks in the state, there are none within or adjacent to the Project boundary.

3.3.7.1.5 Non-Project Uses of Project Lands

FirstLight has granted permission to others for non-project uses of Project lands in accordance with the provisions of the current FERC licenses for the Northfield Mountain Pumped Storage Development and the Turners Falls Development, along with its Permit Program. These non-project uses generally include camps, docks and landscape uses for abutters, and water withdrawals for agricultural purposes. In addition, FirstLight annually grants a number of permission for temporary use of non-project lands for one-time events, such as running races, state cross-country meets, horseback riding, and triathlons. All non-project uses that require prior FERC approval have been granted such approval.

FirstLight has an established Permit Program through which it administers non-project uses of Project lands including lands it owns in fee, or in which it has an interest (Howard, 2008). Under its Permit Program it is FirstLight's policy to "protect the scenic, recreational, and other environmental values of the Project, consistent with safe, efficient operation", and consistent with the Standard Land Use Articles in the current licenses for the Turners Falls and Northfield Mountain Pumped Storage Developments.

Consistent with the Standard Land Use articles, FirstLight's Permit Program recognizes four categories of proposed uses of Project lands that require varying levels of FERC notification and control requirements:

Category A: Miscellaneous uses and/or conveyances of interests not addressed in subsequent categories which may require FERC approval. For Category A uses, FirstLight assesses the proposed use, and determines on a case by case basis the best method of processing the proposed use/conveyance request such as processing the proposed use under Category B, C, or D, or obtaining prior FERC approval prior to granting permission. Category A uses are typically temporary use of non-Project lands for one-time events, such as running races, state cross-country meets, horseback riding, and triathlons.

Category B: Uses associated with single-family residential dwelling abutting the Project boundary such as (1) landscape planting; (2) non-commercial piers, landings, boat docks or similar facilities; and (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline. For Category B uses, FirstLight has an established program for issuing permits without prior FERC approval or notification for the specified types of use and occupancy of Project lands and waters, which may be subject to the payment of a reasonable fee to cover the costs of administering the permit program. For proposed uses in this category, FirstLight places an emphasis on multiple use and occupancy of facilities for access to Project lands or waters. FirstLight also ensures, to the extent practical, that the uses and occupancies for which it grants permission are maintained in good repair and comply with applicable State and local environmental, health, and safety requirements. Before granting permission for construction of bulkheads or retaining walls, FirstLight inspects the site to consider whether planting vegetation, grading or the use of riprap would be adequate to control erosion at the sites, and to determine that the proposed construction is needed and would not change the basic contour of the reservoir.

Category C: Municipal and utility uses such as (1) replacement, expansion, realignment, or maintenance of bridges and roads for which all necessary State and Federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas and electric distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project reservoir. For Category C use, no later than January 15 of each year, FirstLight prepares a report for the Project, which is filed with FERC, that briefly describes each conveyance made during the calendar year.

Category D: Uses such as (1) construction of new bridges or roads for which all necessary State and Federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary Federal and State water quality certificates or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary Federal and State approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 watercraft at a time and are located at least one-half mile from any other private or public marina; (6) recreational development consistent with an approved Exhibit R or approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed or a particular use is five acres or less: (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from the edge of the project reservoir at normal maximum surface elevation: and (iii) no more than 50 total acres of project lands for each project development acres conveyed under this category in any calendar year. For Category D uses, prior to conveying any interest in Project lands or waters, FirstLight conducts an internal review of the proposed use, and prepares information about the proposed use, including the location of the lands to be conveyed, the nature of the proposed use, and the identity of any Federal or State agencies consulted or approvals needed. At least 45 days prior to conveyance, FirstLight files the information on the proposed use and conveyance with FERC. Unless FERC, within 45 days from the filing date, requires FirstLight to file an application for prior approval, FirstLight then conveys the intended interest at the end of that period.

For both Category C and D uses, before notifying FERC, FirstLight consults with Federal and State fish and wildlife agencies, as appropriate, and the State Historic Preservation Officer.

For all categories of uses, FirstLight also reviews the proposed use/conveyance to ensure that it is not inconsistent with any FERC approved recreational resources.

Proposed uses of Project lands in all categories of uses are, to the extent practical, reviewed by FirstLight to ensure that the proposed use or conveyance of rights will not adversely affect the operation of the Project.

Permits granted by FirstLight under its Permit Program for non-project use of Project lands are generally in the form of a 5-year revocable license agreement. The license agreements regulate such use and occupancy through numerous provisions protecting Project and natural resources and thus are consistent with the "protection and enhancement of the project's scenic, recreation, or other environmental values…"[47] License agreement terms can vary and all can be terminated upon 6 months' notice by either party. The license agreements also expressly state that they are "subject to the terms and conditions as imposed by the FERC Project Licenses or to be imposed by FERC in connection with any order relative to the Projects." As a result of this provision, the ability of the Commission to further condition or even prohibit such authorized use and occupancy in order to meet the public interest standard of Section 10(a) of the Federal Power Act is fully preserved by FirstLight. All license agreements have in common the provisions below:

- The license holder must allow unobstructed use of the property by the public without regard to race, color, religious creed or national origin.
- The license is not transferable.
- The license holder must obtain all necessary federal, state, and local permits.
- Excavation, clearing, grading or filling of property is prohibited.
- Docks, piers, walls or other waterway improvements are prohibited unless all state and federal approvals have been obtained.
- Construction of any structures, fixtures or improvements on the property is prohibited without prior written approval by FirstLight.
- Parking or storage of vehicles or equipment on Project Property is prohibited, unless expressly authorized by conditions of the license.
- Hazardous materials may not be used or stored on the property unless otherwise authorized by the conditions of the license.
- Removal of timber, vegetation or plantings is prohibited without prior written permission from FirstLight.
- FirstLight reserves its right to flood and flow water on the property.
- The application of any fertilizer, pesticides and herbicides is prohibited (applicable to vegetated shoreline sites).
- FirstLight may require the license holder to plant and maintain native vegetation to reduce or prevent erosion and run-off into the Connecticut River (applicable to vegetated shoreline sites).

These requirements provide a comprehensive regulatory structure that assures that the granting of permission for non-project uses does not adversely affect the Project's scenic, recreational and environmental values.

3.3.7.2 Environmental Effects

Continued operation of the Northfield Project, as proposed, will enable Project lands or the land uses surrounding the Project to continue. Project lands will continue to be a mix of forested, developed and agricultural lands which, for the most part, will remain available for public use for recreation. Non-project uses of Project lands will continue to be approved and managed by FirstLight in accordance with the terms of the standard land use articles that are anticipated to be included in the new license. As they do currently, under the new license, FirstLight will carefully manage non-project use of Project lands by issuing short-term license agreements/leases (typically 5 years) to ensure that uses of the lands are consistent with Project

[47] Article 52(a) of the Northfield License and Article 43(a) of the Turners Falls License.

purposes, that non-project uses of the lands are limited to the uses specified under the terms of the license agreement/lease, and that disturbance to the land, vegetation, and any other natural features are minimized. FirstLight will revoke or not renew license agreements or leases for such non-project use of Project lands if terms of those license agreements/leases are violated. For requested non-project uses of Project lands that have the potential to impact significant resources, including wetlands, historic properties, traditional cultural sites, RTE species or their habitats, or other important habitats, FirstLight will consult with the appropriate agencies before approving the requested non-project use of Project lands. For requested non-project uses of Project lands that require prior FERC approval, FirstLight will consult with the appropriate agencies and then prepare a request package for FERC that includes the results of the consultation and information about the proposed use of the lands. Overall, the continued operation of the Project, as proposed, will maintain the character of surrounding lands and will promote public interaction with the surrounding nature through the NMTTC, parks, trails and campgrounds. Use of adjacent lands is not anticipated to be affected by FirstLight's proposal for relicensing the Project.

3.3.7.3 Cumulative Effects

There are no cumulative effects identified for land use in the Northfield Project.

3.3.7.4 Proposed Environmental Measures

FirstLight is proposing minor modifications of the Northfield Project boundary so as to consolidate the two separately licensed projects, into a single licensed project. Minor modifications are also being proposed to remove lands that are not necessary for Project purposes from the Project boundary. Overall, the proposed Project boundary will look very similar to the existing Project boundaries for the two projects, with these exceptions:

FirstLight is proposing to remove the USGS-owned and operated Conte Fish Lab from the Project boundary. The lands associated with the Lab being proposed to be removed have a land use designation of Developed and Forested. Figure 3.3.7.4-1 depicts proposed parcel to be removed from the Project boundary. The Lab is owned, operated and maintained by the USGS for purposes of research, and serves no Project purpose. None of the facilities that comprise the Lab or the property owned by the USGS contains lands, waters, facilities or structures that are necessary for Project purposes. Nor are there any significant natural or recreational resources located on Conte Lab property. FirstLight's Phase IA (Reconnaissance) Archaeological Survey for Massachusetts identified several previously recorded archaeological resources on this parcel. These resources have not been investigated for NRHP eligibility. Removal of the parcel from the Project, however, will not result in an adverse effect to these resources because the parcel is owned by USGS (a federal governmental entity) and therefore will still be subject to Section 106 requirements. FirstLight's historical structures survey did not identify any eligible historic structures on this parcel. There are two parking lots owned by FirstLight, within the vicinity of the Conte Lab, which can be utilized for recreational access to the Cabot Woods Fishing Access site. These parking lots will remain within the Project boundary.

FirstLight is also proposing to remove an 8.1 acre parcel of land (Figure 3.3.7.4-2), which is a part of a larger parcel of land known as the Fuller Farm property. The parcel is located on the easterly side of Millers Falls Road (State Route 63) in Northfield, Massachusetts and has a land use designation of Developed, Agricultural – Pasture/Grass, and Forested. FirstLight's predecessor purchased the farm as part of a much larger tract when acquiring land to construct the Northfield Mountain Development. When the design was finalized, the farm and land were not necessary for Project purposes, even though they continued to remain in the Project boundary along with the larger tract, some of which contains recreational trails or is used for recreational programming. The 8.1 acre farm property, however, includes residential and agricultural structures, and the underlying lands are not necessary for power generation, recreation, or any other Project purpose. The 8.1 acre parcel has never been used for and is not needed for operation and maintenance of the Project. The parcel is also not needed for recreational opportunities. The Project currently provides

ample recreational opportunities and the portion of the larger tract that contains recreational trails and used for recreation programming will remain in the Project boundary.

FirstLight's historical structures survey found that the buildings (house, barn, and outbuildings) (known as the Fredrick Morgan, Sr. house/Morgan-Fuller Residence in MHC's Inventory of Historic and Archaeological Assets) located on the 8.1 acre parcel are not eligible for listing on the National Register of Historic Places due to lack of historic/architectural significance and lack of integrity.[48] FirstLight's Phase IA (Reconnaissance) Archaeological Survey for Massachusetts identified the 8.1 acre parcel as sensitive for the presence of archaeological resources (Sara et al. 2014a and 2014b).[49] While FirstLight's Phase IA reconnaissance level archaeological survey included the 8.1 acre parcel in its recommendations for intensive (Phase IB) survey, the parcel is not in a location that is susceptible to erosion or in an area that suggests there are Project-related effects on the property.

Maps showing the location of the two parcels to be removed from the Project boundary are contained in Exhibit G.

There are no other environmental measures related to land uses proposed at this time.

3.3.7.5 Unavoidable Adverse Impacts

No unavoidable adverse impacts are expected to land use in the Northfield Project.

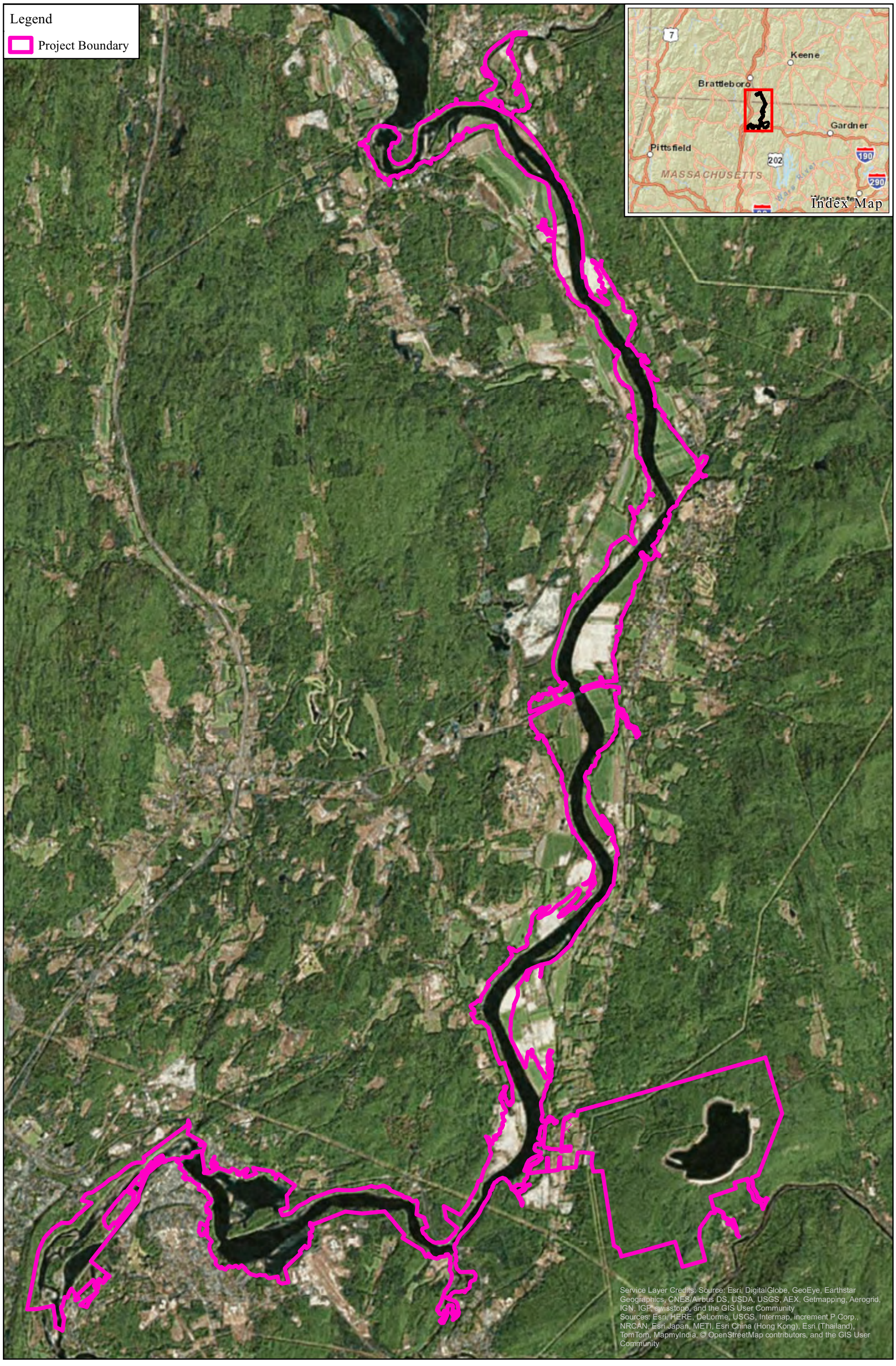
[48] Historic Architectural Resources Survey & National Register Evaluation at V-35, Project Nos. 2485 and 1889 (filed Jan. 21, 2015).

[49] The Study Report for the Phase IA Archaeological Investigation for Massachusetts was submitted to the MHC and filed with FERC as "privileged" on December 31, 2015. Technical revisions, as requested by the MHC, were submitted to the MHC and filed with FERC as "privileged" in May 2015.

Table 3.3.7.1.2-1: Land Use Designations within the Project Boundary

Land Use Designation	Acres	% of Project Area
Agricultural - Crops	1,010[1]	13.9
Agricultural - Pasture/Grass	37	0.5
Natural/Undeveloped	37	0.5
Developed	333	4.6
Forested	951	13.1
Open Water	2,647	36.5
Wetland	396	5.5
Recreation	1,835[2]	25.3
Total	**7,246**	**100**

[1] The majority of the agricultural cropland within the Project boundary is on lands which FirstLight does not own in fee.
[2] Approximately 1,673 of these acres are the Northfield Mountain Tour and Trail Center.



FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

N

0 0.5 1 2
Miles

Figure 3.3.7.1.1-1
Existing Project Boundary

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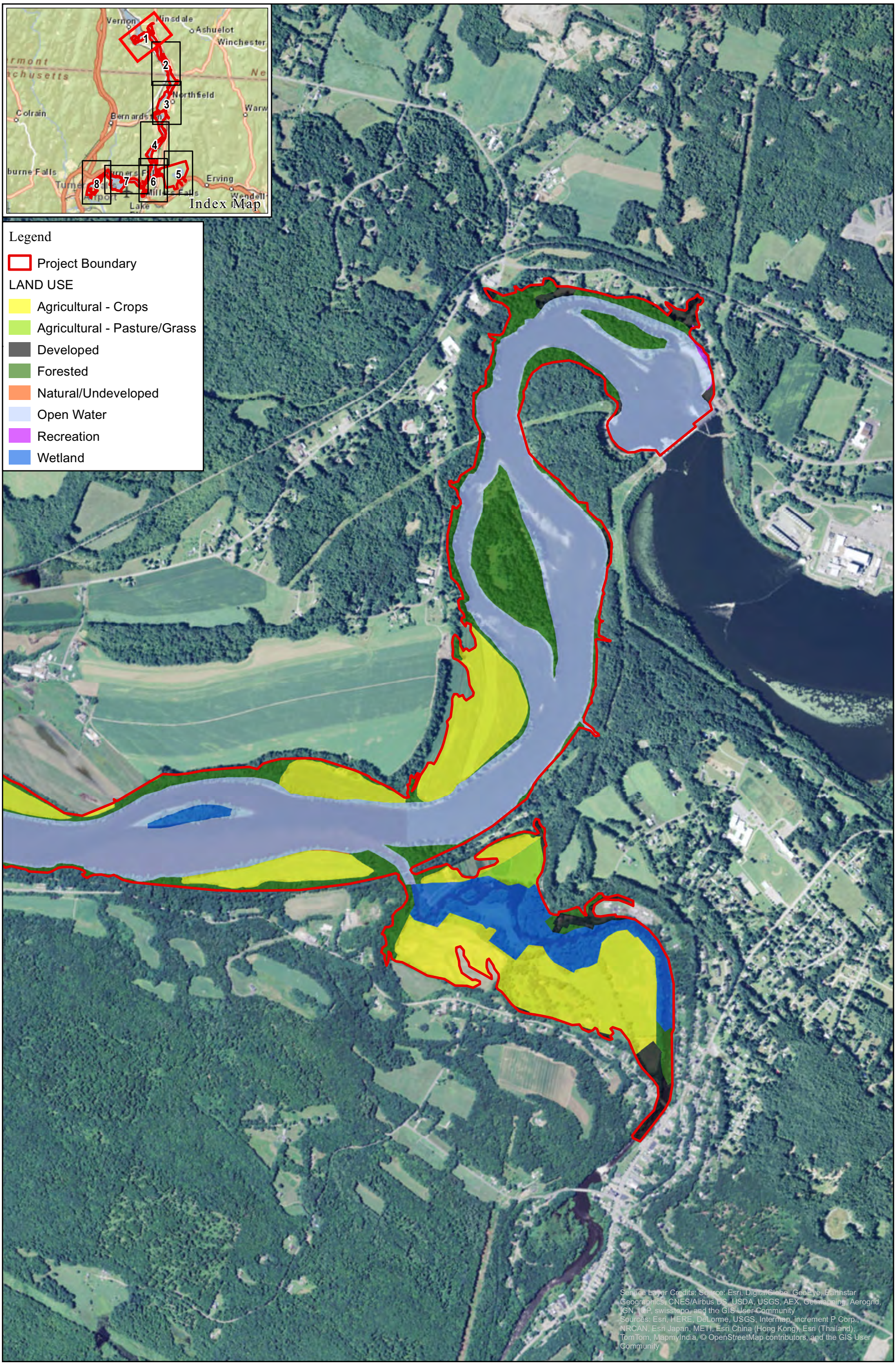

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

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Figure 3.3.7.1.2-1
Land Uses within the Project Boundary

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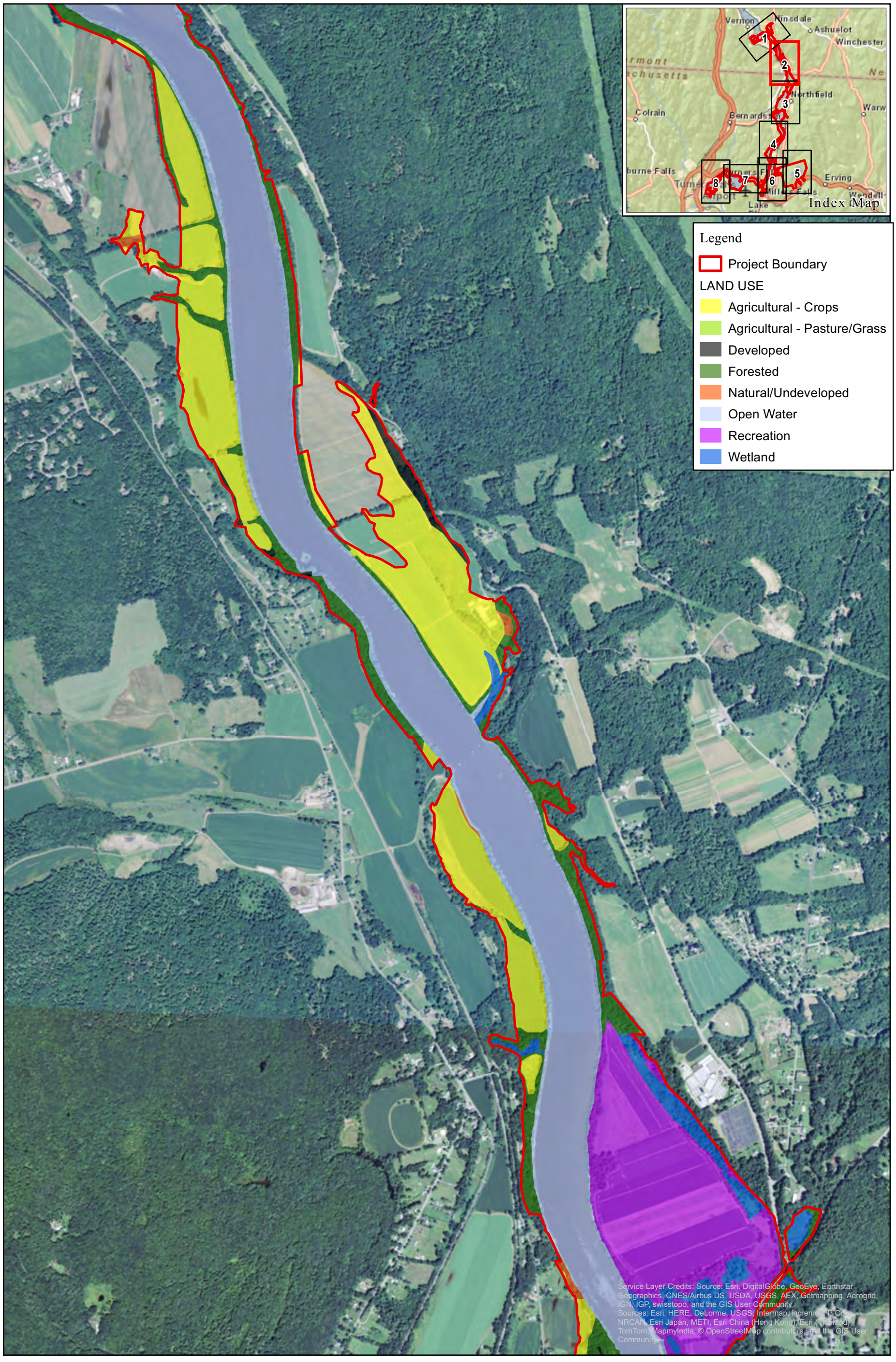

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

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Figure 3.3.7.1.2-1
Land Uses within the Project Boundary

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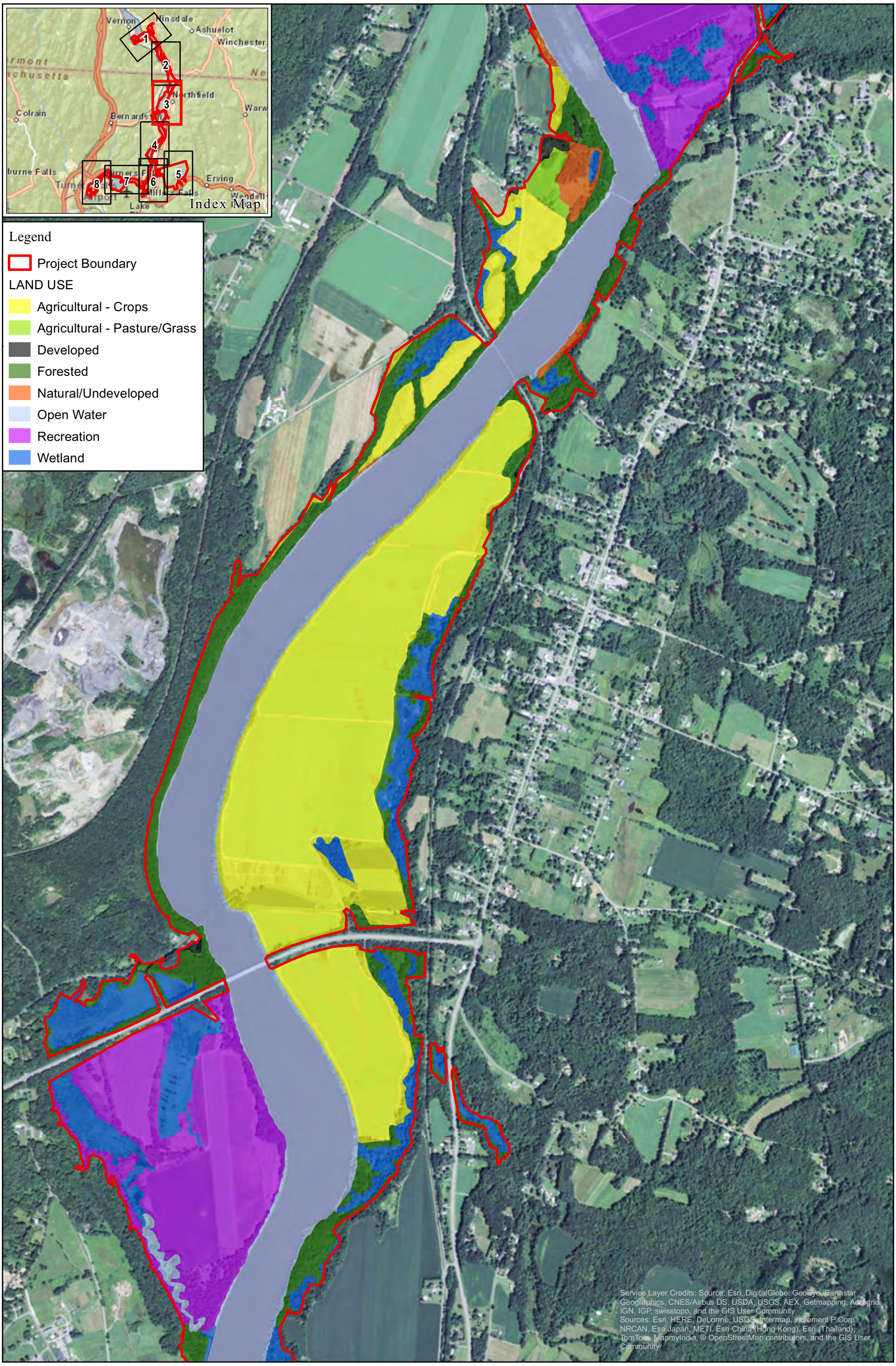

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

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Figure 3.3.7.1.2-1
Land Uses within the Project Boundary

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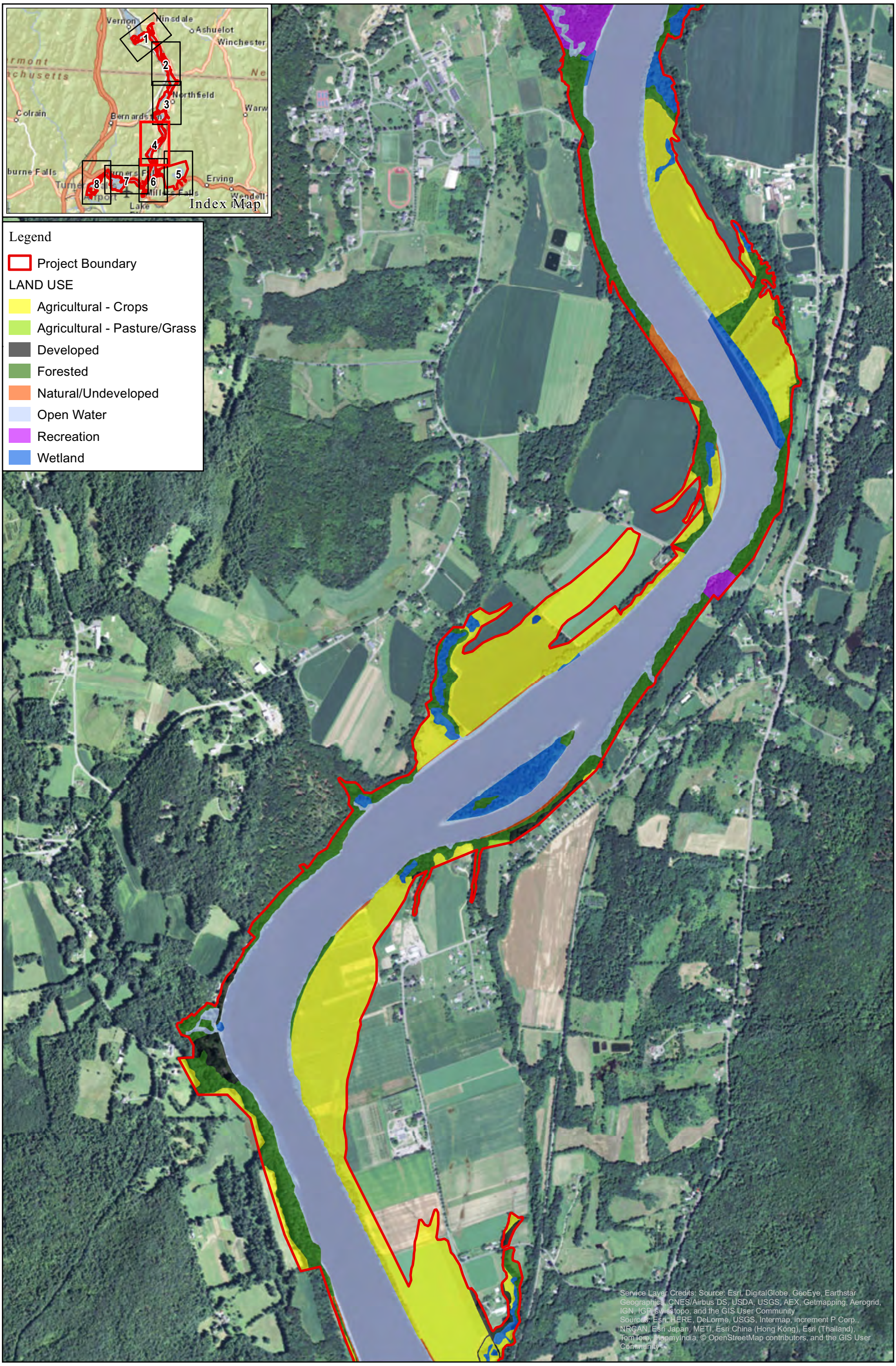

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

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Figure 3.3.7.1.2-1
Land Uses within the Project Boundary

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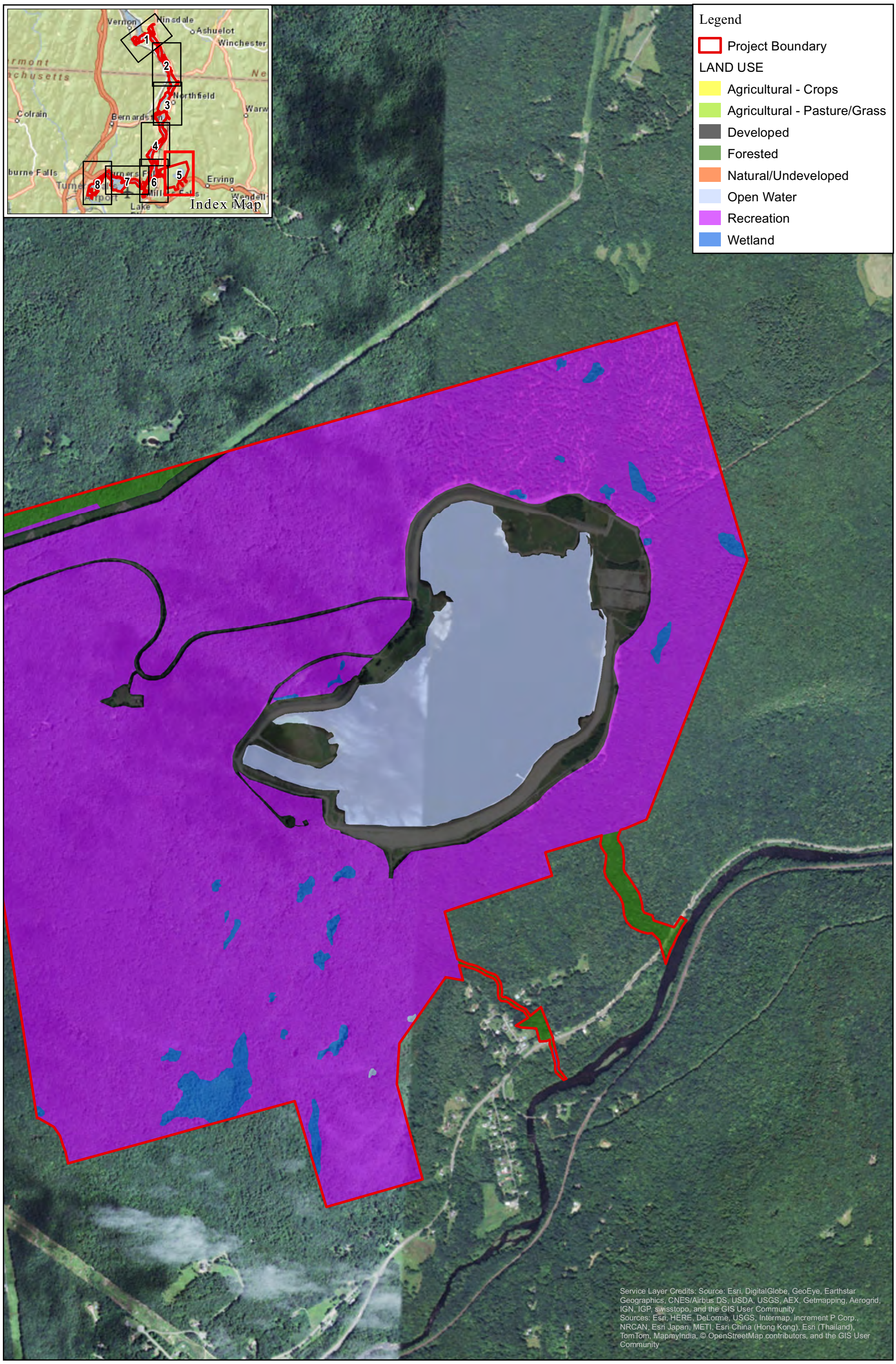

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

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Miles

Figure 3.3.7.1.2-1
Land Uses within the Project Boundary

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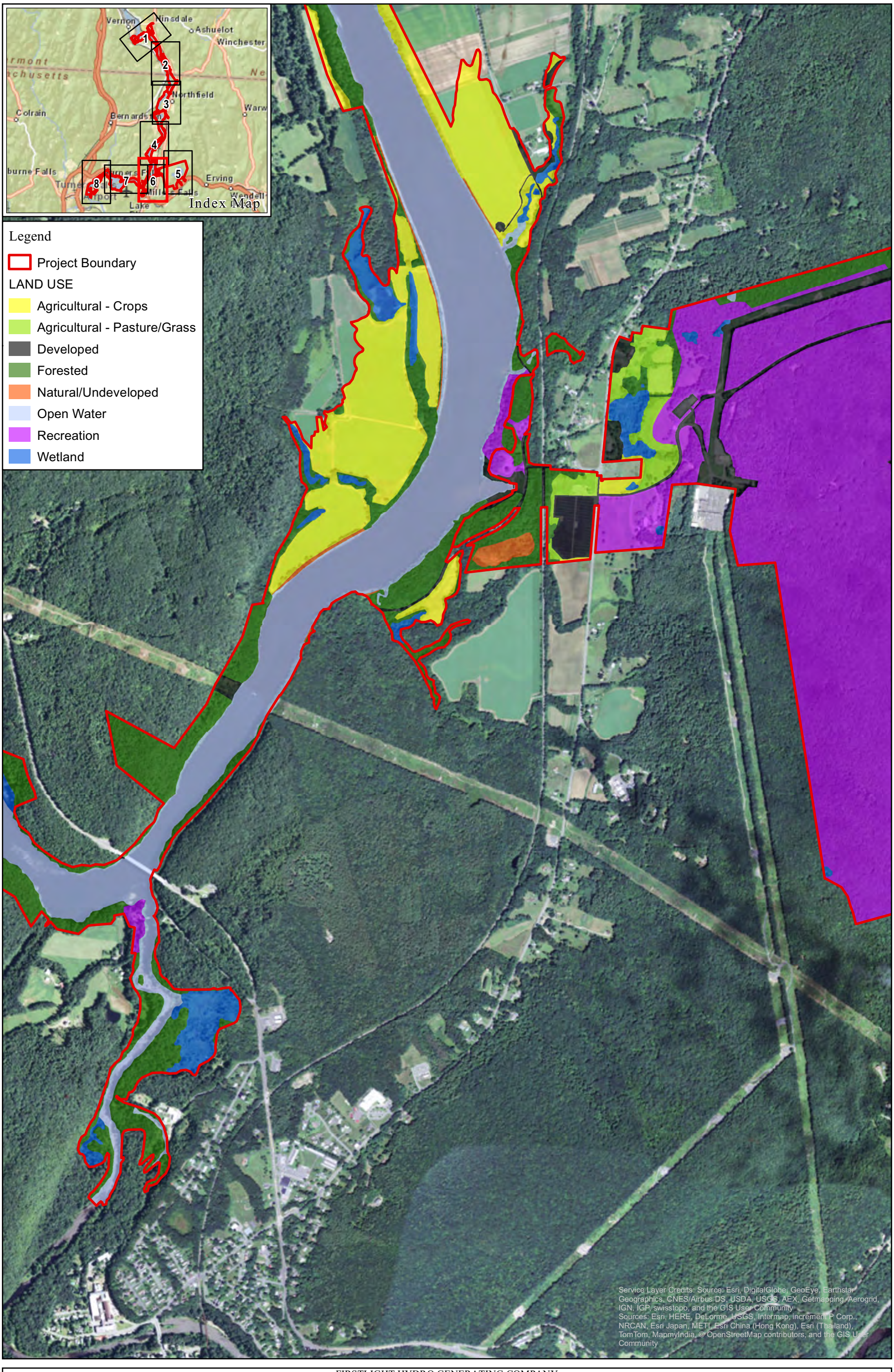

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

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Miles

Figure 3.3.7.1.2-1
Land Uses within the Project Boundary

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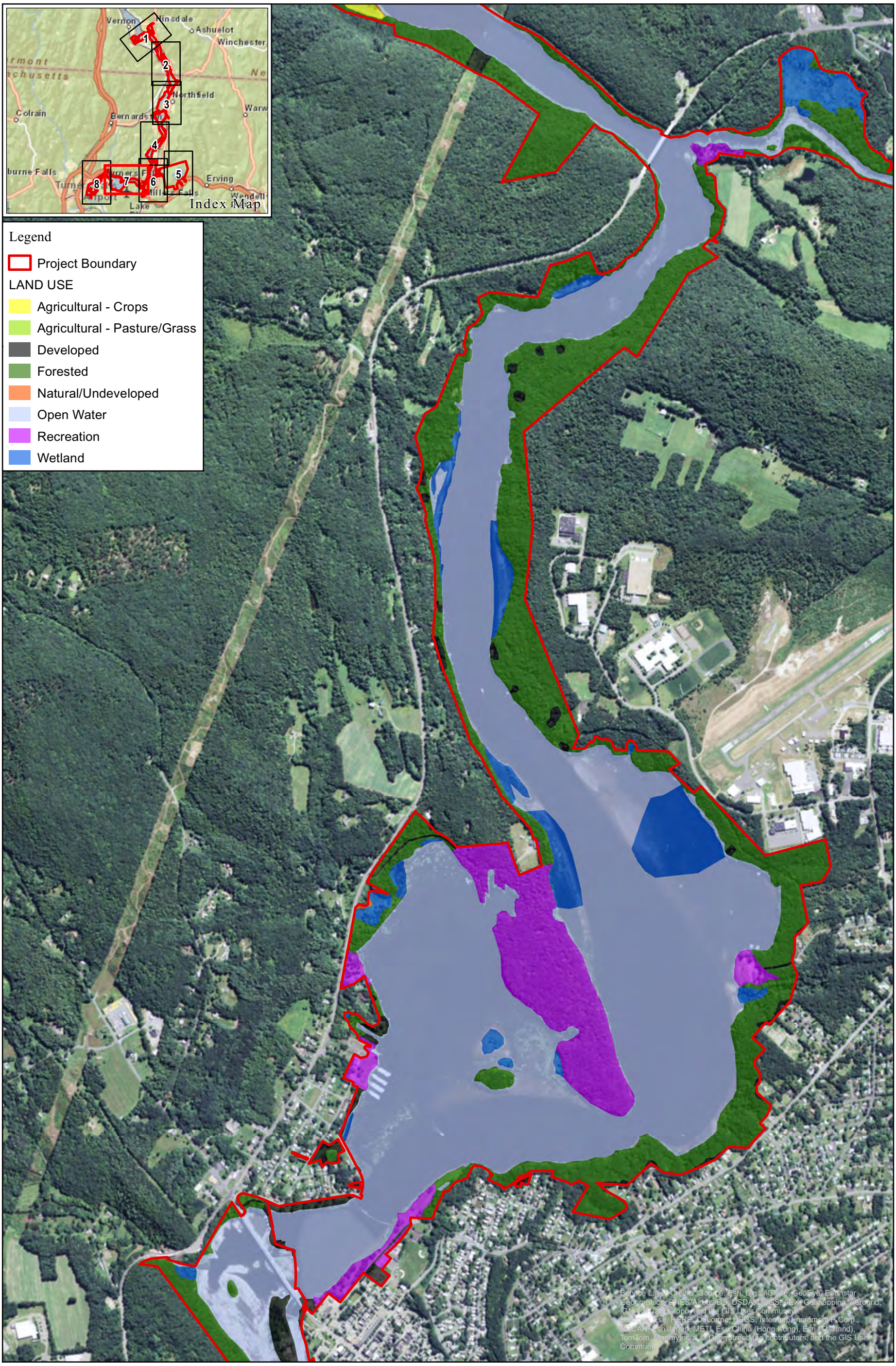

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

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Miles

Figure 3.3.7.1.2-1
Land Uses within the Project Boundary

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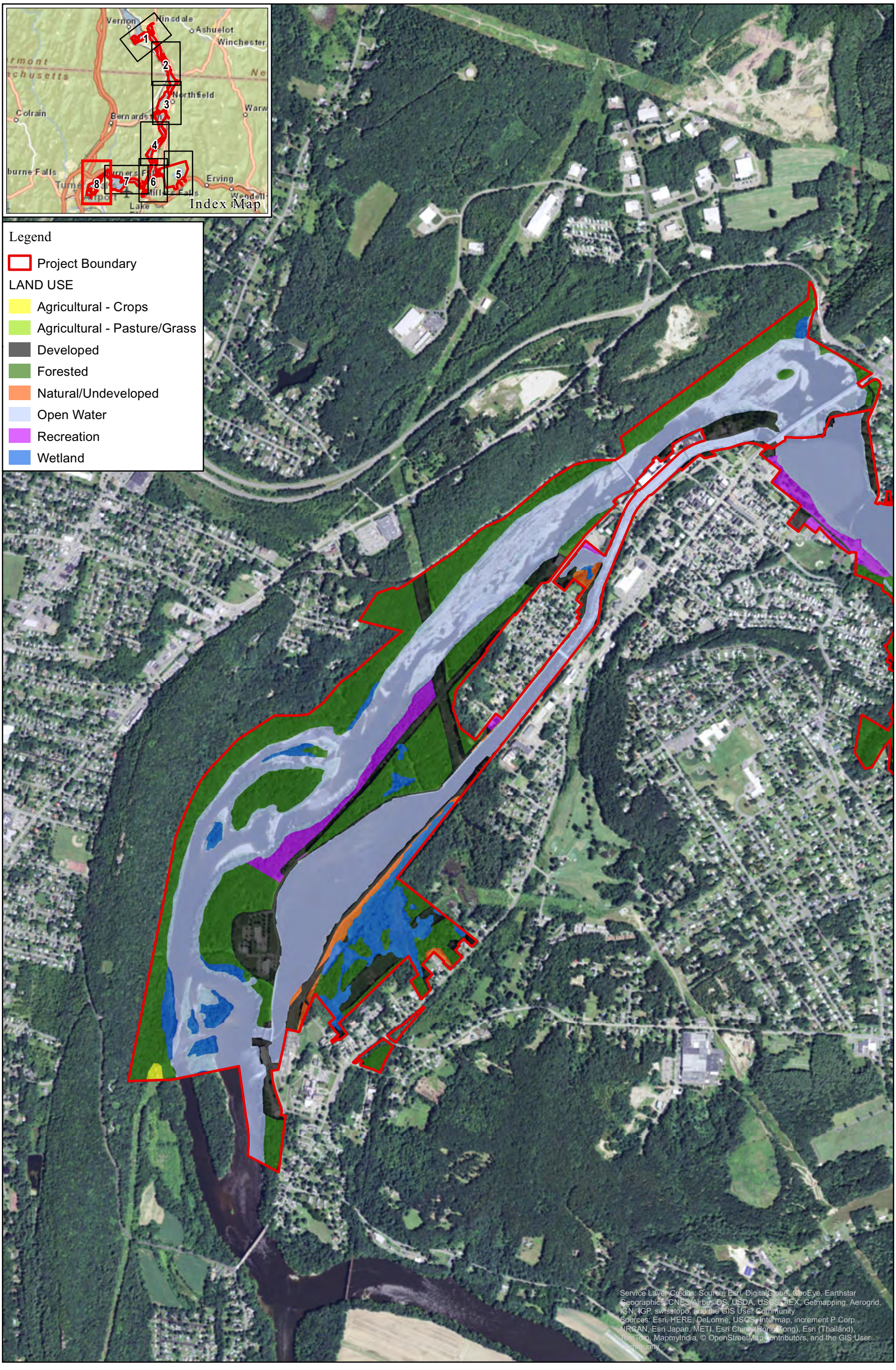

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

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Miles

Figure 3.3.7.1.2-1
Land Uses within the Project Boundary

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FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

0 155 310 620
Feet

Figure 3.3.7.4-1
Proposed Removal of the
USGS Owned and Operated
Conte Fish Lab

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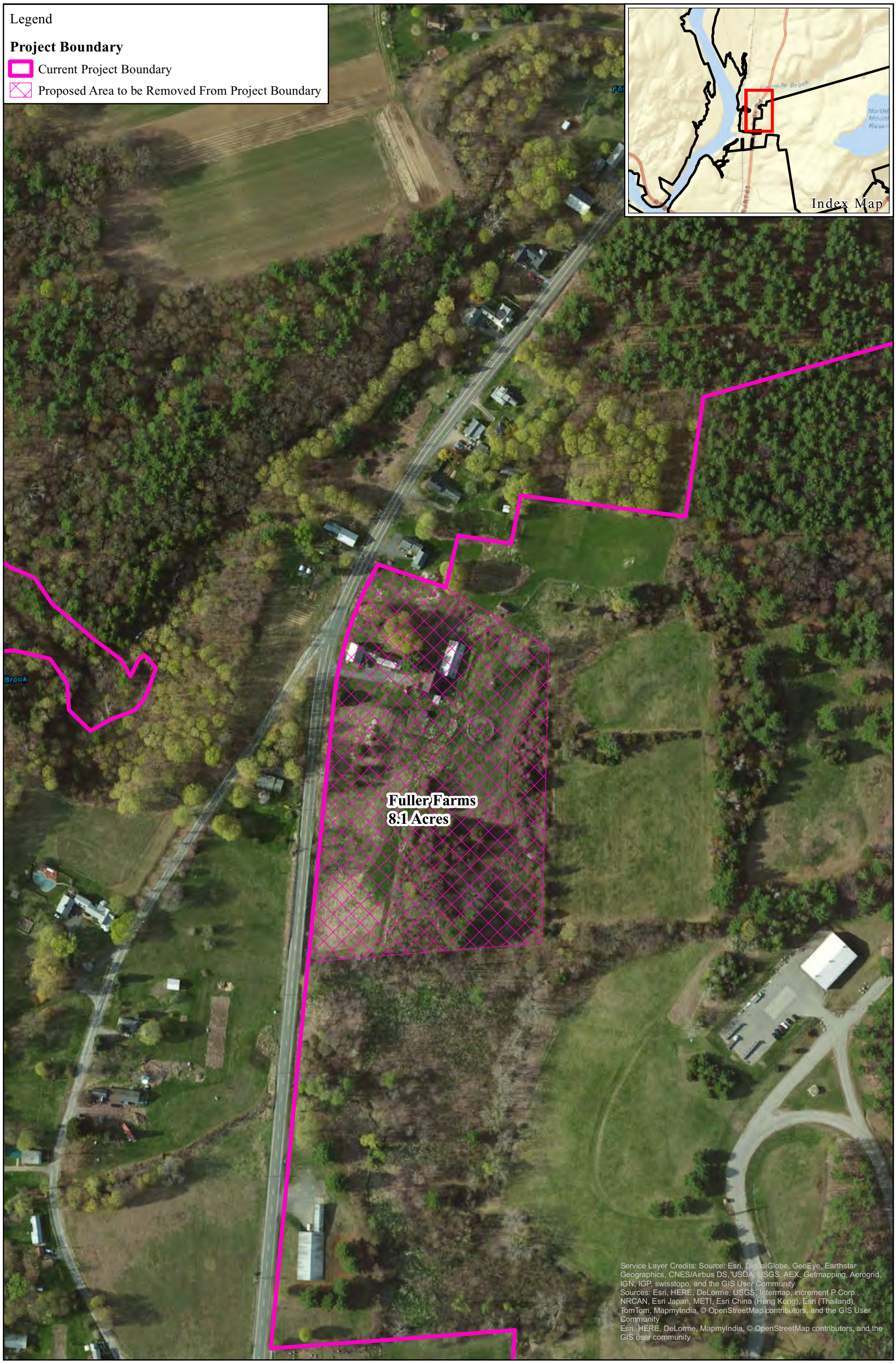

FIRSTLIGHT HYDRO GENERATING COMPANY
Northfield Mountain Pumped Storage Project No. 2485
Turners Falls Hydroelectric Project No. 1889

Draft License Application
Exhibit E

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0 100 200 400 Feet

Figure 3.3.7.4-2
Proposed Removal of the
8.1 Acre Fuller Farm Property

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3.3.8 Cultural Resources

Section 106 of the National Historic Preservation Act (NHPA) of 1966 (Section 106), as amended, requires the Commission to evaluate the potential effects of continued operation of the Project on properties listed in or eligible for listing in the National Register of Historic Places (NRHP) within the Project's Area of Potential Effects (APE). Properties listed in or eligible for listing in the NRHP are called historic properties. Section 106 also requires FERC to seek concurrence with the State Historic Preservation Offices (SHPO) on any finding of effects, and allow the Advisory Council on Historic Preservation an opportunity to comment before acting on a license application.

If Native American Traditional Cultural Properties (TCP) have been identified, Section 106 also requires the Commission to consult with interested Indian tribes that might attach religious or cultural significance to such properties.

3.3.8.1 Affected Environment

3.3.8.1.1 Area of Potential Effects

On November 27, 2013, FERC defined the APE for the Project in accordance with Section 106 and in consultation with the three SHPOs for the states included within the Project boundaries: the MHC, the NHDHR, and the Vermont Division for Historic Preservation (VDHP), along with the Narragansett Indian Tribe, and the Nolumbeka Project. The Project APE for both archaeological and historic architectural resources is defined as *"…all lands within the current FERC Project Boundary of the two projects in addition to any other lands outside the FERC Project Boundary where historic properties could be affected by project-related adverse effects. The Projects' APEs include lands within Franklin County, Massachusetts, Windham County, Vermont, and Cheshire County, New Hampshire. On lands adjacent to the project boundaries, the APEs would also include an additional 10 meters (33 feet) of lands inland from the top of banks of the Connecticut River and associated tributaries."* The APE for the Northfield Project is shown on Figure 3.3.8.1.1-1.

3.3.8.1.2 Precontact and Historic Period Background

Geographic Background. The Turners Falls Development and Northfield Mountain Pumped Storage Development are located on the Connecticut River in the states of Massachusetts, New Hampshire, and Vermont. The greater portion of the Turners Falls Development and Northfield Mountain Pumped Storage Development, including developed facilities and most of the lands within the Project boundary, are located in Franklin County, MA; specifically, in the towns of Erving, Gill, Greenfield, Montague, and Northfield. The northern reaches of the Turners Falls Development and Northfield Mountain Pumped Storage Development boundaries extend into the towns of Hinsdale, in Cheshire County, NH, and Vernon, in Windham County, VT.

Precontact Period Context (ca. 12,000 B.P. – ca. 500 B.P.)

The precontact period archaeological record of the Connecticut River Valley dates back more than 10,000 years (Johnson, 2007). Archaeologists have divided this record into three major periods known as the Paleoindian, Archaic, and Woodland periods. Further subdivisions within these periods are based on similarities in artifact forms and cultural adaptations over broad regions of the northeast. It is important to note that these divisions may be useful as archaeological constructs, and that their boundaries may represent changes perceived as culturally significant by archaeologists in the region).

Paleoindian Period (ca. 12,000-10,000 Years B.P.). The earliest recognized precontact period inhabitants in the Connecticut River Valley, and throughout North America, are referred to as Paleoindians. Paleoindians are believed to be the first people to migrate into North America and, in their pursuit of large game, rapidly colonized the continent (Martin, 1973). Throughout North America, the hallmark of Paleoindian people is the fluted spear point, which presumably was used to hunt down large game species,

some of which are now extinct. These spear points are characterized by a lanceolate form and exhibit a long, groove-like flake struck from their base on both faces. In the northeast, Paleoindians are believed to have been highly mobile hunters and gatherers reliant mainly on caribou and their site locations tend to be associated with elevated landforms that may have provided prominent overlooks for migrating caribou herds (Spiess *et al*., 1998).

In the Connecticut River Valley, very little is known of the Paleoindian period. Only a few sites have been found in the region and these occur in a variety of settings. For example, the DEDIC/Sugarloaf site in Deerfield is situated on the surface of Lake Hitchcock bottom deposits and overlooks the modern floodplain (Ulrich, 1978); the Hadley Site is located on a low rise in a broad alluvial plain (Curran & Dincauze, 1977: 344-345); and the Hannemann Site is located on the sandy, well-drained Montague Plain near the Turners Falls airport (Hasenstab, 1987). The lack of Paleoindian sites is somewhat perplexing as the valley would have been a natural corridor for travel over great distances. Boisvert (1999) suggests Paleoindian occupation of northern New Hampshire often correlates with river valleys in order to provide ease of travel and communication with other regions. As suggested by Curran and Dincauze (1977), it might be that the environment of Lake Hitchcock was not favorable for Paleoindian occupation due to its limited resources and this is supported by the fact that the few resources recovered to date are found within the former margins of the lake. This would suggest that the environment became more favorable after drainage of the lake. The lack of Paleoindian sites may also reflect sampling biases, or the possibility that sites favored by Paleoindians have long since been destroyed by erosion processes and development. Regardless, the Paleoindian resources in the valley share a common trait with other Paleoindian sites of the northeast. This trait is the use of high quality cherts and other cryptocrystalline materials to manufacture stone tools.

The end of the Paleoindian period and subsequent transition into the Early Archaic period is poorly understood with no clearly defined correlation between the two periods. The beginning of the Archaic period within the Connecticut River Valley is marked only by the presence of bifurcate projectile points that are typically out of context. These points are best known in more southern regions and they suggest a different material culture than the preceding Paleoindian period.

Archaic Period (ca. 10,000-3,000 Years B.P.). The Archaic period represents the longest cultural period in the region, spanning around 7,000 years. This time frame is indicative of persistent cultural adaptations, as inferred from artifact assemblages, which lasted over several millennia. As noted earlier, Early Archaic period occupation is poorly represented in the valley and not well understood. The scant evidence comes from a few bifurcate points representative of the Early Archaic period recovered from the Riverside Archaeological District (Johnson & Krim, 2007; Nassaney, 1999). The lack of Early Archaic period remains may be due to the fact that sites dating to this period have been deeply buried in alluvial deposits and therefore not adequately sampled. Another possibility is that sites dating to the Early Archaic period have gone unrecognized due to the absence of chipped stone projectile points. Research in northern New England has revealed Early Archaic assemblages consisting of crudely fashioned flake and unifacial tools made on cobbles and locally available stone (Robinson, 1992). These Early Archaic assemblages are commonly found in stratified riverine settings and reveal an adaptation to aquatic resources, particularly beaver, muskrat, and fish. It is presumed that similar resources and settings would have been available in the Connecticut River Valley as well.

By the Middle Archaic period, sites are somewhat more numerous, but still relatively scarce within the Connecticut River Valley. Middle Archaic period sites are marked by an increase in chipped stone spear points, particularly those of the Neville and Stark variety. These points have been found in a variety of settings, including river and stream margins in both upland and lowland areas (Johnson, 2007). They are believed to have affiliations with forms in the mid-Atlantic region suggesting broad regional influences during the Middle Archaic period (Dincauze *et al* 1976). The variety of settings where Middle Archaic sites are found led some researchers to hypothesize the establishment of seasonal scheduling of subsistence activities and increased recognition of territories (e.g., Dincauze *et al*., 1977; Thomas, 1980).

By the Late Archaic period, sites are more frequent and larger in size, possibly suggesting an increase in population density (Nassaney, 1999). The sites also tend to occur in a wider variety of settings with large sites occurring where resources could be seasonally procured in abundance (e.g., Turners Falls) and smaller sites occurring in upland areas where specific resources were exploited. Quarrying of diabase and steatite from sources within the valley also becomes more widely recognized during the Late Archaic period and is believed to be part of a groundstone industry that likely emerged during the earlier Archaic period (Robinson, 1992; Johnson & Krim, 2007). The Late Archaic is divided into three major traditions that include the Laurentian, Small-Stemmed, and Susquehanna traditions. These traditions are largely inferred from different point styles that range from side-notched forms (e.g., Otter Creek and Brewerton), crudely fashioned stemmed forms made of local materials (Small-Stemmed Point), and broad-bladed forms (Susquehanna). As in most areas of the northeast, the Laurentian and Small-Stemmed Traditions tend to predate the Susquehanna Tradition. In particular, it is uncertain whether the various archaeological assemblages of the Late Archaic reflect local, long-term cultural adaptations or movement of people into the region with a different culture and way of life. The expansion of sites and variety of point styles during the Late Archaic period, particularly those of the Susquehanna, may relate to environmental changes that led to decreases in aquatic resources and increases in the habitat of terrestrial animals.

Woodland Period (ca. 3,000-500 Years B.P.). The introduction of pottery manufacture signals the beginning of what archaeologists call the Woodland period in the Connecticut River Valley. Woodland period sites are the best represented in the valley and occur in a variety of sizes and habitats, as well as show a diverse range of activities (Johnson, 2007). The Connecticut River Valley played a significant role in the development of the Woodland period due to its fertile bottomlands, which were favorable for horticulture, and its exposures of Lake Hitchcock bottom sediments, which provided a readily available source of clay for pottery manufacture. The period is divided into Early, Middle, and Late subdivisions.

During the Early Woodland period, adaptations established during the Late Archaic continue with most Early Woodland components found in similar settings to Late Archaic sites. Diagnostic tool forms during the Early Woodland include Vinette I pottery, Meadowood projectile points, and blocked end tube pipes suggestive of influence from Adena cultures in the Midwest. The first real evidence for mortuary activity containing Adena-like artifacts, also appears during this time and is believed to be representative of wide-spread exchange system recognized over a broad region of eastern North America (Johnson, 2007). The Middle Woodland period is defined largely by the presence of different pottery styles. Long established patterns of seasonal exploitation of resources, and concomitantly congregation of people, at favored locations such as Turners Falls, continue. However, by the end of the Middle Woodland period, horticulture became established as a part of the subsistence pattern. The emergence of horticulture certainly would have affected settlement patterns to some degree with occupation increasing in areas where fertile soils were prevalent. The Late Woodland period is marked by the continued development of horticulture, evolving pottery styles, and the presence of diagnostic triangular projectile points known as Levanna.

The picture that emerges from Woodland period sites is one showing a long-standing cultural adaptation to the diversified use of local resources. In addition, the nature of artifact forms present and certain types of stone recovered from Woodland period sites indicate trade and communication with people from far-off regions. By the end of the period, historical evidence suggests core settlement areas had developed in the lowlands of the valley with peripheral areas occupied during certain times of the years for hunting and gathering. The Woodland period ends with European contact around 500-450 years ago. At this time, referred to as the contact period, many of the artifacts attributable to precontact period inhabitants disappear from the archaeological record and trade goods, such as copper and beads, emerge in the record.

Historic Period Context (1500-1973)

Contact Period (1500 – 1620). The contact period (1500-1620) in the Connecticut Valley is defined by direct and indirect interaction between Native American populations and Europeans. It is unclear when initial contact between these populations took place in the region, but most likely occurred to the south of

the study area in the early seventeenth century. Contact between these populations (direct and indirect) was intermittent and it is thought that little material culture of European origin was utilized by Native Americans.

Plantation Period (1620 – 1675). The Plantation period (1620-1675) witnessed the development of a number of European settlements including those in the town of Northfield. During this period, direct contact between Europeans and the Native American population increased in part due to mutual involvement in the fur trade. This contact led to widespread epidemics and resulted in the decimation of Native American populations and the abandonment of Native American settlements.

Colonial Period (1675-1775). Colonial settlement of the Project area (present-day towns of Gill, Greenfield, Montague, Erving and Northfield, MA; Vernon, VT; and Hinsdale, NH) in the seventeenth century was scattered and short-term and is for the most part poorly documented. Turners Falls gained its name from the historic "Falls Battle" of 1676, when Captain William Turner attacked a group of Pocumtucks and members of other tribes camped at the falls of the Connecticut River. More than 300 Indians died in the battle before they counter-attacked, killing Turner and 40 of his men (Jenkins, 1980:8.1).

Considered a northern outpost of colonial settlement, the Vernon and Northfield areas were largely abandoned during King Philip's War and only lightly re-settled after the conclusion of Queen Anne's War in 1714. Confusion over the town boundaries of Northfield in relation to the New Hampshire colony to the north resulted in several inconclusive surveys that muddied settlement claims in the area for many years (NHDOT, 2007:4). A 1753 decree by New Hampshire's Royal Governor created two towns north of Northfield on either side of the Connecticut River, both named Hinsdale (Holmes *et al*., 1991:56).

Federal Period (1775-1830). Vermont, contested among New York, New Hampshire, and Massachusetts in the years before the Revolution, enjoyed a population boom in the late 1700s. In 1783, the province had a population of 10,000; by 1790, it had increased to 55,425. On March 4, 1791 Vermont gained statehood. In October 1802, the town on the Vermont side of the Connecticut River changed its name from Hinsdale to Vernon (Child 1884:304; Holmes et al. 1991:56).

Turners Falls itself was not settled until 1792, when a canal and dam were proposed by the Proprietors of the Upper Locks and Canals of the Connecticut River to aid navigation around both Turners Falls and South Hadley to the south. When completed in 1798, the locks and canals formed a vital link in the 300-mile system of waterways from Wells River, VT to Hartford, CT (Jenkins 1980:8.1). The canal, designed by Benjamin Prescott of Northampton, was 2.5 miles long and 14 feet wide, with ten locks. In 1799, the Fifth Massachusetts Turnpike Company was established to either construct new roads or take over and improve existing ones in western Massachusetts.

Early Industrial Period (1830-1870). Railroads opened up the entire Connecticut River Valley area to sustained economic development beginning in the 1840s and remained the area's transportation backbone for nearly a century. The first railroad line to reach the Turners Falls area of Montague was the Connecticut River Railroad, a north-south line between New Haven and Greenfield which began service in 1846 (Holmes *et al*., 1991:24). This line was extended to Brattleboro, Vermont in 1851.

The present-day Village of Turners Falls in Montague dates only from 1866, when Colonel Alvah Crocker decided to create a planned industrial community on the model of Lowell or Holyoke (Jenkins, 1980:8.1). Crocker and his associate Wendell T. Davis bought up the stock and water rights of the defunct Proprietors of the Upper Locks and Canals and eventually acquired 700 acres of land in the Turners Falls area (Abercrombie, 1925). Crocker and Davis founded the Turners Falls Company which embarked on building a dam and a new power canal that roughly paralleled the route of the old navigational canal, from which water was thereafter leased or sold to factories for power purposes. A wood-and-stone crib dam with a 30-foot fall at the Turners Falls rapids was completed in early 1867 (Jenkins, 1980:8.2).

The new village received a huge boost in 1868, when the John Russell Manufacturing Company moved to Turners Falls. Its complex of two- and four-story buildings (no longer standing) running for nearly 2,000

feet along the power canal housed one of the largest cutlery factories in the world at the time (Jenkins, 1980:8.2; Montague Bicentennial Committee, 1954:12; Great Falls Discovery Center, 1996:3).

Late Industrial Period (1870-1915). In 1871, the Montague Paper Company (partially owned by Alvah Crocker) built its complex on a site on either side of the power canal just below the dam bulkhead. The Keith Paper Company (later Hammermill Paper) Mill complex was completed in 1873. In 1874, the Turners Falls Cotton Mill was built at the southern end of the power canal (Holmes *et al*., 1991:28).

The Riverside area of Gill remained sparsely populated until late 1867 when Amos Perry, David Wood, and Nathaniel Holmes bought water rights on the Connecticut River from the Turners Falls Company along with a small parcel of land in Riverside at the edge of the river for a grist- and saw-mill (Gill Historical Commission, 1999:2). In 1872, Holmes, Wood and Perry incorporated as the Turners Falls Lumber Company to bring logs downriver to their saw-mill from Vermont, New Hampshire, and Canada. The company's saw-mill provided vast amounts of lumber for the development of Turners Falls across the river and lumber production soon surpassed the gristmill (Gill Historical Commission, 1999:3).

By the early 1880s, Hinsdale possessed a well-developed industrial infrastructure, centered on several paper and cotton mills built along the Ashuelot River. High, Hancock, and Prospect Streets were laid out on the north side of town, reflecting the steep hillside on which the village is built. High Street, located above the heat and noise of the valley below, was soon lined with spacious architect-designed residences (NHDOT, 2007:8).

On June 9, 1886, A.S. Clarke of the Clarke & Chapman Machine Company, made arrangements with the Turners Falls Company for a six-hour additional use of water for the purpose of generating electricity at night. In late 1886, an electric generating station opened at the Turners Falls gatehouse and in 1892, the gatehouse was expanded for greater water flow (Sanborn Map Company, 1895). The present Turners Falls Gatehouse was built in 1903-1904 following demolition of the original 1866 gate house and was substantially enlarged in 1913-1914 (Turners Falls Power & Electric Company, 1914a and b; Gregory, 2006: 12).

The Turners Falls Power Canal also was improved by widening it and increasing its depth (Sanborn Map, Company, 1895). By 1917, the canal was extended to its present length of approximately 2.5 miles (Turners Falls Power & Electric Company, 1917). Final work on the canal's excavation was completed that year when it reached its present depth of between 25-40 feet and between 100-920 feet (the latter at the Cabot forebay) in width (Jenkins, 1980: 8.4)(Gregory, 2006:13)(Holmes *et al*., 1991:28).

In 1892, the Boston & Maine Railroad acquired the entire Connecticut River Railroad, made up of the former 21-mile Ashuelot Railroad and the Cheshire Railroad, among others (Wallace *et al*., 2001:36). In 1911, the railroad extended its line from Dole Junction, NH to Brattleboro, VT on the other side of the river. Known as the Fort Hill Branch of the Boston & Maine Railroad, the rail line at one time included eight bridges, a 2,800-foot causeway and numerous stone culverts and drains (Hostutler and Muzzey, 1994).

In 1904, the Central Railroad of Vermont, rebuffed in its offer to construct a combination rail/vehicular bridge, proceeded with plans to construct its own bridge across the Connecticut River in Northfield. The six-span, pin-connected, metal Pratt truss bridge was completed later that year. The bridge's current appearance with five spans now consisting of a series of Warren deck trusses is the result of a major reconstruction carried out by the American Bridge Company for the railroad after the bridge was severely damaged in the 1936 flood (Arts Council of Franklin County, 1978d).

By the beginning of the twentieth century, the Turners Falls Company had moved into the emerging hydro-electric market (Jenkins, 1980:8.3). In 1904, Charles Hazelton, treasurer of the Turners Falls Company, proposed to his board of directors that that they make better use of the water power currently being wasted by widening and extending the power canal, and establishing a hydroelectric generating plant of 5,000 kilowatt capacity. (Bennett, 1990a:5).

In 1905, the Turners Falls Company completed construction of Turners Falls Power Station No. 1, a 1,000-kilowatt unit built approximately 3,000 feet downstream of the Turners Falls Gate House at the upstream end of the power canal (Turners Falls Company, 1904 and 1907). As designed, the construction of Turners Falls No. 1 Power Station involved the installation of six small horizontal Francis-type units (WMECO, 1987:2). The first generation of electricity from water power by the Turners Falls Company took place in 1906. By 1913, the station had grown to five units with a total capacity of 5,000 kW.

In 1908, Boston financier Phillip Cabot assumed the post of president of the Turners Falls Company, which was reorganized and renamed the Turners Falls Power & Electric Company, reflecting the company's new focus on hydroelectric power and its transmission. Cabot's ambitious plans called for the construction of a second powerhouse, named Cabot Station in his honor, replacing and raising the original Crocker-built dam with the present Gill and Montague (Turners Falls) Dams, and extending and widening the power canal and Gate House. Work began on dam construction in 1912 and was completed in 1915 along with the Cabot Station in 1917 and the newly improved power canal by the 1920s.

The Sixth Street Bridge was constructed across the power canal in 1912. It is a riveted, double-intersection Warren thru-truss, designed by the Eastern Bridge & Structural Company of Worcester MA, and erected by a crew of workers from the Turners Falls Company (Bennett, 1990a:4). The Eastern Bridge & Structural Company also built footbridges at Fifth Street and to the Keith's Mill (Arts Council of Franklin County, 1978a, b, and c).

Modern Period (1915-Present). In 1915, the Eleventh Street Bridge was completed over the power canal. The bridge is a unique triple-barreled configuration of a double-intersection Warren thru-truss, with a pair of trusses on either side of the roadway, and lateral bracing between each pair, but none over the roadway. The Eleventh Street Bridge was also engineered by the Eastern Bridge & Structural Co. and is the only known example of this bridge type in Massachusetts (Arts Council of Franklin County, 1978e; Bennett, 1990a:1).

In 1915, the Turners Falls Company completed construction of a new Turners Falls Dam to replace the original Crocker-built dam. That same year, construction began on the Cabot Station powerhouse located at the south end of the power canal. Cabot Station was named for Philip Cabot who was largely responsible for its construction, first as President of the Turners Falls Company after 1908, and then as founder and president of the Turners Falls Power & Electric Company (Arts Council of Franklin County, 1978c). Historically, Cabot Station represents the last major industrial development of the water resources at Turners Falls. When it was completed, Cabot Station was the largest hydroelectric facility in Massachusetts, and the principal source of power for the Turners Falls Power & Electric Company.

With the advent of the automobile in the early 1900s, the Massachusetts Highway Commission made plans to improve all the state's roads, including the section of highway from Greenfield to North Adams. Work was begun in September of 1912 and completed in November of 1914, at a cost of $350,000. At the opening ceremonies, October 24, 1914, the highway was officially dedicated as "The Mohawk Trail" after the Mohawk Indians of that region (Bennett, 1990b:1).

The French King Bridge was conceived as part of a state-financed project to relocate a particularly hazardous seven-mile stretch of the old Mohawk Trail Highway (State Route 2) between Erving and Greenfield. After looking at several plans, the engineers decided to cross the Connecticut River with a bridge at the height of the hills on either side, about 135 feet above the water. Construction of the French King Bridge began in September of 1931, was completed at a cost of $385,000, and opened to travel on September 10, 1932. The bridge is one of four known steel deck-arch vehicular bridges in Massachusetts, and has the sixth-longest span of any vehicular bridge in the state (Bennett, 1990b:6).

After extensive studies in the 1920s and 1930s, the Turners Falls Power & Electric Company and the Connecticut River Power Company of New Hampshire combined to form the Connecticut River Conservation Company. Its purpose was to "develop a system of reservoirs on the headwaters and tributaries of the Connecticut whereby the tremendous spring run-off might be stored for use during the

period of low flow in the River." It was projected that five-billion cubic feet of storage water could be made available for power purposes, saving ten thousand tons of coal annually (Samartino, 1991:26).

In 1942, the biggest merger was made when three pre-existing companies were merged into Western Massachusetts Electric Company (WMECO): Turners Falls Power & Electric Company, Pittsfield Electric Company, and United Electric Light Company. The several power companies continued to expand and to cooperate in transmission exchanges. Combined, nearly two dozen major hydroelectric stations along the Connecticut River were capable of producing collectively 700 thousand kilowatts of power. Studies to increase the generating capacity at the Turners Falls plants were well underway in 1961. In 1965, three Connecticut Valley power companies—Western Massachusetts Electric Company, Connecticut Light & Power Company, and the Hartford Light Company—joined forces to form Northeast Utilities Service Company (NU) (WMECO, 1987: 4).

Construction of the Northfield Project began in 1968, with the major job being the drilling and dynamiting of a 2,500-foot tunnel, 565-foot ventilation shaft, 1130-foot pressure shaft, and the mile-long tail race between the powerhouse and the river, as well as the 10-story-high underground power house. Over 4.9 billion tons of rock were blasted to create the tunnels, shafts, and powerhouse (Samartino, 1991:26). Four 250,000-kilowatt capacity turbine generators were placed in the powerhouse cavern 700 feet below the surface. Also built were a 300-acre reservoir, a rock-fill dam 144 feet high and 5600 feet long, and other dikes totaling 5600 feet. At the same time, the Turners Falls Dam downriver was raised, which created a 2,500 acre reservoir on the Connecticut River. The Northfield Mountain Pumped Storage Development began operation in early 1972. As part of the development, WMECO created the Northfield Recreation and Environmental Center (also known as the Northfield Mountain Tour and Trail Center or the Visitors Center), with exhibits on the area's geology, history, and ecology, along with facilities and trails for hiking, skiing, and snowshoeing (Samartino, 1991).

3.3.8.1.3 Precontact and Historic Archaeological Resources

In July and August 2014, FirstLight conducted an archaeological reconnaissance survey (Phase IA Study) within the Project APE (Sara *et al*., 2015a and 2015b). The purpose of the Phase IA archaeological reconnaissance was to identify archaeologically sensitive areas within the Project APE and provide recommendations where Phase IB archaeological surveys should occur based on identified sensitivity and Project-related effects, including Project-induced erosion. The study integrated background research with field investigations. The background research involved a review of state files at the MHC, NHDHR, and VDHP to identify known archaeological resources within a one-mile buffer of the Project APE and to review previous archaeological studies conducted in the region. In addition, numerous local repositories were consulted in order to provide a cultural context for the Project. The purpose of this research was to provide a framework for understanding the historic contexts of the region and to develop a sensitivity model for predicting the locations of potential archaeological resources. The field investigations consisted of walkover inspection and boat survey of the shoreline within the Project boundaries to assess current environmental conditions.

The field investigations segregated the Project APE into 65 segments (48 segments in Massachusetts, 10 in New Hampshire, and 7 in Vermont) based on geomorphic and topographic differences. These segments consist of floodplains, older river terraces, islands, and glacial and/or early postglacial landforms. Portions of all 65 segments are considered sensitive for archaeological resources. In addition to the 65 segments evaluated during the study, a separate archaeological sensitivity analysis was conducted for the Fuller Farm property in the Town of Northfield, Massachusetts.

In Massachusetts, background research identified 56 previously recorded precontact period and seven historic period archaeological sites within the Project APE. Additionally, 70 precontact period and 25 historic period archaeological sites were identified within a one-mile distance of the Project boundary. Precontact period sites in the Project vicinity span the known human occupation of the region from the Paleoindian period to the Late Woodland and Contact period. In addition, historic period sites are located

within or adjacent to the Project APE. These include domestic, transportation related (ferry and bridge crossings), and industrial related sites dating from the first European contact in the region in the seventeenth century to the present day.

As a result of the fieldwork in Massachusetts, the locations of three previously recorded precontact period sites were confirmed in the field based on the observation of surface artifacts, and four previously unrecorded historic period archaeological sites were located within the Project APE. These newly identified archaeological sites include the remnants of historic Munns Ferry north of Kidds Island, the remnants of a small summer cottage on an upland ridge overlooking the Connecticut River, a historic surface scatter and related ground depression west of Cabot Camp, and a partial stacked-stone foundation and spring-related feature on a hillside west of the Route 2 Bridge (French King Bridge).

In addition, the sensitivity analysis for the Fuller Farm property in Massachusetts found it to be sensitive for the presence of archaeological resources.

In New Hampshire, background research did not identify any previously recorded sites within the Project APE, although there were three previously reported archaeological resources in Cheshire County, New Hampshire located within one mile but outside of the Project APE.

In Vermont, four sites (WD-1, WD-10, WD-124, and WD-125) are located within or directly adjacent to the Project APE. Site WD-1 is also located within the Project boundary for the Vernon Hydroelectric Project (Project No. 1855), which is currently undergoing relicensing. During field investigation, no newly identified archaeological sites were recorded in Vermont or New Hampshire during the Phase IA study.

A sensitivity model was developed to categorize the sensitivity of landforms within the Project areas for precontact period archaeological resources. This model is based on analysis of environmental attributes associated with previously recorded archaeological site locations within a one-mile distance of the Project boundary and is intended to predict where precontact period archaeological resources may be located in the Project APE. The model found that modern floodplains and early Holocene river terraces in the northern half of the Project APE are considered to have the greatest sensitivity for precontact period archaeological resources with no preference for secondary tributaries of the Connecticut River. In its Phase IA study review letter of February 5, 2015 to FirstLight, the NHDHR commented that not many surveys have been conducted along the margins of the Connecticut River and cautioned that this should be taken into account when using the model's data set on informing archaeological sensitivity.

In addition to a sensitivity assessment, areas of shoreline in the Project APE were also evaluated for evidence of active erosion that may threaten culturally sensitive landforms although the causes of erosion were not examined in the Phase IA study. The causes of erosion within the impoundment are being examined as part of Study No. 3.1.2 *Northfield Mountain/Turners Falls Operations Impact on Existing Erosion and Potential Bank Instability;* a final report will be field with FERC. The erosion classification was based on the criteria set forth in the 2013 FRR of the Project APE and included identification of the type, stage, indicators, and extent of erosion (Simons & Associates, 2014). Indicators of active erosion such as exposed roots, creep, overhanging banks, and notching were noted along the shoreline during the course of the archaeological reconnaissance.

Erosion processes in the form of bank undercutting, slumping, exposed tree roots, and leaning shoreline trees were documented primarily in the Turners Falls Development APE along long stretches of low-lying floodplain shoreline from the Northfield tailrace to the Vernon Dam. Little to no erosion was noted in the stable shorelines south of the French King Gorge, with the exception of Barton Island and Rawson Island. No erosion processes were observed in the Northfield Mountain Pumped Storage Development APE.

3.3.8.1.4 **Historic Buildings and Structures**

Between November 2013 and March 2014, FirstLight conducted a historic architectural survey and NRHP evaluation within the Project APE *(Relicensing Study 3.7.2: Historic Architectural Resources Survey & National Register Evaluation of Northfield Mountain Pumped Storage Project [No. 2485] and Turners*

Falls Hydroelectric Project [No. 1889]). The 2013-2014 historic architectural survey consisted of background research on previously identified architectural resources in the APE; preparation of a historic context of the APE from the colonial period to the modern period; a survey of all architectural resources 50 years or older within the APE; and evaluation of their NRHP eligibility, either as an individual resource or as a contributing resource in an NRHP-listed or -eligible historic district. The Northfield Mountain Pumped Storage Facility, built between 1968 and 1972, also was surveyed as it will be 50 years old by the time the current license expires in 2018.

There are 29 previously identified resources within the Project APE. The Turners Falls Historic District, consisting of historic industrial, residential, and commercial buildings in Turners Falls, was listed in the NRHP in 1983 and contains 13 contributing resources located within the Project APE. Seven historic resources in the APE—Cabot Power Station and Dam; Eleventh Street Bridge; East Mineral Road Bridge; Gill-Montague Bridge; French King Bridge; Schell Memorial Bridge (all located in Massachusetts) and the Hinsdale Historic District (located in New Hampshire)—previously have been determined eligible for the NRHP. (The Cabot Station Gantry Crane was determined NRHP-eligible in 1987 but has since been demolished). Three previously surveyed resources—Central Vermont Railroad Bridge over the Connecticut River (MA); Boston & Maine Railroad-Fort Hill Branch Bridge over Ashuelot River (NH); and Boston & Maine Railroad-Fort Hill Branch Bridge Piers over the Connecticut River (NH)—previously have been determined not eligible for NRHP listing. Six previously surveyed resources in the Project APE—"The Patch" district, Frederick Morgan House, Red Suspension Bridge, the Riverside district and two individual resources, the Frank Smith House and the Hunt-Sanderson House both located within the Riverside district—had not been evaluated for NRHP eligibility at the time of the 2013 – 2014 survey. There are no previously surveyed resources located within the Vermont section of the APE.

As a part of its field survey, FirstLight identified an additional 38 resources 50 years or older (in addition to the Northfield Mountain Pumped Storage facility, which is less than 50 years old) not previously surveyed within the APE. FirstLight evaluated these 39 resources, plus the six previously surveyed resources not yet evaluated, for NRHP-eligibility according to the NRHP Criteria and standards for integrity. Of the six previously surveyed resources, "The Patch" Historic District in Turners Falls (a small portion of which is located within the Project APE), the Riverside Historic District in Gill (with the two previously named contributing resources located within the Project APE), and the Hinsdale Historic District are eligible for the NRHP. Two previously surveyed resources—Red Suspension Bridge and Morgan House—are not eligible for NRHP listing.

Of the 39 newly surveyed resources, 12 resources (all located within Massachusetts) are eligible for NRHP listing and 27 (22 in Massachusetts, 3 in Vermont, and 2 in New Hampshire) are not eligible for the NRHP due to lack of architectural/historical significance and/or loss of integrity. In New Hampshire, three newly surveyed resources (a highway bridge, a culvert, and a USGS gauging station) are contributing resources within the NRHP-eligible Hinsdale Historic District in Hinsdale. The Northfield Mountain Pumped Storage facility is considered NRHP-eligible under Criteria A and C in 2018.

The Vermont SHPO has concurred with FirstLight's recommendation that there are no NRHP-eligible architectural resources within the Project APE. The New Hampshire SHPO concurred that no additional survey or evaluation is required. Concurrence with FirstLight's recommendations on NRHP-eligibility on surveyed resources in the Massachusetts portion of the Project APE from the Massachusetts SHPO is pending.

3.3.8.1.5 **Traditional Cultural Properties**

To document TCPs in the Project APE, FirstLight contacted the Narragansett Indian Nation (NIT) and the Nolumbeka Project on several occasions in 2014 to initiate tribal consultation and documentation of TCPs within the Project APE. Despite several attempts to initiate interviews and field investigations with Tribal members to document TCPs within the Project APE, interviews and field investigations have not occurred as neither entity has yet agreed to meet with FirstLight's ethnographer. In response to an April 29, 2015

request of the Nolumbeka Project, by letter dated June 9, 2015, FirstLight agreed to walk the Wissatinnewag Property (located outside of the APE) with the Nolumbeka Project. To date, the Nolumbeka Project, however, has not contacted FirstLight's ethnographer to set up a site visit. Background research conducted in accordance with the Revised Study Plan (RSP) identified one NRHP-listed TCP in the Project vicinity. The TCP is located at the Turners Falls Municipal Airport, Franklin County, Massachusetts. Known as the Turners Falls Sacred Ceremonial Hill Site, it consists of four visible stone piles and an extended row of stacked stones. No NRHP-listed TCPs in the Project APE have otherwise been identified (Will, 2015).

3.3.8.2 Environmental Effects

The Licensee is proposing to remove an 8.1 acre parcel of land (the Fuller Farm property) from the Project boundary because it is not needed for continued operation of the Project. As noted above, the Fuller Farm property was found to be sensitive for the presence of archaeological resources and may require further studies (such as an intensive (locational) archaeological survey (Phase IB). The proposal to remove the 8.1 acre parcel is discussed in more detail in Section 3.3.7.4.

As set forth in Section 2.2.1, the Licensee is also proposing to remove a 20.1 acre parcel owned by USGS and on which USGS's Conte Lab is located. As noted in Section 3.3.7.4, the Phase IA Study identified several previously recorded archaeological resources on this parcel, which have not been investigated for NRHP eligibility. Nonetheless, because the parcel will remain under the ownership of USGS (a federal governmental entity), which is subject to Section 106 requirements, there will be no adverse effect as a result of removing the Conte Lab parcel from the Project. The Licensee is not proposing any other changes to the Project or any changes in the operation of the Project that would affect any of the identified archaeological or architectural resources found within the Project APE.

To protect eligible cultural resources over the term of a new license, the Licensee is proposing to prepare and implement a Historic Properties Management Plan (HPMP). The purpose of the HPMP is to set forth specific actions and processes to manage historic properties within the Project APE. It is intended to serve as a guide for FirstLight's operating personnel when performing necessary activities and to prescribe site treatments designed to address ongoing and future effects to historic properties. The HPMP also describes a process of consultation with state and federal agencies. Measures anticipated to be included in the HPMP are: identification surveys and site NRHP evaluations, site management measures; training of staff; routine monitoring of known cultural resources; and periodic review and revision of the HPMP.

As reported in the Phase IA archaeological reconnaissance survey reports, based on the results of the sensitivity modeling and the observed erosion, 24,425 meters of shoreline in the Project APE are recommended for future Phase IB survey in the event that it is determined that the observed erosion is Project-induced, or that there are other Project-related effects. This includes 12,200 m of shoreline in Massachusetts, 6,875 m of shoreline in New Hampshire, and 5,350 m of shoreline in Vermont. The purpose of such field survey would be to ascertain the presence or absence of archaeological site(s) and if such resources have the potential to be adversely impacted by Project-induced erosion or other Project-related effects. The MHC has concurred that an intensive (locational) archaeological survey (Phase IB) should be conducted within the survey segments identified in the Massachusetts Phase IA report (Sara *et al*., 2015a). The NHDHR and VDHP have concurred with the recommendation for Phase IB archaeological survey within the segments identified for survey in New Hampshire and Vermont (Sara *et al*., 2015b). Provisions will be included in the HPMP to provide for continuing archaeological surveys of these portions of the Project shorelines in the event that it is determine that the observed erosion is Project-induced, or that there are other Project-related effects, as well as for the Fuller Farm property.

As noted in Section 3.3.8.1.4, there are 23 previously evaluated architectural resources and 16 newly evaluated architectural resources located in the Project APE (all located within Massachusetts), which are either listed (the Turner Falls Historic District) or eligible for NRHP listing. One of these resources is the Northfield Mountain Pumped Storage facility, which will be 50 years old in 2018. Provisions will be

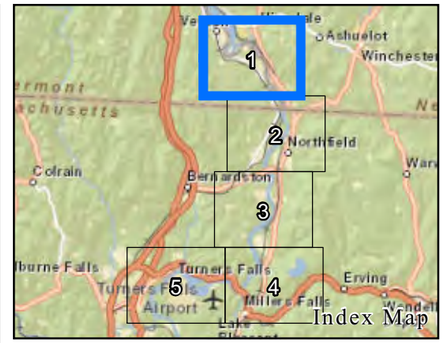
included in the HPMP to provide for management measures to avoid adverse effects to these resources from any future Project modifications or activities.

3.3.8.3 Proposed Environmental Measures

As described above, FirstLight's proposed Project includes one measure specifically related to the protection of cultural resources, which is the development and implementation of the HPMP. The HPMP will ensure that appropriate consultation occurs prior to any future activity that may affect the historic properties associated with the Project. When developed, the HPMP will be filed with the SHPOs for Massachusetts, Vermont, and New Hampshire, Tribes, and FERC under separate cover as "privileged," because it will contain confidential archaeological site location information. The HPMP will address known NRHP-eligible historic properties as well as include provisions to address any subsequently historic properties identified during the term of a new license.

3.3.8.4 Unavoidable Adverse Impacts

Continued operation of the Northfield Project will result in no unavoidable adverse impacts on historic properties. Implementation of the HPMP would assure that the effects of the Project on cultural resources will be taken into account. Therefore, pursuant to the National Historic Preservation Act, Section 106 (16 U.S.C. § 470f (2006) and 36 CFR § 800.5(b) (2008), the Project as proposed would not have any adverse effects on historic properties located at the Project.



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

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Exhibit E
Figure 3.3.8.1.1-1: Area of Potential Effects
Map 1

N

Legend

*Area of Potential Effects**

* Final Area of Potential Effect defined by Northfield Project Boundary

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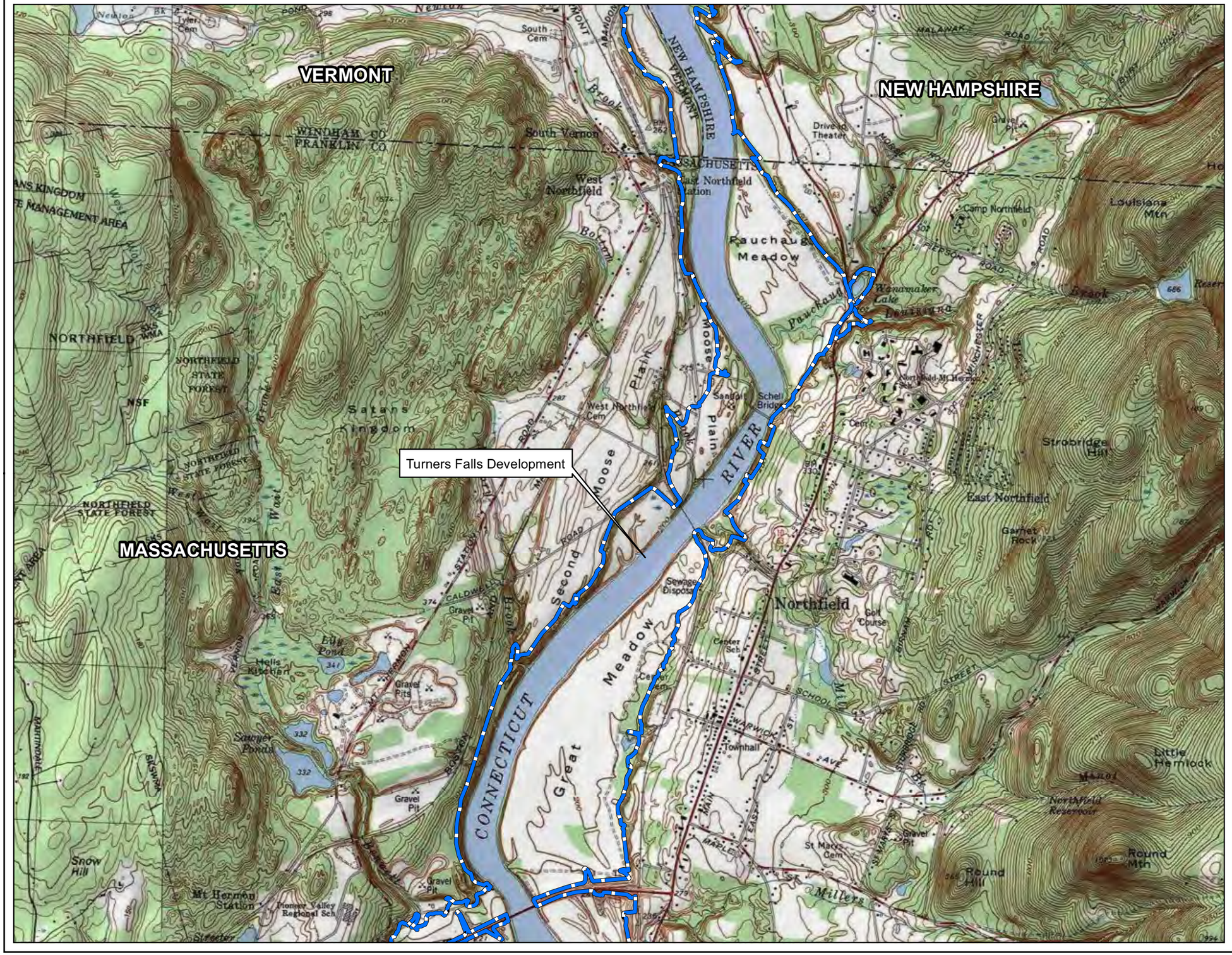

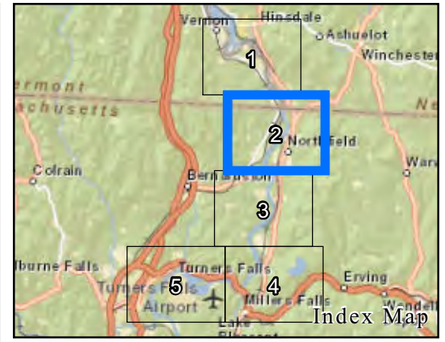

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Exhibit E
Figure 3.3.8.1.1-1: Area of Potential Effects
Map 2

N

Legend

*Area of Potential Effects**

* Final Area of Potential Effect defined by Northfield Project Boundary

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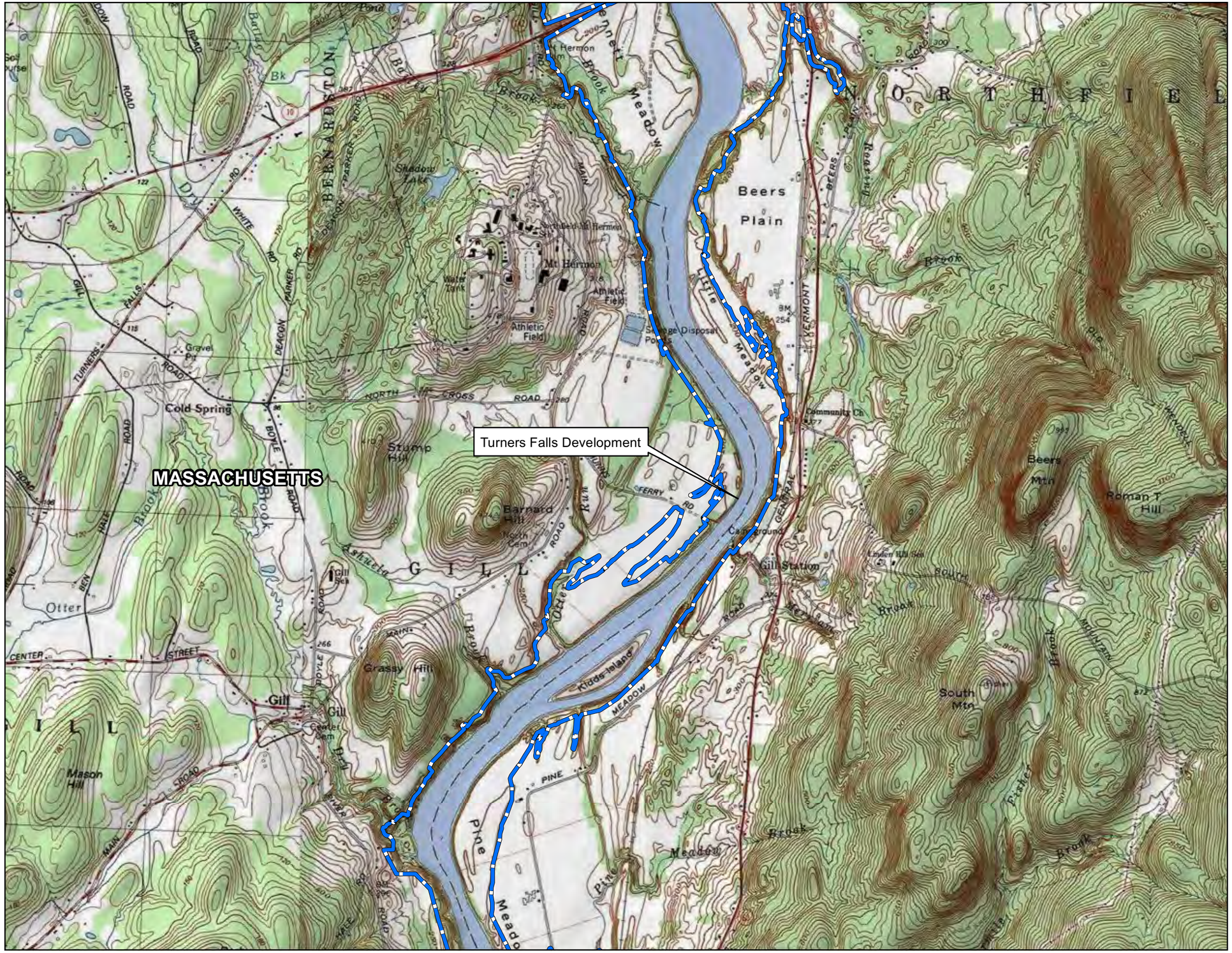

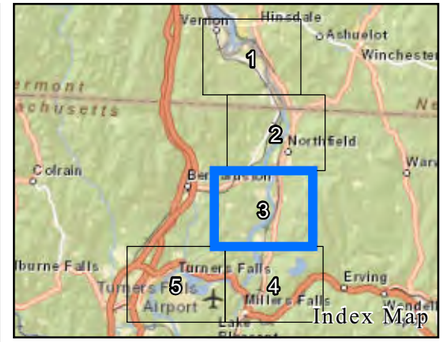

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Turners Falls Hydroelectric Project No. 1889

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Exhibit E
Figure 3.3.8.1.1-1: Area of Potential Effects
Map 3

Legend

Area of Potential Effects*

* Final Area of Potential Effect defined by Northfield Project Boundary

N

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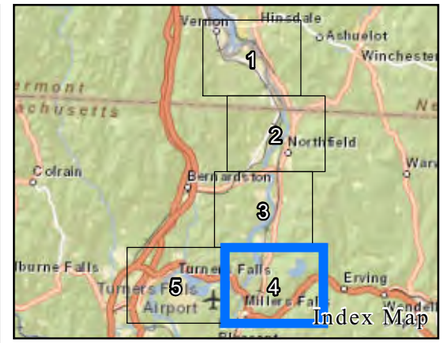
Turners Falls Development

Northfield Mountain Pumped Storage Development

Cabot Camp

MASSACHUSETTS



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Turners Falls Hydroelectric Project No. 1889

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Exhibit E
Figure 3.3.8.1.1-1: Area of Potential Effects
Map 4

N

Legend

*Area of Potential Effects**

* Final Area of Potential Effect defined by Northfield Project Boundary

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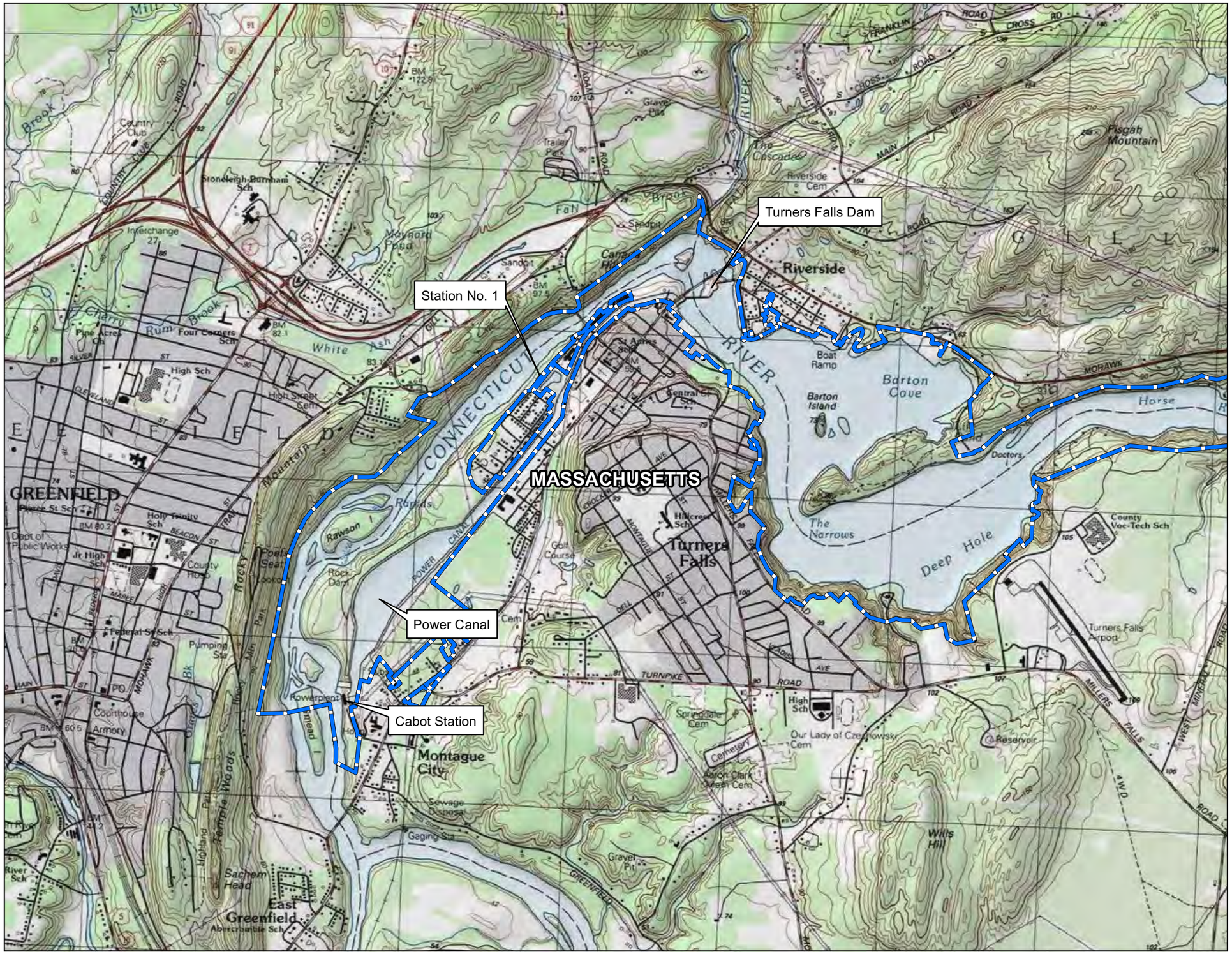

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Exhibit E
Figure 3.3.8.1.1-1: Area of Potential Effects
Map 5

N

Legend

*Area of Potential Effects**

* Final Area of Potential Effect defined by Northfield Project Boundary

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3.3.9 Aesthetic Resources

3.3.9.1 Affected Environment

3.3.9.1.1 Landscape Description

The Connecticut River valley's landscape has distinct natural beauty and classic New England farm village patterns. In the Project vicinity, historic villages and working landscapes combine with natural riverine beauty to create a scenic corridor. The region is comprised of riverside farmlands, woodlands, historic village centers founded in the late 1600s, working landscapes laid out during Colonial times, and vistas of the Connecticut River and mountain ranges. Step-like terraces and floodplains slope up to the bordering hills. The valley is framed by the Berkshire Mountains on the west and by the central uplands on the east. In autumn, the trees blaze with color (PVPC, 2012).

The corridor along TFI was designated as a scenic landscape in 1981 by the Massachusetts Department of Conservation and Recreation (then Department of Environmental Management). Below Cabot Station, most of the river corridor down to South Hadley is also considered a scenic landscape. Figure 3.3.9.1.1-1 depicts these scenic landscape designations as well as other aesthetic elements and scenic byways in the Turners Falls Project and Northfield Mountain Pumped Storage Development vicinity.

3.3.9.1.2 Scenic Byways and Viewscapes

Connecticut River National Scenic Byway

The roadways along the Connecticut River in New Hampshire, Vermont, and Massachusetts were designated as state scenic byways in 1994, 1999, and 2000, respectively. In 2005, the Vermont and New Hampshire sections were designated as a National Scenic Byway. The Massachusetts section, which extends from the state border in Northfield down to South Hadley, was added to the Connecticut River National Scenic Byway in 2009. Scenic byway routes in the Project vicinity include Route 142 through Vernon, VT, Route 63 through Hinsdale, NH and Northfield, Erving, and Montague, MA, and Route 47 through Sunderland, Hadley, and South Hadley, MA. Designated waypoints along the byway include Northfield Mountain Tour and Trail Center and the Great Falls Discovery Center in Turners Falls. Figure 3.3.9.1.1-1 shows the route of the Connecticut River Scenic Byway in the Turners Falls Project and Northfield Mountain Pumped Storage Development vicinity (USDOT, 2012).

Mohawk Trail Scenic Byway

The Mohawk Trail Scenic Byway was one of the earliest scenic byways in New England, receiving its designation in 1953. It follows an east-west corridor along Route 2 from Athol to Williamstown, MA. In Erving, the Byway passes through forested areas along the Millers River with views of the Erving Cliffs (Farley Ledges) as well as of mountains in Wendell and Gill. At the Erving-Gill town line, the Byway crosses the Connecticut River on the French King Bridge with spectacular views up and down the river (see below). In Gill, the Byway has a more rural feel with views of Barton Cove, some views of the river through trees to Montague and farmsteads, and a gently rolling landscape. Near the eastern town line, a panoramic view of the Village of Turners Falls and its historic industrial landscape is visible across the Connecticut River and the power canal. The Byway then turns onto Route 2A and passes through historic downtown Greenfield (FRCOG, 2009).

Connecticut River Water Trail

The Connecticut River Water Trail is a 12-mile-long paddling trail that runs from the Turners Falls Dam to a boat access point one mile north of Hatfield Center (see Figure 3.3.9.1.1-1). It features a nearly unbroken vegetated shoreline, wetlands, high bluffs, long views, and floodplain forests. The water trail is part of the longer Connecticut River Greenway State Park, which encompasses the length of the river in Massachusetts (MADCR, 2012).

Metacomet-Monadnock Trail/New England National Scenic Trail

The Metacomet-Monadnock Trail (M-M Trail) is a long distance hiking footpath that extends from the Connecticut state line to Mt. Monadnock in New Hampshire (see Figure 3.3.9.1.1-1). In 2001, the National Park Service certified sections of the trail, including those near Northfield Mountain, as a National Recreational Trail. In 2009, the trail was designated as part of the New England National Scenic Trail (NET), which also includes the Mattabesett Trail in Connecticut (collectively known as the M-M-M Trails). In Northfield, the M-M Trail traverses the open ledges of Crag Mountain, from which views of Northfield Mountain Reservoir can be seen to the southwest (see Figure 3.3.9.1.2-1) (AMC, 2010).

Connecticut River National Blueway

The Connecticut River was designated the first National Blueway on May 24, 2012 by the US Department of Interior. The federal designation comprises the entire river, as well as its watershed. The Blueway designation was intended to provide for better coordination of local, state and federal groups to promote best management practices, information sharing and stewardship. Though the National Blueway System has been dissolved, the Connecticut River maintains the designation of the nation's first and only National Blueway.

Scenic Viewpoints

Located between the Northfield Mountain Pumped Storage Development tailrace and the Turners Falls Dam, the French King Gorge, with its 250-foot-high rocky banks, is of ecological and scenic significance. The gorge was formed thousands of years ago by glacial melt waters. The Route 2 Bridge that connects Gill to Erving, also known as the French King Bridge, provides scenic views to the north and south, where the Millers River empties into the Connecticut (see Figure 3.3.9.1.2-2). This is a popular tourist destination and some parking is provided on both sides of the road at the bridge (MADCR, 2012).

The Gill-Montague Bridge just below Turners Falls Dam provides scenic views of the dam and bypass reach for pedestrian and automobile traffic. Figure 3.3.9.1.2-3 is an aerial image showing the bridge, the Village of Turners Falls, and the landscape surrounding the lower TFI.

At more than 1,200 feet in height, Mt. Toby in Sunderland, just south of the Turners Falls Project and Northfield Mountain Pumped Storage Development, looms over the middle Connecticut River valley offering outstanding panoramic views. A moderate hiking trail of about 6 miles leads to the top, and there are shorter hiking trails as well. Related geologically to Mt. Sugarloaf, Mt. Toby features cliffs, caves, waterfalls, wetlands, and open fields (MADCR, 2012).

3.3.9.2 Environmental Effects

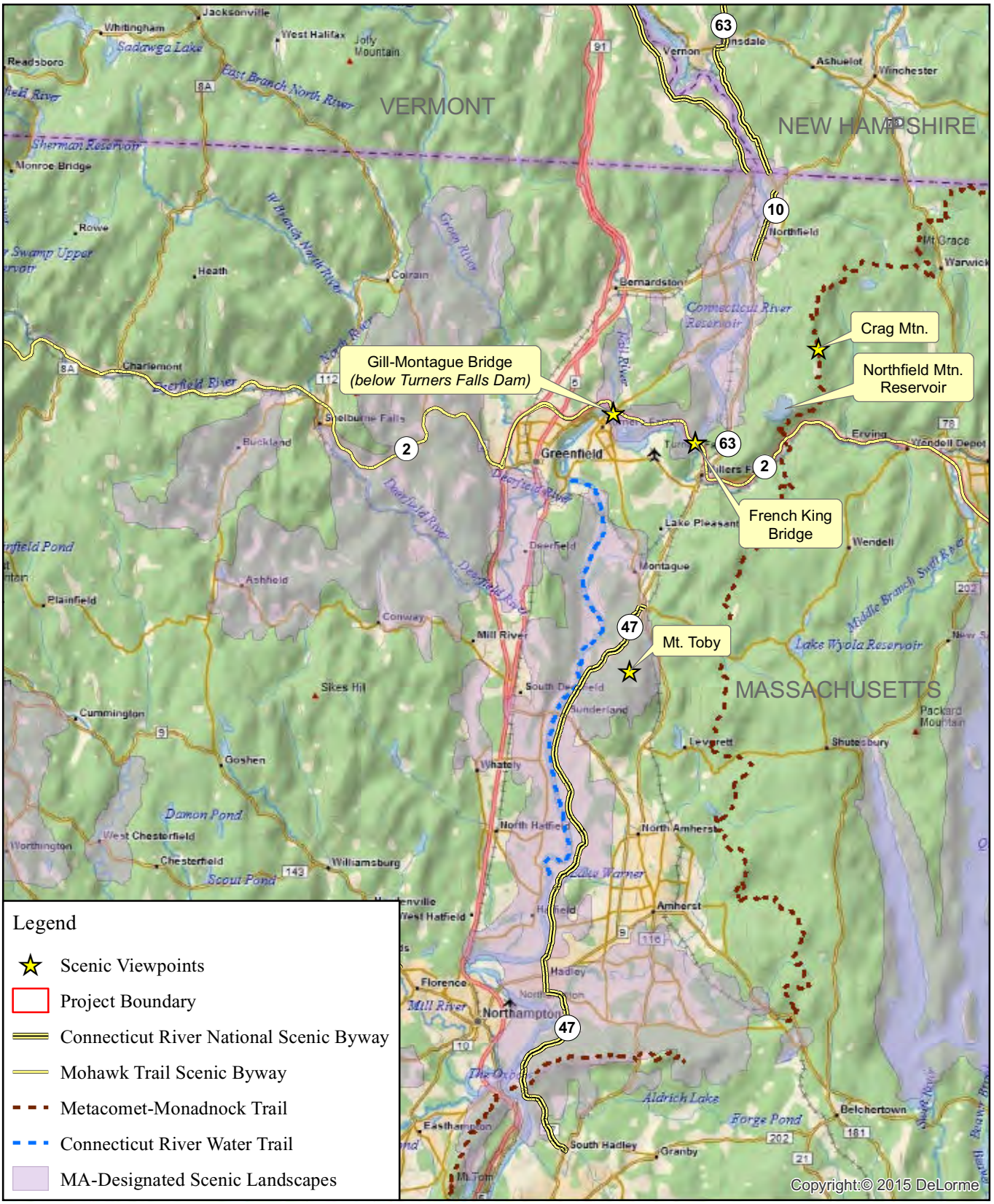
The only proposed change to Project operations is to use more of the Upper Reservoir storage capacity by increasing the storage range from the current operating range of 1000.5 feet to 938 feet to 1004.5 to 920 feet. FirstLight has requested, and FERC has approved, similar amendments to expand the Upper Reservoir operating limits to the same limit proposed during portions of 2001, 2005, 2006 and 2014. An analysis of intraday water level variations of the TFI during the 2014/2015 winter amendment period, compared to the same periods for the winters 2000-2015, showed less variability. The increase in Upper Reservoir storage is not expected to change the aesthetics of the TFI.

3.3.9.3 Proposed Environmental Measures

FirstLight is not proposing any measures to enhance aesthetic resources. Although FirstLight is proposing to use more the Upper Reservoir storage capacity, aesthetics are not expected to be affected.

3.3.9.4 Unavoidable Adverse Impacts

No unavoidable adverse impacts are expected on aesthetic resources.



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

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Figure 3.3.9.1.1-1
Aesthetic Resources
in the Project Vicinity

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Figure 3.3.9.1.2-1: View of Northfield Mountain Reservoir from Crag Mountain

Figure 3.3.9.1.2-2: French King Bridge over Turners Falls Impoundment

Figure 3.3.9.1.2-3: Aerial View of Turners Falls Dam Area, Looking Upstream

3.3.10 Socioeconomic Conditions

3.3.10.1 Affected Environment

3.3.10.1.1 Population Patterns

The Pioneer Valley region encompasses 43 cities and towns in the Connecticut River Valley in western Massachusetts. An estimated 608,000 people live in the nearly 1,200-square-mile region, which includes the fourth largest metropolitan area in New England (Springfield). The Pioneer Valley's diverse economic base, its renowned academic institutions, and its wealth of natural resources make it a unique place to live and work. Residents live in downtown areas, suburban neighborhoods, quiet villages, historic areas, and rural homesteads. People work in downtown offices in Springfield, the region's cultural and economic center; in plants and factories in Holyoke and Chicopee, the first planned industrial communities in the nation; in academic halls in Amherst, Northampton, and South Hadley, home to venerable colleges and a flagship university; in tobacco fields in Hadley, where families have worked the land for generations; in distribution centers in Westfield, near the crossroads of two interstate highways; and in offices scattered throughout the region (PVPC, 2012).

The area immediately surrounding the Project is relatively rural in nature. Franklin County is the most rural in Massachusetts, and Greenfield is its largest municipality. Based on the results of the 2010 census (presented in Table 3.3.10.1.1-1), the estimated populations of the three counties within the Project boundary—Franklin County, MA, Cheshire County, NH, and Windham County, VT—are 71,444, 77,274, and 44,453, respectively. This translates to population densities of 99 people per square mile in Franklin County, 106 people per square mile in Cheshire County, and 56 people per square mile in Windham County. Housing densities are roughly 46, 48, and 37 units per square mile, respectively (US Census Bureau, 2010).

Table 3.3.10.1.1-2 shows that over the last decade, populations have remained relatively stable in the Project vicinity—ranging from a decline of 0.1 percent in Franklin County to an increase of 4.7 percent in Cheshire County (US Census Bureau, 2010).

The nearest major town is Greenfield, MA, which has a population of 17,610 (2010) and a town center located about 4 miles southwest of the Turners Falls Dam. Other significant population centers near the Project are shown in Table 3.3.10.1.1-3 and include Northampton (28,709 residents, 28 miles south of the Turners Falls Project and Northfield Mountain Pumped Storage Development), Amherst (37,819 residents, 17 miles south of the facilities), Holyoke (39,885 residents, 38 miles south), Springfield (152,906 residents, 48 miles south), and Hartford, CT (124,775 residents, 70 miles south). For reference, Boston is approximately 106 miles east of the Project and has about 602,609 residents (US Census Bureau, 2010).

3.3.10.1.2 Economic Patterns

Income distributions of the counties in the Project vicinity are shown in Table 3.3.10.1.2-1. Median household income in the region was lower than that for Massachusetts overall ($62,072), ranging from $47,386 in Windham County to $52,644 in Cheshire County. In 2010, 12.7% of households throughout the state earned less than $15,000; this figure was identical for Franklin County and was bracketed by Cheshire and Windham counties at 9.7% and 13.3%, respectively. Additionally, while over 29% of Massachusetts households earned more than $100,000 in 2010, only 17.2% of households in Franklin County, 17.7% in Cheshire County, and 14.5% in Windham County surpassed that amount (US Census Bureau, 2010).

Table 3.3.10.1.2-2 displays the distribution of the civilian employed population (age 16 or over) for each county and the Commonwealth of Massachusetts. In general, counties in the Project vicinity have a higher percentage of people employed in the natural resources, construction and maintenance sector and the production, transportation, and material moving sector than in Massachusetts overall, while less people are employed in the management, business, science, and arts sector. Additionally, unemployment rates are

lower in the Project vicinity—ranging from 6.5% in Windham County, 9.7% in Cheshire County, and 10.2% for Massachusetts (US Census Bureau, 2010).

Some of the larger employers in the Project vicinity include the Greenfield Community College (300 employees in 2010), Yankee Candle in Whately (1,500 employees), Cooley Dickinson Hospital and Smith College in Northampton (1,800 and 1,000 employees, respectively), and the University of Massachusetts in Amherst (7,900 employees) (Clarke, 2011). FirstLight employs approximately 53 full-time employees at the Northfield Mountain Pumped Storage Development and 12 full-time employees at the Turners Falls Development.

As summarized in Exhibit E, FirstLight pays considerable federal, state and local taxes. Based on fiscal year 2015 dollars, the local, state and federal taxes for both developments combined was $12,055,322, $827,638 and $13,793,991, respectively.

3.3.10.2 Environmental Effects

FirstLight proposed to operate the Project in the same manner in which it has been historically operated, continuing to supply low cost electricity and jobs, which benefits the socioeconomic health of the region.

3.3.10.3 Proposed Measures

Because the proposed Project would continue to have a beneficial effect on socioeconomic resources, FirstLight does not proposed any new measures related to socioeconomic resources.

3.3.10.4 Unavoidable Adverse Impacts

The Project has no known unavoidable adverse effects on socioeconomic resources.

Table 3.3.10.1.1-1: Population and Housing Data in the Project Vicinity

County	Population (2010)	Housing Units (2010)	Land Area (sq. mi.)	Population Density (people/sq. mi.)	Housing Density (units/sq. mi.)
Franklin Co., MA	71,444	33,695	725	99	46
Cheshire Co., NH	77,274	34,682	729	106	48
Windham Co., VT	44,453	29,601	798	56	37

Source: (US Census Bureau, 2010)

Table 3.3.10.1.1-2: Population Trends in the Project Vicinity

County	Population (2000)	Population (2010)	Percent Change
Franklin Co., MA	71,535	71,444	-0.13%
Cheshire Co., NH	73,825	77,274	4.67%
Windham Co., VT	44,216	44,453	0.54%

Source: (US Census Bureau, 2010)

Table 3.3.10.1.1-3: Major Population Centers near the Project

Town or City	Population (2010)	Approximate Distance from Turners Falls Dam (mi)
Greenfield, MA	17,610	4
Amherst, MA	37,819	17
Brattleboro, VT	7,136	22
Northampton, MA	28,709	28
Keene, NH	23,547	36
Holyoke, MA	39,885	38
Springfield, MA	152,906	48
Hartford, CT	124,775	70
Boston, MA	602,609	106

Source: (US Census Bureau, 2010)

Table 3.3.10.1.2-1: Income Distribution for Households in the Project Vicinity

County or State	Median Household Income (2010)	Percent of Households with Incomes More than $100,000	Percent of Households with Incomes Less than $15,000
Franklin Co., MA	$50,514	17.2%	12.7%
Cheshire Co., NH	$52,644	17.7%	9.7%
Windham Co., VT	$47,386	14.5%	13.3%
Massachusetts	$62,072	29.2%	12.7%

Source: (US Census Bureau, 2010)

Table 3.3.10.1.2-2: Occupation Distribution in the Project Vicinity

County or State	Occupation					Percent Unemployed
	Management, business, science, and arts	Service	Sales and office	Natural resources, construction, and maintenance	Production, transportation, and material moving	
Franklin Co., MA	37.5%	15.6%	23.3%	10.1%	13.5%	7.8%
Cheshire Co., NH	34.5%	17.3%	23.0%	9.0%	16.1%	9.7%
Windham Co., VT	39.0%	18.1%	20.2%	11.2%	11.5%	6.5%
Massachusetts	43.5%	17.4%	23.5%	6.8%	8.9%	10.2%

Source: (US Census Bureau, 2010)

3.4 No-Action Alternative

Under the No-action Alternative, the existing Project would continue to operate as it has historically operated as described in Section 2.1. The measures in the current licenses as described in Section 2.1 would continue - none of FirstLight's proposed measures or those that may be proposed by others would be required and any environmental or recreation benefits from such recommendations would not occur. The Project would continue to be of importance to recreation, generation of renewable energy, and minimization of atmospheric pollutants.

4 DEVELOPMENTAL ANALYSIS

This section analyzes the cost of continued operation and maintenance of the Project under the No Action and Proposed Alternatives. Costs are associated with the operation and maintenance of hydropower facilities, as well as the costs of providing the proposed PM&E measures. The economic analysis has been conducted using a 50-year time period.

4.1 Power and Economic Benefits of the Project

Consistent with FERC's approach to economic analysis, the value of the Project's power benefits is determined by estimating the cost of obtaining the same amount of energy and capacity using likely alternative resources available in the region. This analysis is based on current costs and does not consider future escalation of fuel prices in valuing the Project's power benefits.[50]

The Project has generation facilities associated with the Turners Falls Development—specifically Station No. 1 and Cabot Station and the Northfield Mountain Pumped Storage Development located approximately 5.2 miles upstream of the Turners Falls Dam. The first generation facility on the power canal is Station No. 1 which has a total authorized installed capacity of 5.693 MW. There are five operational horizontal Francis turbines operating under a gross head of approximately 43.7 feet and the individual turbines have maximum hydraulic capacities ranging from 140 to 560 cfs. Cabot Station is located at the downstream terminus of the power canal and has a total authorized installed capacity of 62.016 MW or approximately 10.336 MW for each of the 6 units. The vertical Francis turbines operate at a normal head of 60 feet and have a maximum total hydraulic capacity of approximately 13,728 or 2,288 cfs/unit. Under the No Action alternative the Turners Falls Development will generate an average of approximately 328,022 MWh per year (based on the period 2000-2014). For the analysis in Section 4.1.1 below, which is based on 2013 pricing data, the 2013 Turners Falls Development annual generation of 356,376 MWh was used.

The Northfield Mountain Pumped Storage Development contains four reversible pump/turbines operating at gross heads ranging from 753 to 824.5 feet. Three of the turbines have capacities of 291.7 MW, while the remainder has a capacity of 267.9 MW, but is currently undergoing upgrades and will have a capacity of 291.7 MW by February 2016. Historically the total station capacity was 1,080 MW, but is currently 1,143 MW and will be 1,166.8 MW after the upgrades are complete. When operating in a pumping mode, the maximum hydraulic capacity (4 pumps) is approximately 15,200 cfs (3,800 cfs/pump). Alternatively, when operating in a generation mode, the approximate maximum hydraulic capacity (4 turbines) is approximately 20,000 cfs (5,000 cfs/turbine). The licensed operating range of the upper reservoir is between 1,000.5 and 938 ft resulting in a storage capacity of 12,318 acre-feet and about 8,475 MWh of generation[51]. Under the No Action alternative the Northfield Mountain Pumped Storage Development will generate an average of approximately 1,053,891 MWh per year while using 1,437,464 MWh per year for pumping (based on the period 2000-2009, 2011-2014). For the analysis in Section 4.1.1 below, which is based on 2013 pricing data, the 2013 Northfield Pumped Storage Development annual generation of 808,943 MWh and annual pumping 1,069,438 MWh was used.

4.1.1 Economic Assumptions

FirstLight operates the Project with the primary purpose to supply energy, capacity, regulation and other ancillary services to the ISO-NE Interconnection. In operating the Project, FirstLight ensures dam safety, provides a range of existing environmental measures and ensures capacity, peaking, reserve, and ancillary/regulation power services to the New England Power Pool. The power value at the Turners Falls

[50] Mead Corporation, Publishing Paper Division, 72 FERC ¶ 61,027 (July 13, 1995).

[51] Note that after February 2016 the FERC nameplate rating will increase to 1,166.8 MW (291.7 MW x 4 units) after the Unit 1 upgrade is completed.

Development and Northfield Mountain Pumped Storage Development varies as shown in Table 4.1.1-1 due to the different timing of operation as described in more detail in Exhibit B and D.

Table 4.1.1-1: Assumptions for Economic Analysis (2013)

Assumption	Turners Falls Development	Northfield Mountain Pumped Storage Development	Source of Information
Average Power Value (Generation) (2013 value)	$58.185/MWh	$85.172/MWh	FirstLight
Average Power Value (Pumping) (2013 Value)	---	$40.012/MWh	FirstLight
2013 Annual Generation (MWh)	356,376 MWh	808,943 MWh	FirstLight
2013 Annual Energy for Pumping (MWh)	---	1,069,438 MWh	FirstLight
Period of Analysis	50 years	50 years	---
Net Investment (book value)	$284,970,827	$926,156,091	FirstLight
Capacity Value (67.709 MW) (2013 value)	$2,214,660	---	FirstLight
Capacity Value (1143 MW) [1] (2013 value)	---	$35,520,940	FirstLight
Locational Forward Reserve Market and Real-Time Reserves	---	$14,931,318	FirstLight
Reserve	$77,441	---	FirstLight
Ancillary Service (2013 value)	($112,592)[2]	$1,670,097	FirstLight

[1]Note that after February 2016, the FERC nameplate rating will increase to 1,166.8 MW (291.7 MW x 4 units)
[2]Ancillary includes Utility charges for electric production.

4.1.2 Annual Power Value

Table 4.1.2-1 shows the total valuation of power for the No-Action and Proposed Alternatives. For both scenarios, this assumes a 2013 annual generation of 356,376 MWh at the Turners Falls Development, 808,943 MWh at the Northfield Mountain Pumped Storage Development and 1,069,438 MWh used in pumping at the Northfield Mountain Pumped Storage Development.

Table 4.1.2-1: Valuation of the Annual Output of the Turners Falls Development and Northfield Mountain Pumped Storage Development (2013)

	Turners Falls Development		Northfield Mountain Pumped Storage Development		Total	
	No Action	Proposed	No Action	Proposed	No Action	Proposed
Energy Generated at $85.172/MWh (for 808,943 MWh)	--	--	$68,899,098	$68,899,098	$68,899,098	$68,899,098
Energy for Pumping at $40.012/MWh (for 1,069,438 MWh)	--	--	($42,790,965)	($42,790,965)	($42,790,965)	($42,790,965)
Energy Generated at $58.185 (for 356,376 MWh)	$20,735,750	$20,735,750	--	--	$20,735,750	$20,735,750
Capacity Value	--	--	$35,520,940	$35,520,940	$35,520,940	$35,520,940
Capacity Value	$2,214,660	$2,214,660	--	--	$2,214,660	$2,214,660
Locational Forward Reserve Market and	--	--	$14,931,318	$14,931,318	$14,931,318	$14,931,318

	Turners Falls Development		Northfield Mountain Pumped Storage Development		Total	
	No Action	Proposed	No Action	Proposed	No Action	Proposed
Real-Time Reserves						
Reserve	$77,441	$77,441			$77,441	$77,441
Ancillary Service	($112,592)	($112,592)	$ 1,670,097	$ 1,670,097	$ 1,557,505	$ 1,557,505
Regulation			$3,561,234	$3,561,234	$3,561,234	$3,561,234
Total Value (Energy + Capacity Value +Reserve + Ancillary + Regulation)	$22,915,259	$22,915,259	$81,791,722	$81,791,722	$104,706,981	$104,706,981
Total value per MWh	$64.30	$64.30	$101.11	$101.11	$89.85	$89.85

NOTE: Numbers may not be exact due to rounding.

4.1.3 Project Costs under the No-Action Alternative

The total annualized current costs for the Project No-Action Alternative is $94,370,566 (Table 4.1.3-1).

Table 4.1.3-1: Summary of Current Annual Costs and Future Costs under the No-Action Alternative (2013)

Items	Annual Cost		
	Turners Falls Development	Northfield Mountain Pumped Storage Development	Total
Capital Costs[52]	$1,901,763	$15,308,478	$17,210,241
Local, State and Federal Taxes[53]	$6,533,061	$20,143,890	$26,676,951
Annual Depreciation and Amortization Expense[54]	$6,771,000	$28,957,000	$35,728,000
Operation and Maintenance Expenses[55]	$3,731,591	$11,023,783	$14,755,374
Total	$18,937,415	$75,433,151	$94,370,566

4.1.4 Project Costs under the Proposed Alternative

At this time, FirstLight is not proposing environmental measures as many studies are incomplete or have not been started. Thus, at this time, FirstLight has not included costs associated with added capital costs, or additional operation and maintenance costs for the Project.

4.2 Comparison of Alternatives

4.2.1 No-Action Alternative

Under the No Action Alternative, the Project would continue to operate as it does now. In 2013, the Project generated 1,165,319 MWh (356,376 MWh at Turners Falls Development + 809,943 at Northfield Mountain Pumped Storage Development) and the Northfield Mountain Pumped Storage Development used 1,069,438 MWh. The 2013 power value of the Project (Table 4.2.2-1) under the no-action alternative would be $104,706,981 ($89.85/MWh). The 2013 cost of producing this power including depreciation, operation and maintenance costs, and taxes would be approximately $94,370,566 ($80.98/MWh). The 2013 net benefit of the Project would be approximately $10,336,415 ($8.87/MWh).

[52] As described in Exhibit D, Section 4.1.
[53] As described in Exhibit D, Section 4.2.
[54] As described in Exhibit D, Section 4.3.
[55] As described in Exhibit D, Section 4.4.

4.2.2 Proposed Alternative

Under the Proposed Alternative, the range of operation at the Northfield Mountain Pumped Storage Development's Upper Reservoir would be increased from the current range of 938 and 1000.5 feet to 920 and 1004.5 feet for a total range of 84.5 feet. This added range of operation would result in an increased storage capacity of 3,009 acre-feet resulting in a total of 15,327 acre-feet of storage and an added generation capacity of 1,990 MWh. However, at the time of filing of this Draft License Application, not all of the FirstLight studies are complete. Therefore FirstLight has not finalized its proposed operation of the Project and is not proposing other operational changes or other PMEs.

Historically, FirstLight has been granted temporary license amendments to operate the Upper Reservoir at its proposed range several times in the past 15 years, most recently between December 1, 2014 and March 31, 2015. A license amendment application with a similar range of operation (December 1 to March 31) for the Upper Reservoir is also currently pending with FERC for the remainder of the license. Based on historical information, including the most recent license amendment period, pumping and generation values did not substantially change with a higher amount of storage in the Upper Reservoir. In general, the most substantial change was an increase in the reserve storage in the Upper Reservoir that could be used during emergencies associated with grid instabilities in the Northeast. While additional generation could occur based on the expanded range of storage at the Upper Reservoir, this has not historically occurred or was very limited and therefore no substantial changes in the proposed alternative are expected. Under the proposed alternative, the generation would remain at 1,165,319 MWh and the Northfield Mountain Pumped Storage Development would use 1,069,438 MWh. The 2013 power value of the Project (Table 4.2.2-1) under the proposed alternative would be $104,706,981 ($89.85/MWh). The 2013 cost of producing this power including depreciation, operation and maintenance costs, and taxes would be approximately $94,370,566 ($80.98/MWh). The 2013 net benefit of the Project would be approximately $10,336,415 ($8.87/MWh).

Table 4.2.2-1: Comparison of the Power Value, Annual Costs, and Net Benefits of the No Action and Proposed Alternatives (2013)

	No-Action Alternative			Proposed Alternative		
	Turners Falls Development	**Northfield Mountain Pumped Storage Development**	**Total**	**Turners Falls Development**	**Northfield Mountain Pumped Storage Development**	**Total**
Annual Generation (MWh)	356,376	808,943	1,165,319	356,376	808,943	1,165,319
Annual Power Value:						
$ per year	$22,915,259	$81,791,722	$104,706,981	$22,915,259	$81,791,722	$104,709,981
$/MWh	$64.30	$101.11	$89.85	$64.30	$101.11	$89.85
Annual Costs:						
$ per year	$18,937,415	$75,433,151	$94,370,566	$18,937,415	$75,433,151	$94,370,566
$/MWh	$53.14	$93.25	$80.98	$53.14	$93.25	$80.98
Annual Net Benefits:						
$ per year	$3,977,844	$6,358,571	$10,336,415	$3,977,844	$6,358,571	$10,336,415
$/MWh	$11.16	$7.86	$8.87	$11.16	$7.86	$8.87

5 CONCLUSIONS

5.1 Comparison of Alternatives

This section will compare the developmental and non-developmental effects of FirstLight's proposed Project and the No-Action Alternative when FirstLight's proposal for relicensing the Project is further developed.

5.2 Comparison of Development and Recommended Alternative

[This section will be completed by FERC in its DEIS.]

5.3 Unavoidable Adverse Impacts

[This section will be completed by FERC in its DEIS.]

5.4 Consistency with Comprehensive Plans

Section 10(a) (2) of the FPA requires the Applicant to review applicable federal and state comprehensive plans, and to consider the extent to which a Project is consistent with the federal or state plans for improving, developing, or conserving a waterway or waterways affected by the Project. A list of existing FERC-approved State of Massachusetts, New Hampshire and Vermont and federal comprehensive plans was provided in FERC's Scoping Document 2, issued April 15, 2013. This list of plans is consistent with FERC's latest list of approved plans, issued December 2014. Of those listed, the Applicant identified and reviewed 23 plans. Of these, the following plans are pertinent to the Project. No inconsistencies were found.

Massachusetts

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6 CONSULTATION DOCUMENTATION

Throughout the ILP, FirstLight has engaged in substantive consultation with relicensing participants, and have filed all licensing materials with FERC. Names and addresses for federal, state, and interstate resource agencies, Indian tribes, or members of the public with which FirstLight has consulted during relicensing, and a comprehensive summary of all consultation activities between filing of the PSP on April 15, 2013 and submittal of the FLA will be included with the FLA.

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8 ATTACHMENT A: LETTER FROM MASSACHUSETTS OFFICE OF COASTAL ZONE MANAGEMENT

THE COMMONWEALTH OF MASSACHUSETTS
EXECUTIVE OFFICE OF ENERGY AND ENVIRONMENTAL AFFAIRS
OFFICE OF COASTAL ZONE MANAGEMENT
251 Causeway Street, Suite 800, Boston, MA 02114-2136
(617) 626-1200 FAX: (617) 626-1240

June 9, 2015

John S. Howard
Director FERC Compliance, Hydro
FirstLight Power Resources, Inc.
99 Millers Falls Road
Northfield, MA 01360

RE: Federal Consistency Certification: Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485).

Dear Mr. Howard:

The Massachusetts Office of Coastal Zone Management (CZM) has completed its review of the information provided in your April 27, 2015 letter regarding relicensing of the Turners Falls Hydroelectric Project (FERC No. 1889) and Northfield Mountain Pumped Storage Project (FERC No. 2485) with the Federal Energy Regulatory Commission. These activities are located in the towns of Greenfield, Montague, Gill, Northfield, and Erving MA.

The activities associated with this project fall outside the geographical boundaries of the Massachusetts Coastal Zone as delineated in *Chapter 5: Massachusetts Coastal Regions and An Atlas of Resources, 1 June 1977* and further described in the Massachusetts Coastal Zone Management Plan. Therefore, these activities are not subject to federal consistency review by this office.

Thank you for submitting the information to CZM. If you have any questions regarding our review process, feel free to call me at (617) 626-1050.

Sincerely,

Robert L. Boeri
Project Review Coordinator

Draft Application for New License for Major Water Power Project – Existing Dam

Northfield Project

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

EXHIBIT H- PLANS AND ABILITY OF APPLICANT TO OPERATE THE PROJECT

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EXHIBIT H – PLAN AND ABILITY OF APPLICANT TO OPERATE THE PROJECT

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 4.51 (e) describes the required content of this Exhibit.

The following excerpt from the Code of Federal Regulations (CFR) at 18 CFR § 5.18(c) describes the required content of this Exhibit.

(i) Information to be supplied by all applicants. All Applicants for a new license under this part must file the following information with the Commission:

(A) A discussion of the plans and ability of the applicant to operate and maintain the project in a manner most likely to provide efficient and reliable electric service, including efforts and plans to:

(1) Increase capacity or generation at the project;

(2) Coordinate the operation of the project with any upstream or downstream water resource projects; and

(3) Coordinate the operation of the project with the applicant's or other electrical systems to minimize the cost of production.

(B) A discussion of the need of the applicant over the short and long term for the electricity generated by the project, including:

(1) The reasonable costs and reasonable availability of alternative sources of power that would be needed by the applicant or its customers, including wholesale customers, if the applicant is not granted a license for the project;

(2) A discussion of the increase in fuel, capital, and any other costs that would be incurred by the applicant or its customers to purchase or generate power necessary to replace the output of the licensed project, if the applicant is not granted a license for the project;

(3) The effect of each alternative source of power on:

(i) The applicant's customers, including wholesale customers;

(ii) The applicant's operating and load characteristics; and

(iii) The communities served or to be served, including any reallocation of costs associated with the transfer of a license from the existing licensee.

(C) The following data showing need and the reasonable cost and availability of alternative sources of power:

(1) The average annual cost of the power produced by the project, including the basis for that calculation;

(2) The projected resources required by the applicant to meet the applicant's capacity and energy requirements over the short and long term including:

(i) Energy and capacity resources, including the contributions from the applicant's generation, purchases, and load modification measures (such as conservation, if considered as a resource), as separate components of the total resources required;

(ii) A resource analysis, including a statement of system reserve margins to be maintained for energy and capacity;

(iii) If load management measures are not viewed as resources, the effects of such measures on the projected capacity and energy requirements indicated separately;

(iv) For alternative sources of power, including generation of additional power at existing facilities, restarting deactivated units, the purchase of power off-system, the construction or purchase and operation of a new power plant, and load management measures such as conservation: The total annual cost of each alternative source of power to replace project power; the basis for the determination of projected annual cost; and a discussion of the relative merits of each alternative, including the issues of the period of availability and dependability

of purchased power, average life of alternatives, relative equivalent availability of generating alternatives, and relative impacts on the applicant's power system reliability and other system operating characteristics; and the effect on the direct providers (and their immediate customers) of alternate sources of power.

(D) If an applicant uses power for its own industrial facility and related operations, the effect of obtaining or losing electricity from the project on the operation and efficiency of such facility or related operations, its workers, and the relate community.

(E) If an applicant is an Indian tribe applying for a license for a project located on the tribal reservation, a statement of the need of such Indian tribe for electricity generated by the project to foster the purposes of the reservation.

(F) A comparison of the impact on the operations and planning of the applicant's transmission system of receiving or not receiving the project license, including:

(1) An analysis of the effects of any resulting redistribution of power flows on line loading (with respect to applicable thermal, voltage, or stability limits), line losses, and necessary new construction of transmission facilities or upgrading of existing facilities, together with the cost impact of these effects;

(2) An analysis of the advantages that the applicant's transmission system would provide in the distribution of the project's power; and

(3) Detailed single-line diagrams, including existing system facilities identified by name and circuit number, that show system transmission elements in relation to the project and other principal interconnected system elements. Power flow and loss data that represent system operating conditions may be appended if applicants believe such data would be useful to show that the operating impacts described would be beneficial.

(G) If the applicant has plans to modify existing project facilities or operations, a statement of the need for, or usefulness of, the modifications, including at least a reconnaissance-level study of the effect and projected costs of the proposed plans and any alternate plans, which in conjunction with other developments in the area would conform with a comprehensive plan for improving or developing the waterway and for other beneficial public uses as defined in Section 10(a)(1) of the Federal Power Act.

(H) If the applicant has no plans to modify existing project facilities or operations, at least a reconnaissance level study to show that the project facilities or operations in conjunction with other developments in the area would conform with a comprehensive plan for improving or developing the waterway and for other beneficial public uses as defined in Section 10(a)(1) of the Federal Power Act.

(I) A statement describing the applicant's financial and personnel resources to meet its obligations under a new license, including specific information to demonstrate that the applicant's personnel are adequate in number and training to operate and maintain the project in accordance with the provisions of the license.

(J) If an applicant proposes to expand the project to encompass additional lands, a statement that the applicant has notified, by certified mail, property owners on the additional lands to be encompassed by the project and governmental agencies and subdivisions likely to be interested in or affected by the proposed expansion.

(K) The applicant's electricity consumption efficiency improvement program, as defined under Section 10(a)(2)(C) of the Federal Power Act, including:

(1) A statement of the applicant's record of encouraging or assisting its customers to conserve electricity and a description of its plans and capabilities for promoting electricity conservation by its customers; and

(2) A statement describing the compliance of the applicant's energy conservation programs with any applicable regulatory requirements.

(L) The names and mailing addresses of every Indian tribe with land on which any part of the proposed project would be located or which the applicant reasonably believes would otherwise be affected by the proposed project.

(ii) Information to be provided by an applicant licensee. An existing licensee that applies for a new license must provide:

(A) The information specified in paragraph (c)(1) of this section.

(B) A statement of measures taken or planned by the licensee to ensure safe management, operation, and maintenance of the project, including:

(1) A description of existing and planned operation of the project during flood conditions;

(2) A discussion of any warning devices used to ensure downstream public safety;

(3) A discussion of any proposed changes to the operation of the project or downstream development that might affect the existing Emergency Action Plan, as described in subpart C of part 12 of this chapter, on file with the Commission;

(4) A description of existing and planned monitoring devices to detect structural movement or stress, seepage, uplift, equipment failure, or water conduit failure, including a description of the maintenance and monitoring programs used or planned in conjunction with the devices; and

(5) A discussion of the project's employee safety and public safety record, including the number of lost-time accidents involving employees and the record of injury or death to the public within the project boundary.

(C) A description of the current operation of the project, including any constraints that might affect the manner in which the project is operated.

(D) A discussion of the history of the project and record of programs to upgrade the operation and maintenance of the project.

(E) A summary of any generation lost at the project over the last five years because of unscheduled outages, including the cause, duration, and corrective action taken.

(F) A discussion of the licensee's record of compliance with the terms and conditions of the existing license, including a list of all incidents of noncompliance, their disposition, and any documentation relating to each incident.

(G) A discussion of any actions taken by the existing licensee related to the project which affects the public.

(H) A summary of the ownership and operating expenses that would be reduced if the project license were transferred from the existing licensee.

(I) A statement of annual fees paid under part I of the Federal Power Act for the use of any Federal or Indian lands included within the project boundary.

1 INFORMATION TO BE SUPPLIED BY ALL APPLICANTS

The Federal Power Act (FPA) requires applicants for a new license to provide certain information, including information about the applicant's record as the current licensee of the Project. Pursuant to 18 C.F.R. Section 5.18(c), this information is provided in this Exhibit. 18 C.F.R. Section 16.10(a) requires all applicants for a new license to provide certain information such as the need for Project power and the examination of alternative sources; plans to modify an existing Project; an applicant's ability to operate and maintain the Project; and the applicant's electrical efficiency programs. This information is included in Section 1.0 of this Exhibit. Pursuant to 18 C.F.R. Section 16.10(b) 5.18(c)(1)(ii), Section 2.0 contains information to be provided by an applicant who is the existing licensee for a Project and discusses FirstLight's safe management, operation, and maintenance of the Turners Falls Project (now Development) and Northfield Mountain Pumped Storage Project (now Development); operational history and programs to upgrade Project operation and maintenance; compliance with the current licenses; and actions related to the Project that affect the public.

The Turners Falls Development and Northfield Mountain Pumped Storage Development are collectively referenced herein as the Project.

1.1 Efficient and Reliable Electric Service

1.1.1 Increase in Capacity or Generation

At the Northfield Mountain Pumped Storage Development, there are four pump-turbines. Units 2, 3, and 4 underwent efficiency improvements with the replacement of the turbine runner, and rewind of the motor generator[1]. A new runner was installed in Unit 1 in 2004, and the rewind is scheduled to commence in August 2015 and end in February 2016. No further modifications are proposed. At the Turners Falls Development, the six Cabot units underwent modifications in the early-to-mid 2000's.

FirstLight currently has no plans to increase capacity of the Project. FirstLight expects to maintain the efficient use of the water to maximize the generation output and provide the region a reliable and sound source of generation.

1.1.2 Coordination with any Upstream or Downstream Water Resource Projects

Headwater Benefits- Connecticut River Mainstem Storage Reservoirs

Inflows to the Turners Falls Impoundment (TFI) are largely controlled by operations at several upstream dams on the Connecticut River. More specifically, five upstream dams operate as seasonal storage reservoirs, where water elevations are typically lowered in the fall and winter, and refilled with the spring freshet. The seasonal operation and re-regulation of discharges from these dams provide benefits to downstream hydropower facilities by curtailing high flows in the spring and increasing low flows in the summer. These dams and storage volumes, in upstream to downstream order, include the following:

- First Connecticut Lake, 3.33 billion ft^3
- Second Connecticut Lake, 506 million ft^3
- Lake Francis, 4.326 billion ft^3
- Moore Reservoir, and 4.97 billion ft^3
- Comerford Reservoir. 1.279 billion ft^3

[1] On August 17, 2011, and supplemented on January 17, 2012, February 14, 2012, and February 24, 2012, FirstLight filed an amendment application to revise the authorized installed capacity of Northfield Mountain. FERC issued an order amending the license and revising annual changes on March 23, 2012.

Pursuant to a 1993 Headwater Benefit Agreement among predecessor companies and TransCanada, FirstLight pays an annual headwater benefit fee to TransCanada for the seasonal operation of its storage reservoirs (primarily driven by Moore Reservoir), which provides an incremental increase in generation at the Turners Falls Development. The Northfield Mountain Pumped Storage Development does not receive any benefit as its operation is independent of river flows.

Headwater Benefits- United States Army Corps of Engineer Storage Projects in Connecticut River Basin

In 1998, FERC issued its order on Headwater Benefits in the Connecticut River Basin. The order notes that because of energy gains at the Turners Falls Hydroelectric Development due to seasonal operation of the United States Corps of Engineers' Union Village, North Hartland, North Springfield, Ball Mountain, Townsend, Otter Brook, Surry Mountain, Tully and Birch Hill headwater storage projects, FirstLight pays an annual headwater benefit fee.

Headwater Benefits- Mascoma River Basin Storage Reservoirs

Pursuant to a 1990 Agreement among predecessor companies and the New Hampshire Water Resources Council, FirstLight pays headwater benefits for the seasonal operation of storage reservoirs located in the Mascoma River Watershed, which provides an incremental increase in generation at the Turners Falls Development. The Mascoma River empties into the Connecticut River near Lebanon, NH.

Other

In addition to the seasonal storage reservoirs, the next three projects (operated by TransCanada) above Turners Falls Dam - namely Vernon, Bellows Falls, and Wilder[2] - operate as peaking hydropower facilities, whereby flows can fluctuate on an hourly basis. Like Turners Falls Dam, the minimum flow required at Vernon Dam is equivalent to 0.2 cfs per square mile of drainage area or 1,250 cfs. The Vernon Hydroelectric Project has a station hydraulic capacity of 17,130 cfs[3] and when operating at full capacity, it exceeds the full hydraulic capacity of the Turners Falls Development of 15,938 cfs, not accounting for incremental inflow from the 897 mi^2 between the two dams. The magnitude and timing of discharges from the Vernon Hydroelectric Project are critical to the operation of the Turners Falls Development and Northfield Mountain Pumped Storage Development.

Article 304[4] of the Vernon Hydroelectric Project FERC license requires TransCanada to coordinate project operations with FirstLight. A letter Agreement amending the original 1993 Headwater Benefit Agreement was filed with FERC on June 20, 2003. The Agreement requires TransCanada to provide FirstLight by 8:00 am each day, with its estimate of total discharge (cfs-hours) expected the next day at the Vernon Hydroelectric Project. When TransCanada receives the hourly dispatch schedule for the next day from the ISO-New England (ISO-NE), it faxes or emails the schedule for Vernon discharges to FirstLight between 1:30 pm and 2:00 pm. There is no current requirement, however, for TransCanada to provide an hourly dispatch schedule the day ahead. If any subsequent dispatch schedules are received during the day showing changes in the projected hourly release schedules, the revised schedule for Vernon is faxed or emailed to FirstLight. Not having reliable and timely estimates of Vernon's hourly release schedule the day ahead

[2] The Vernon Hydroelectric Project (FERC No. 1904), Bellows Hydroelectric Project (FERC No. 1855) and Wilder Hydroelectric Project (FERC No. 1892) are owned and operated by TransCanada.
[3] FERC Order Amending License and Revising Annual Charges, Project No. 1904-042, July 28, 2006.
[4] Article 304 was added to the license in 1992 (59 FERC ¶62,267) and generally requires the Licensee of Project No. 1904 (Vernon Hydroelectric Project) to develop and file with the Commission a coordination agreement with the licensee of certain downstream facilities in the event that the regional central dispatch system was ever discontinued. The dispatching of these hydropower projects under that system was discontinued several years ago in connection with the restructuring of the New England power markets.

prevents FirstLight from the most efficient management of the Turners Falls Impoundment for power production.

1.1.3 Coordination of Operations with Electrical Systems

FirstLight coordinates operation of the Project with other electrical systems through its participation in the markets operated by ISO-NE.

1.2 Need for Project Electricity

1.2.1 Cost and Availability of Alternative Sources of Power

FirstLight is not a utility with retail load obligations. If power from the Project were not available for sale into the markets operated by ISO-NE, the services the Turners Falls Development and Northfield Mountain Pumped Storage Development provide to the grid including peaking generation, capacity, reserve, ancillary services, locational forward reserve market and real-time reserves and regulation would need to be provided from other, existing generation sources or from new generation sources to the system operator.

1.2.2 Increase in Costs if FirstLight is not Granted a License

Costs to the market of replacing services that the Project provides would include reduced efficiency of other generation sources as they would need to modify operations to meet peak daily demand, operating reserve requirements and system ramp needs. Because of the grid stability provided by peaking hydroelectric production, true costs associated with not relicensing the Project are not easily determined.

1.2.3 Effects of Alternative Sources of Power

Effects on Customers

The primary purpose of the Project is to supply energy, capacity, regulation and other ancillary services to the ISO-NE, a regional transmission organization that coordinates the movement of wholesale electricity in Maine, New Hampshire, Vermont, Massachusetts, Connecticut and Rhode Island. The Turners Falls Development generally provides a small amount of electricity from minimum flow releases when power demand is low.

The Northfield Mountain Pumped Storage Development provides important energy, operating reserves and operational flexibility to ISO-New England (ISO-NE) system operation. The fact that ISO-NE, as part of its daily operational planning processes, can rely on the Northfield Mountain Pumped Storage Development to supply these operational flexibilities from a certain fuel supply is of high value to ISO-NE and the New England region. In many periods, this significant supply of operational flexibility has avoided the commitment of many other less flexible resources to provide for a more efficient system dispatch. This peak load ability provides rapid response power resources to the grid to assure reliable operation and prevent regional blackouts.

Storage provides other important reliability benefits to the system. These include helping to manage light load, or excess generation conditions during off peak periods and the ability to respond very quickly to energy and operating reserve activation needs on the power system during any time of the day or year. The value of the Northfield Mountain Project was demonstrated following the August 14, 2003 major blackout in the New York ISO (NY-ISO) grid. On August 15, ISO-NE parted all electrical ties to the New York electrical system to prevent the blackout from spreading further. When it was time to rejoin the two power grids, ISO-NE requested the connection be made at the Northfield Mountain Project. This facility was selected because:

- it is located at the junction of three 345 kV lines;

- it has a major tie line with the NY-ISO;
- the transmission company switchyard located at Northfield Mountain had the equipment necessary to synchronize the two electric grids, and
- the Northfield Mountain Project generators were large enough to make changes in both frequency and voltage.

Once the lines were energized, final adjustments were made by having the Northfield Mountain Project reduce generation to allow for a smooth synchronization of the two systems. The interconnection of the two systems allowed NY-ISO to begin restoration of the north portion of the NY power grid.

The Project provides an important source of electricity during times of peak demand and fast start and fast ramping capability to manage system ramping needs. In order to replace this important service, ISO-NE would need to modify its management of energy production. Alternative sources of power may need to throttle their production levels, which could reduce their overall efficiency.

Effects on the Applicant's Operating and Load Characteristics

Replacing the Turners Falls Development or Northfield Mountain Pumped Storage Development with an alternative facility would result in a change of the system load characteristics by reducing the available offline fast start reserve, peak generation and generation ramping and price responsive demand (pumps). The Turners Falls Development provides ISO-NE with peaking energy, capacity, reserve and ancillary services. The Northfield Mountain Pumped Storage Development provides ISO-NE with peaking energy, capacity, locational forward reserves and real-time reserves, ancillary and regulation services. The above services are beneficial to the reliability and efficiency of the ISO-NE electric grid. Both developments also provide ISO-NE with the ability to bring units to the electric grid quickly in support of a grid disturbance such as a loss of a major unit or other change of load occurrence.

Effects on Communities Served

If FirstLight were not to receive a new license and the Project was taken over by the Federal Government or decommissioned, there would be a significant loss of tax revenues. In 2014, the Project contributed approximately $26.7 million in federal, state and local taxes. The governmental entities affected by this loss in revenue would ultimately have to seek a reduction in expenses or an increase in other sources of revenue.

Additionally, loss of the license may result in a less reliable and efficient energy grid with the absence of the Project. Also, it is likely that many of the Project's recreation facilities would no longer be available to the community.

1.3 Need for Project Power, Reasonable Cost and Availability of Alternative Sources of Power

1.3.1 Average Annual Cost of Power

The average annual cost of the power produced by the Project includes capital costs, operating costs, and costs associated with Project relicensing, including proposed Protection Mitigation and Enhancement (PM&E) measures. As described in Exhibit D, FirstLight has performed an analysis of the costs of producing Project power.

1.3.2 Projected Resources Required to Meet Capacity and Energy Requirements

The Turners Falls Development provides ISO-NE with peaking energy, capacity, reserve and ancillary services. The Northfield Mountain Pumped Storage Development provides ISO-NE with peaking energy, capacity, locational forward reserve market and real-time reserves, ancillary and regulation services.

1.3.3 Resource Analysis and System Reserve Margins

Both the Turners Falls Development and Northfield Mountain Pumped Storage Development operate to produce to peak power and thus are well-suited to meet energy demands as both developments typical operation dictates that it produces power during periods of high demand or periods of high energy ramping needs.

1.3.4 Load Management Measures

Load management is conducted by the ISO-NE, wherein the energy needs on short-term basis are coordinated.

1.4 Use of Power for Applicant-Owned Industrial Facility

FirstLight does not directly use power generated by the Project to operate its own industrial facilities.

1.5 Need for Power if Applicant is an Indian Tribe

FirstLight is not an Indian tribe applying for a project on a tribal reservation; therefore, this section is not applicable.

1.6 Effect of Operations and Planning of the Applicant's Transmission System of Receiving or not Receiving the License

1.6.1 Effects of Power Flow Redistribution

The Applicant does not own or operate a transmission system. However, if FirstLight were not to receive a new license for the Project, ISO-NE would lose a resource that is valuable to its system. For example, on September 2, 2010 ISO-NE was unable to recover a source loss and restore balance over the AC electrical ties with New York within the fifteen minutes required by North American Electric Reliability Corporation reliability standards following a system disturbance. With Northfield available,[5] this likely would not have occurred.[6]

1.6.2 Advantages of the Applicant's Transmission System

The Applicant does not own or operate a transmission system.

1.6.3 Project Single-Line Diagram

Single-line diagrams for Station No. 1 and Cabot which comprise the Turners Falls Development are shown in Figure 1.6.3-1 and 1.6.3-2, respectively. The single-line diagram for the Northfield Mountain Pumped Storage Development is shown in Figure 1.6.3-3.

[5] The Northfield Mountain Project was out of operation from May 1 to November 17, 2010.
[6] This event was reported at the November 17, 2010 NEPOOL Reliability Committee. ISO New England, Inc., September 2, 2010 DCS Event (Nov. 17, 2010), *available at* http://www.iso-ne.com/static-assets/documents/committees/comm_wkgrps/relblty_comm/relblty/mtrls/2010/nov172010/090210_dcs_event.ppt.

1.7 Plans to Modify Existing Project Facilities

At this time, FirstLight has no plans to modify the generation facilities associated with the Project.

1.8 Conformance with a Comprehensive Plan for the Waterway

The Project will be operated under the terms and conditions of a license issued by the Commission, which will be based on the Commission's determination of the license terms and conditions which are best suited to comprehensive development of the waterway. The cumulative environmental impacts of the Project in the context of the Connecticut River Basin are addressed in Exhibit E.

1.9 Financial and Personnel Resources

1.9.1 Financial Resources

FirstLight's parent company, GDF Suez, is one of the world's largest electric utilities. Thus, it has the financial resources to operate the Project during the term of the new license.

1.9.2 Personnel Resources

FirstLight employs approximately 65 full-time people that provide the support needed to operate and maintain the Turners Falls Development and Northfield Mountain Pumped Storage Development. On-site staff are fully qualified to handle all aspects of the operation and maintenance of the Project. Each development is fully equipped to allow staff to perform virtually all routine maintenance functions. All personnel receiving training commensurate with their responsibilities in an ongoing effort to improve their ability to operate the Project in the safest and most efficient manner possible.

In addition to FirstLight employees, FirstLight also contracts with local outside entities to provide maintenance support for the Project.

1.10 Project Expansion Notification

FirstLight currently has no plans to expand the Project to encompass additional lands; therefore notification is not applicable. As described in Exhibit B, FirstLight proposes to increase the useable storage of the Upper Reservoir from 1004.5 feet to 920 feet year-round, for an 84.5 foot drawdown. FirstLight expects to maintain the efficient use of the water to maximize the generation output and provide the region a reliable and sound source of generation.

1.11 Electricity Consumption Efficiency Improvement Program

1.11.1 Customer Energy Efficiency Program

Not applicable. FirstLight does not have load asset customers except wholesale entities.

1.11.2 Compliance of Energy Conservation Programs with Regulatory Requirements

Not applicable.

1.12 Indian Names and Mailing Address

There are no Indian Tribes with lands occupied by the Project or which would otherwise be affected by the relicensing. Nevertheless, FirstLight has included the Narragansett Indian Tribe, Stockbridge-Munsee

Community, Mashpee Wampanoag Tribe, Wampanoag Tribe of Gay Head, and the Nolumbeka Inc. in the distribution of this license application.

2 INFORMATION TO BE SUPPLIED BY APPLICANTS THAT ARE EXISTING LICENSEES

2.1 Measures Planned to Ensure Safe Management, Operation and Maintenance of the Project

2.1.1 Existing and Planned Operation of the Project during Flooding

This information is detailed in Exhibit B of this License Application.

2.1.2 Downstream Warning Devices

FirstLight is in compliance with all Emergency Action Plan (EAP) requirements and has systems in place to notify emergency response teams and homeowners downstream in the unlikely event of a dam breach scenario. The Turners Falls and Northfield Mountain Pumped Storage Developments are monitored from the Northfield Control Room, which is staffed with full-time operators 24 hours/day 365 days/year.

2.1.3 Operational Changes that Might Affect the Emergency Action Plan

No operational changes are proposed that might affect the existing EAP at the Turners Falls and Northfield Mountain Pumped Storage Developments. Each development's EAP is reviewed and tested annually, and updated as required. There are no known or planned changes to either developments' plant operations that would affect the EAP.

FirstLight has sought and received temporary amendments from FERC to utilize more of the Upper Reservoir Storage Capacity by increasing its operating limits from 1000.5 to 938 feet, msl to 1004.5 to 920 ft, msl. As part of this process, FirstLight completed revised Dam Breach Analyses using the as-built condition to store water to elevation 1004.5 msl. The dam breach analysis and inundation mapping were filed and approved by FERC to permit use of the additional storage capacity.

2.1.4 Existing and Planned Monitoring Devices

Both the Turners Falls Hydroelectric Development and the Northfield Mountain Pumped Storage Development (Project) have Surveillance and Monitoring Plans (SMP) filed with FERC. The purpose of the SMP is to describe the existing Surveillance and Monitoring Program for the Project, relate the instrumentation and monitoring to the Potential Failure Mode Analysis (and any identified Potential Failure Modes), and relate the instrumentation and monitoring to design assumptions for the project structures. A separate Dam Safety Surveillance and Monitoring Report (DSSMR) is prepared annually to present data and interpretation for observations and measurements recorded to date, and recommend improvements or changes to the program as appropriate. Since both Developments are subject to 5-year inspections under Part 12D of the FERC regulations, updates to the SMP will be prepared and submitted as needed to the FERC. The SMP is reviewed with the FERC engineer during the annual operation inspection of the Project and reviewed by the Independent Consultant during the 5-year inspection.

2.1.5 Employee Safety and Public Safety Record

FirstLight manages the developments consistent with its long-standing commitment to employee safety. This commitment begins with compliance with applicable local, state, and Federal regulations regarding the safe operation of industrial and electrical facilities. As FirstLight operates the Project's generation facilities, this commitment is implemented primarily through a rigorous safety program adopted by FirstLight. Detailed inspection and maintenance programs ensure employee safety relative to operating

equipment and facilities. The safety program involves employee training sessions, as well as making safety information available to employees. For the 2011 thru 2015 period, there were no lost time incidents at either Development involving FirstLight employees.

FirstLight places a high priority on public safety at both Developments. FirstLight maintains public safety measures (lighting, signage, markers, audible warnings, fencing, etc.) consistent with plans filed with the FERC's New York Regional Office (NYRO). In accordance with 18 CFR 12.10, FirstLight files public safety incident reports with the NYRO.

2.2 Current Operations

Operation of the Project is described in Exhibit B.

2.3 Project History

A complete Project history can be found in Exhibit C of this License Application

2.4 Generation Losses over Previous Five Years

There have been several unscheduled outages at the Turners Falls and Northfield Mountain Pumped Storage Developments during the five-year period of time from 2010-2014 (Table 2.4-1). The table includes outages lasting 24 hours or more at Cabot, Station No. 1 and Northfield.

2.5 Compliance with Terms and Conditions of Existing License

FirstLight has never been found to be in non-compliance with the terms and conditions of the current licenses. Over the term of the current licenses, the Developments have been subject to FERC's standard operational and environmental inspections. Any compliance-related issues noted during the inspections have been promptly addressed by FirstLight.

2.6 Action Affecting the Public

As a major presence in the region, FirstLight plays a prominent role in ensuring the efficient, productive use of water for hydroelectric generation and recreation. The Project also provides electricity that contributes to the stability of the regional power system. This alone significantly affects the general public by providing a low-cost and renewable-energy source to FirstLight's wholesale customers and contributing to the balance of regional power supply and demand.

In addition to operating the Project for hydroelectric generation, FirstLight also manages the Project to provide additional benefits to the local community, natural resources, recreation and the region at large.

Visitors frequent the Project year-round to enjoy the many recreational opportunities available, including boating, fishing, hiking, hunting, and camping. The Project also supports other day-use and overnight-use activities such as wildlife viewing and picnicking. In addition to the benefits that FirstLight provides to the area's natural resources and the recreating public, the Project contributes to the public benefit through the employment of fulltime and seasonal staff.

2.7 Ownership and Operating Expense Reductions if the Project License was Transferred

If the Project license were transferred to another entity, FirstLight's cost of operating and maintaining the Project (see Exhibit D) would be eliminated.

2.8 Annual Fees for Federal or Indian Lands

FirstLight does not pay annual charges for Federal or Indian tribal reservation lands.

Figure 1.6.3-1: Station No. 1 Single Line Electrical Diagram

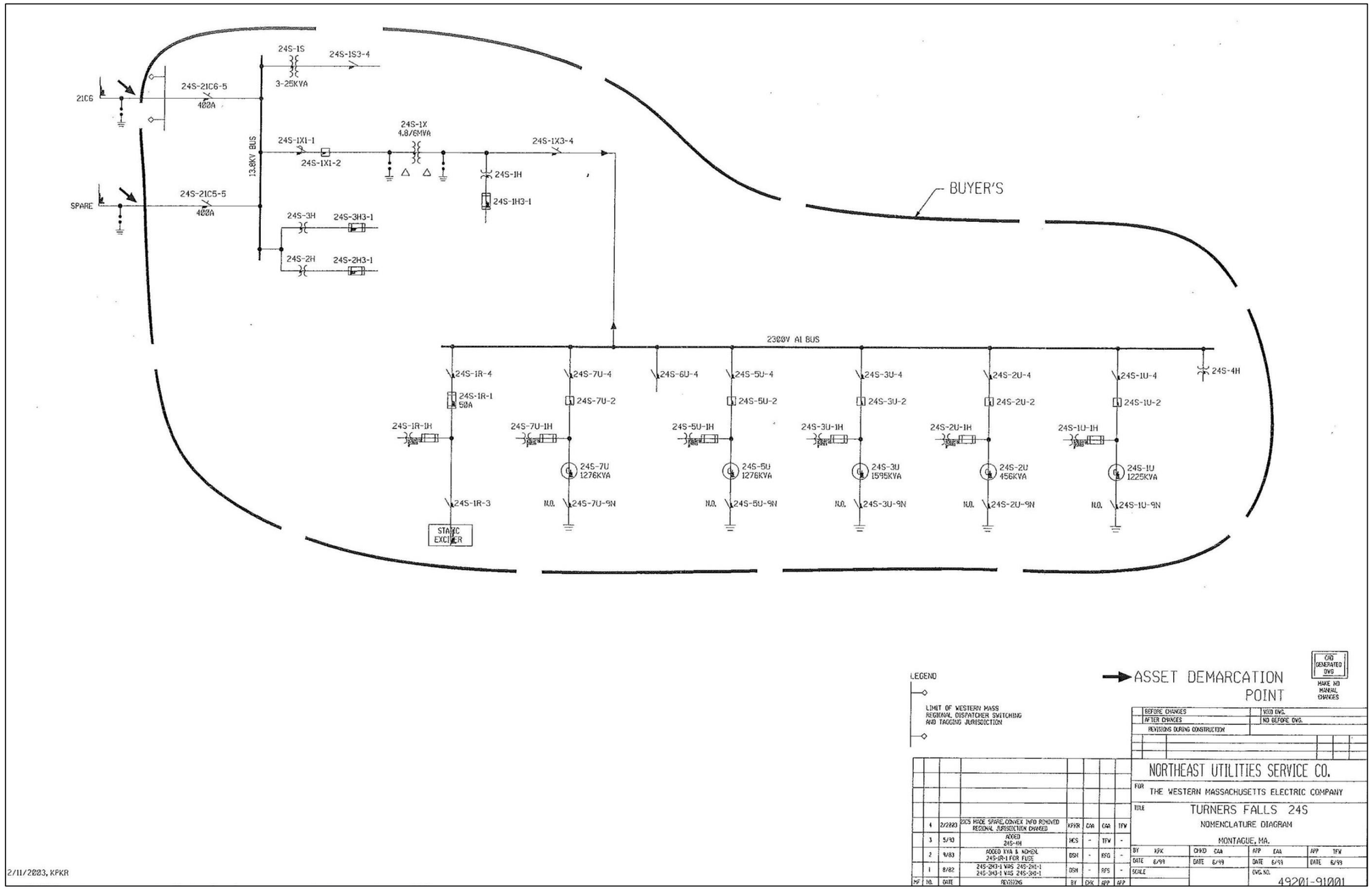

Figure 1.6.3-2: Cabot Station Single Line Electrical Diagram

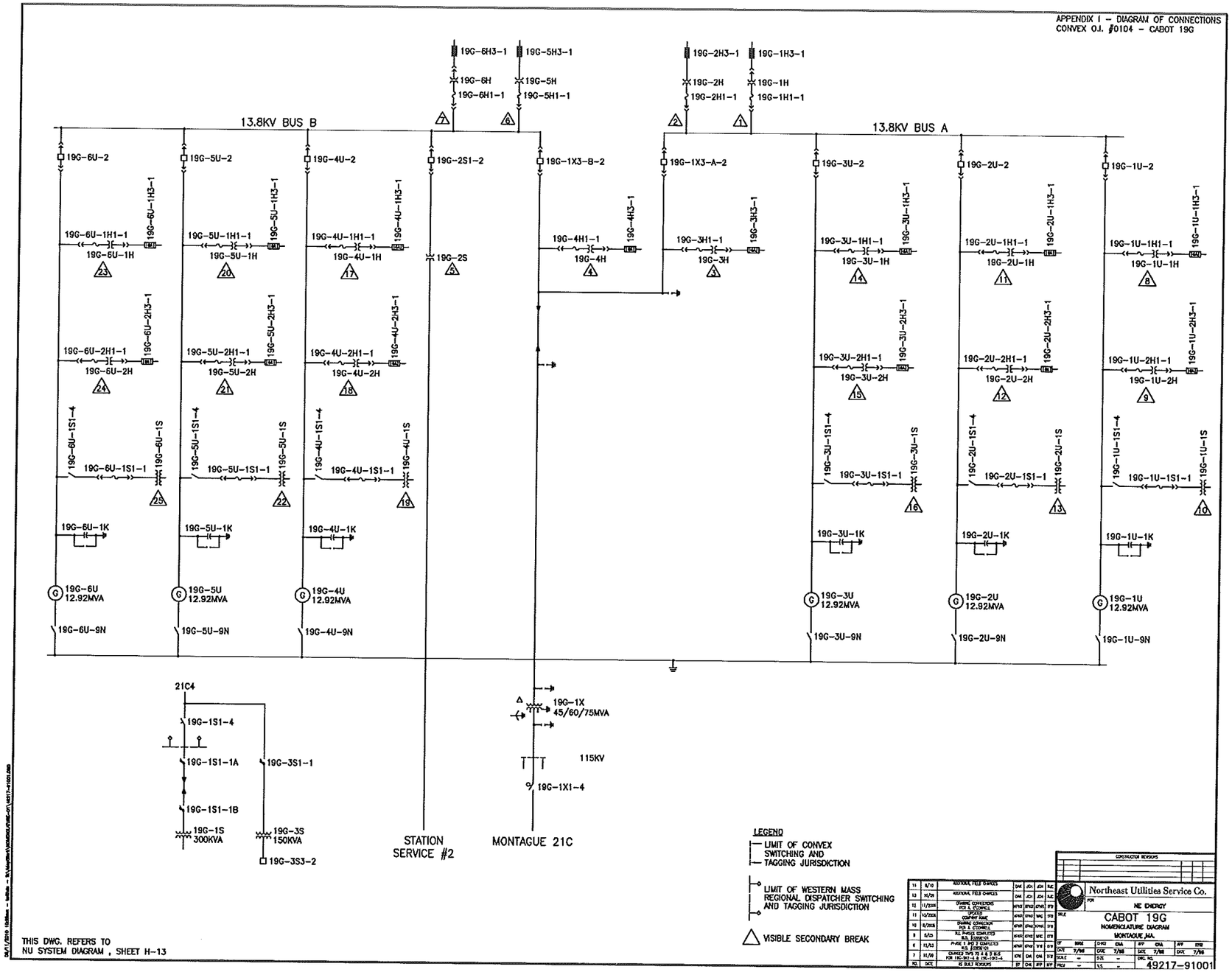

Figure 1.6.3-3: Northfield Mountain Pumped Storage Development Single Line Electrical Diagram

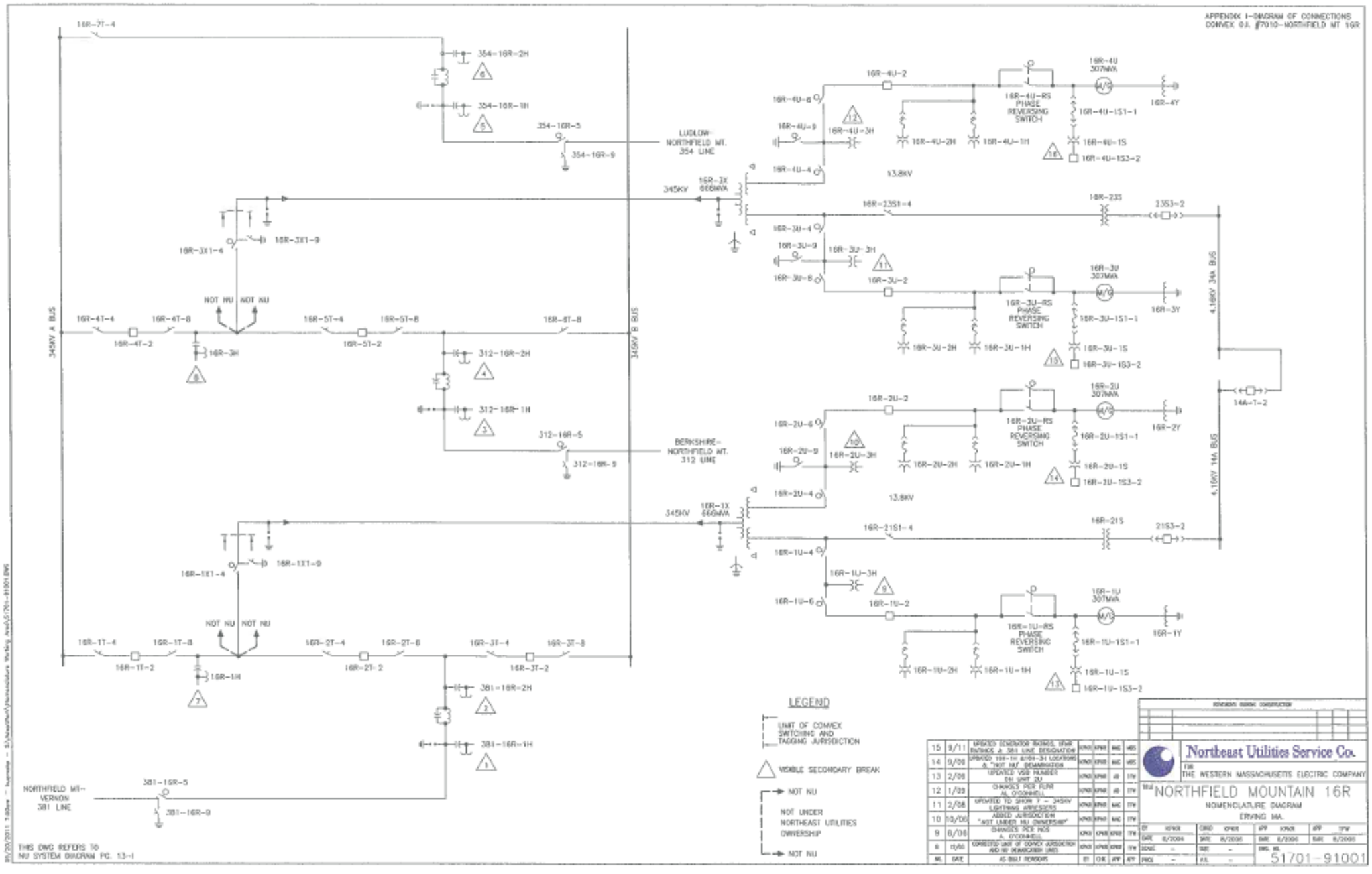

Table 2.4-1: Unscheduled Outages at the Turners Falls Development and Northfield Mountain Pumped Storage Development 2010-2014

Turners Falls Development: Cabot

Date	Description
6/10/2011	Cabot Unit 1: Exciter breaker issue
8/28/2011	Cabot Unit 4, and 6: Excessive Vibration due to High Tailwater (Hurricane Irene)
10/30/2011	Cabot Unit 1: Base excitor breaker issue
10/4/2014	Cabot Unit 1: Governor Problem
10/4/2014	Cabot Unit 3: Penstock Gunite Repair

Turners Falls Development: Station No. 1

Date	Description
1/1/2010	Station No. 1 Unit 2: Loss of excitation relay- moved to Unit 7
7/22/2011	Station No. 1 Unit 2: Governor issue
9/18/2011	Station No. 1 Unit 2: Governor pumping unit issue
10/31/2011	Station No. 1 Unit 2: Used RPM meter on Unit 1
10/31/2011	Station No. 1 Unit 1: Bad RPM meter
8/17/2012	Station No. 1 Unit 2: Loss of field relay failed
8/24/2012	Station No. 1 Unit 1: Inspection of Draft Tubes
2/8/2013	Station No. 1 Unit 7: Batteries bad on governor
9/11/2013	Station No. 1 Units 1, 2, 3, 5, 7 : High humidity caused condensation build up on the stator and rotor, grounding unit

Northfield Mountain Pumped Storage Development

Year	Description
5/23/2010	Northfield Unit 1, 2, 3, 4: Upper Reservoir Unwatering
12/6/2010	Northfield Unit 2: Gate seal inspection
1/7/2012	Northfield Unit 4: Check on depression air issue
5/3/2012	Northfield Unit 1: Unit tripped due to overheated turbine bearing
8/27/2012	Northfield Unit 3: Upper guide heat exchanger leaking water

Document Content(s)