Relicensing Study 3.3.6

IMPACT OF PROJECT OPERATIONS ON SHAD SPAWNING, SPAWNING HABITAT AND EGG DEPOSITION IN THE AREA OF THE NORTHFIELD MOUNTAIN AND TURNERS FALLS PROJECTS

Updated Study Report Summary

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

Prepared for:

FirstLight
GDF SUEZ

Prepared by:

Kleinschmidt

Gomez and Sullivan Engineers

SEPTEMBER 2015

1.1 Study Summary

The purpose of this study is to determine if project operations affect shad spawning site use and availability, spawning habitat quantity and quality, and spawning activity in the river reaches that extend from the base of Vernon Dam to the Route 116 Bridge in Sunderland.

Specifically, the shad spawning study is intended to:

- Determine areas utilized by shad for spawning by conducting night-time visual and aural observation of spawning activity;
- Identify and define those areas geospatially, and obtain data on physical habitat conditions affected by project operations (e.g., water depth, velocity, discharge, substrate, exposure and inundation of habitats);
- Collect information in order to assess project operation effects on observed spawning activity, under a range of permitted or proposed project operation conditions;
- Quantify effects (e.g., water velocity, depths, inundation, exposure of habitats) of project operation on identified spawning areas for a range of conditions, over the complete period of spawning activity; and
- Verify spawning activity as measured by night-time spawning/splash surveys in areas of spawning activity, and downstream of these areas, to gather data to determine project operation effects (location extent of exposure from changing water levels and flows and on associated habitats from project operations).

Consultation: On February 21, 2014, the Federal Energy Regulatory Commission (FERC) issued its second Study Plan Determination Letter (SPDL), which required FirstLight to modify its Revised Study Plan (RSP) Study No. 3.3.6 in consultation with stakeholders. FirstLight filed a modified RSP with its Initial Study Report (ISR). FERC's Determination on Requests for Study Modifications and New Studies issued on January 22, 2015 required further modifications to the RSP to include the power canal in the shad spawning survey area. FERC's determination also acknowledged that water temperature data proposed to be collected as part of the study and as part of Study No. 3.2.1 should be sufficient to compare water temperature values and trends across spawning areas.

On February 4, 2015 a meeting was held with FERC staff, USFWS, MADFW, NMFS, and other non-government stakeholders at the Hampton Inn in Greenfield to discuss the Shad Spawning Study. Following this meeting, FirstLight developed a more detailed field monitoring plan. On March 18, 2015 FirstLight circulated a modified RSP to the stakeholders. On March 24, 2015 a meeting was held with the same stakeholders at the Hampton Inn in Greenfield to discuss the modified RSP. Based on comments received at this meeting, another version of the RSP was sent to stakeholders on April 8, 2015. A conference call was held with stakeholders on April 22, 2015 and a final RSP was completed on April 27, 2015.

1.2 Study Progress Summary

Task 1: Development of a Detailed Study Design

FirstLight developed a hydraulic model of the Connecticut River from the Turners Falls Dam to the Holyoke Dam- see Study No. 3.2.2 *Hydraulic Studies of Turners Falls Impoundment, Bypass Reach, and below Cabot Station*. The report was posted to the northfieldrelicensing.com website on March 31, 2015. The hydraulic model, run in an unsteady mode to simulate peaking operations from Cabot station, was used to predict water surface elevations (WSELs) in this reach under historic flow ranges during the spawning season. These will be used to provide an indication of areas that potentially become dewatered under certain operational scenarios. Spawning sites and associated environmental data collected in Task 2 will be used

in conjunction with the hydraulic model to predict the WSEL at spawning sites over a range of operating conditions and to identify potentially dewatered spawning habitat, which will be analyzed in the Final Report, anticipated to be filed by March 1, 2016.

Counts of shad passed at the Holyoke Dam and Turners Falls were tracked to pinpoint the most effective timing for field surveys. Concurrent adult shad telemetry studies were also used to provide insight as to the location of spawning shad.

Task 2: Examination of Known Spawning Areas between Cabot Station and Route 116 Bridge

Field surveys were conducted in two phases at night by boat during the anticipated spawning period; timing and flow regimes were determined based on information collected in Task 1; Phase 1 identified locations where shad were actively spawning, and information was collected to evaluate project effects in Phase 2. Field surveys began on May 13, 2015 after 10,000 shad had passed the Holyoke Project and continued through June 22, 2015 when upstream movements of shad had ceased and observed spawning activity had greatly tapered off. Field surveys were generally conducted 2-3 times a week during the sampling period, however in some instances, high river flows or severe weather prevented surveys from being conducted (Table 1).

Table 1. Field Sampling Dates.

Week	Sample Date	Task/Phase	Comments
Week 1	5/13/2015, 5/14/2015	T2/P1	
Week 2	5/19/2015, 5/20/2015, 5/21/2015	T2/P2, T3, T4	
Week 3	5/26/2015, 5/27/2015, 5/28/2015	T2/P2, T3, T4	No T3 sample on 5/28/2015 due to failed outboard motor
Week 4	6/4/2015	T2/P2, T3, T4	Remaining Week 4 samples cancelled due to high flows
Week 5	6/8/2015, 6/9/2015, 6/10/2015	T2/P2, T3, T4	
Week 6	6/16/2015, 6/17/2015, 6/18/2015	T2/P2, T3, T4	
Week 7	6/22/2015	T2/P2, T3, T4	Remaining Week 7 samples cancelled due to high flows

Phase 1 Field Work from Cabot Station to Route 116 Bridge

During the first two weeks of the survey (weeks of May 11th and 18th) Phase 1 field work was conducted in order to determine if areas that historically supported shad spawning were still active, as well as identify other locations where spawning occurs. On each sampling event, a two person field crew surveyed the stretch of river between Cabot Station and the Route 116 Bridge by boat. Starting locations were varied to ensure that the results were not biased by visiting the same site at the same time of day every time. When the field crew observed surface splashing potentially indicating spawning activity, spotlights were used to verify that such splashes were made by spawning American shad. At each location where spawning American shad were encountered, their general behavior (e.g., darting, circling, rolling, grouping) was observed and the number of splashes within a 15 minute period was counted as an index of spawning activity. Shown in Figure 1 are the historic spawning areas as well as the spawning locations observed in 2015 as part of this study.

During each sampled spawning event the number of splashes was recorded by each observer and combined into an average count. The general surface area over which each spawning event occurred was estimated and recorded with a GPS unit (Figure 1). Additionally, the sample date, start and end time, water temperature, dissolved oxygen, pH, conductivity, turbidity, depth, surface velocity, and predominant substrate type, when visible, were observed and recorded at each spawning location. Data is currently being analyzed.

Phase 2 Field Work from Cabot Station to Route 116 Bridge

Between the weeks of May 25th and June 22nd, Phase 2 field surveys were conducted to determine the impacts of flow fluctuations on shad spawning locations identified in Phase 1. Shad were located and behavioral observations and environmental conditions (including splash observations, water quality parameters, depth, surface velocity, predominant substrate type, and location) were recorded using the procedures outlined in Phase 1. After documenting conditions, Cabot Station operators were contacted to change operations by bringing on or dropping units. Generation changes of +/- 10 Mw (2,288 cfs) and +/- 20 Mw (4,576 cfs) were made throughout the study. After flow conditions were altered, the field crew waited a minimum of 20 minutes to allow for the new flow rate to stabilize before recording behavioral and environmental conditions again in the same location. Behavioral and environmental data recorded before and after generation manipulations will be used to investigate the potential impacts of operations on spawning across a range of seasonal flows. Data is currently being analyzed.

Task 3: Identification of Spawning Areas in the Turners Falls Impoundment

Beginning the week of May 18th, the Turners Falls Impoundment was surveyed to identify shad spawning areas using the same methodology as described in the Task 2 Phase 1 work above. Shown in Figure 2 are the spawning locations observed in the Turners Falls Impoundment. Shad spawning locations were recorded with a GPS unit. Additionally, after each observed spawning event, a 1-meter long ichthyoplankton net 333 micron mesh was towed for 10 minutes, the net was retrieved, and the contents were preserved for subsequent analysis and identification of shad eggs. Identification of shad eggs will be in accordance with existing literature and will rely on methods of Ross and Bennet (1993) for distinction from white sucker eggs.

A calibrated hydraulic model of the Impoundment was developed and will be used to determine if shad spawning habitat is dewatered as described in Task 1.

Task 4: Identification of Spawning Areas in Turners Falls Canal, Rock Dam and Station No. 1

Beginning the week of May 18th, the Turners Falls Canal as well as sections of the bypass reach were surveyed to identify shad spawning locations. Shown in Figure 3 are the historic spawning areas as well as the spawning locations observed in 2015 as part of this study. During each survey event, the crew walked along the length of the canal, to the extent possible, to determine if shad utilize the canal for spawning activities. Due to safety concerns, only two locations (Rock Dam and Station No. 1) were visited in the bypass channel during shad spawning surveys. Rock Dam was accessed via a well-traveled footpath off Migratory Way. The area just upstream and downstream from the Rock Dam vantage point was evaluated for spawning activity. Located on Power Street, the area just upstream and downstream from the Station 1 tailrace was also evaluated for spawning activity. The canal survey and Rock Dam/Station No. 1 surveys identified spawning areas via splash observations consistent with Phase 1 of Task 2.

When spawning shad were observed, splashes over 15-minute intervals were recorded, as well as time of day and an estimate of the surface area over which the spawning activity occurred. Water quality, depth, and velocity data at the spawning location were not collected due to inaccessibility.

Task 5: Examination of Identified Spawning Areas in Turners Falls Canal

Because minimal shad spawning activity (a single event with an average of 9.5 splashes over a 15 minute period) was observed in the Turners Falls Canal (see Figure 3), no identified spawning areas in the canal were identified for further examination.

Task 6: Data Analysis and Reporting

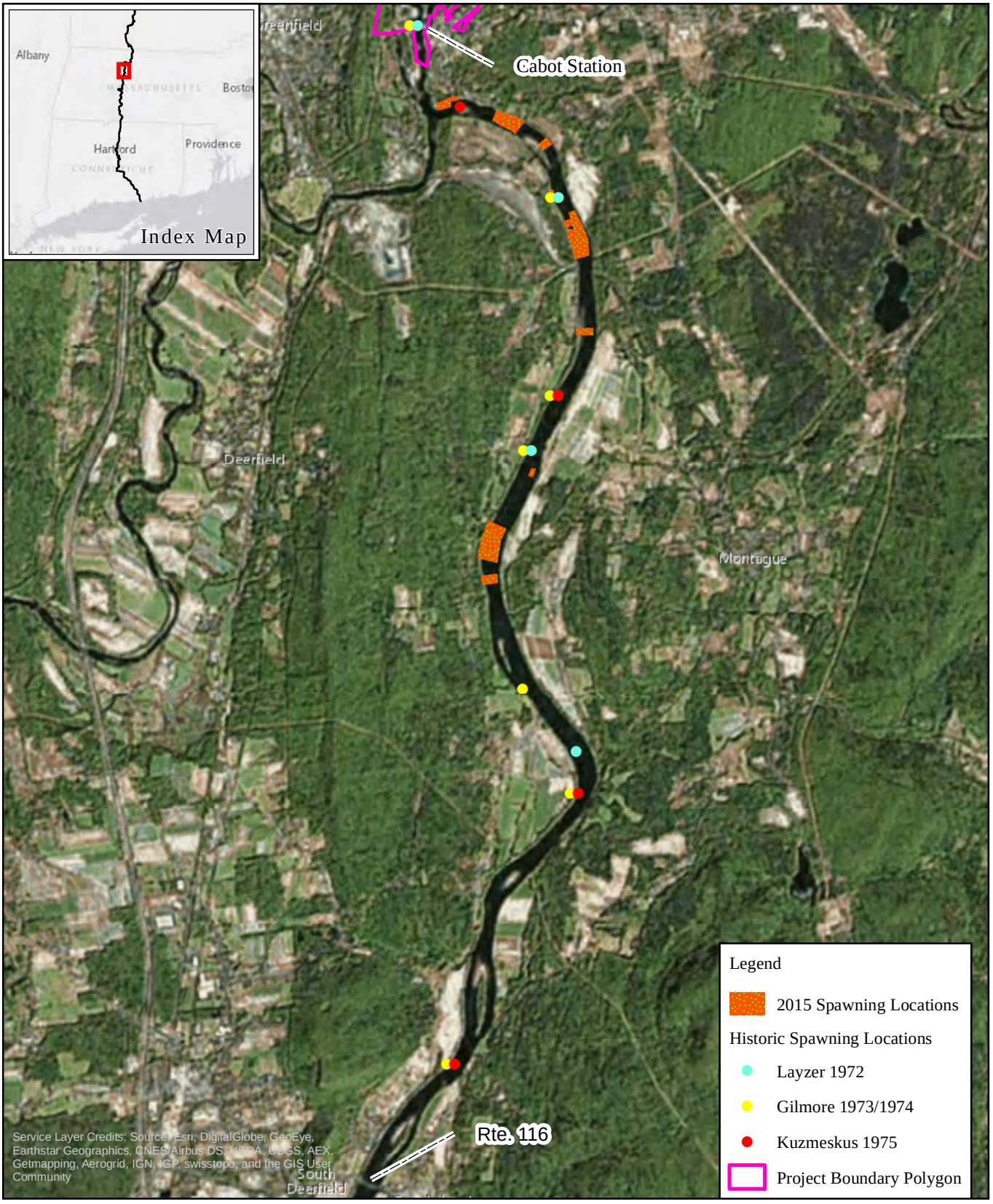
Information collected during this study will be compiled and presented in a report, which will include a map of the study area depicting the locations of observed spawning shad; materials and methods; results; a discussion of observed spawning behaviors; and, if applicable, impacts due to operational changes.

1.3 Variances from Study Plan and Schedule

- Since minimal shad spawning activity was observed in the canal in Task 4 of this study, no further examination of the canal for spawning activity was conducted.

1.4 Remaining Activities

- Data Analysis
- Final Report will be submitted by March 1, 2016.



FirstLight GDF SUEZ

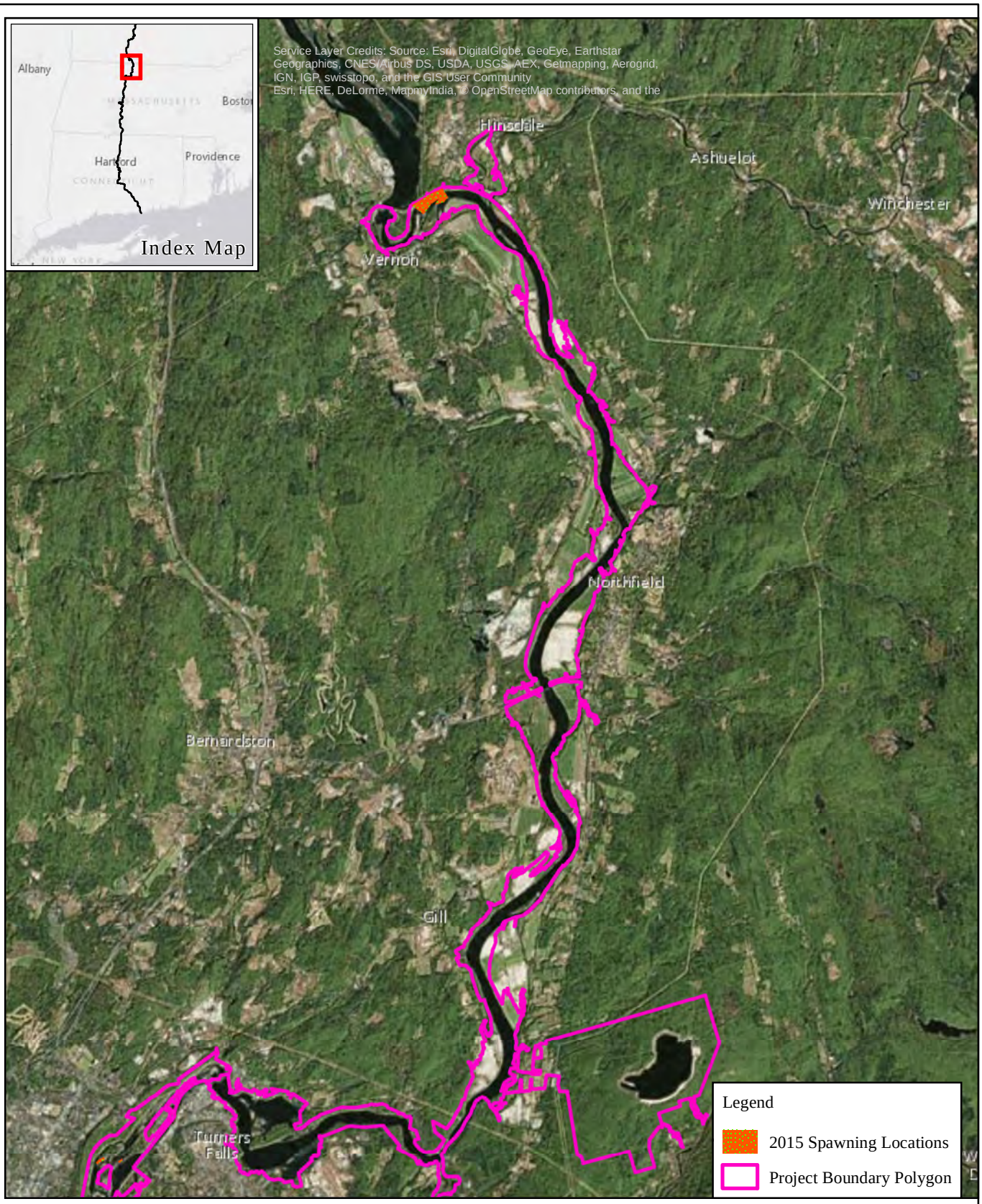
Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)
RELICENSING STUDY 3.3.6

N

0 0.5 1 2 Miles

Figure 1
Historic and 2015 shad spawning locations between Cabot Station and the Route 116 Bridge.

Path: W:\gis\studies\3_3_06\maps\USR_Summary\Figure_1.mxd



FirstLight™
GDF SUEZ

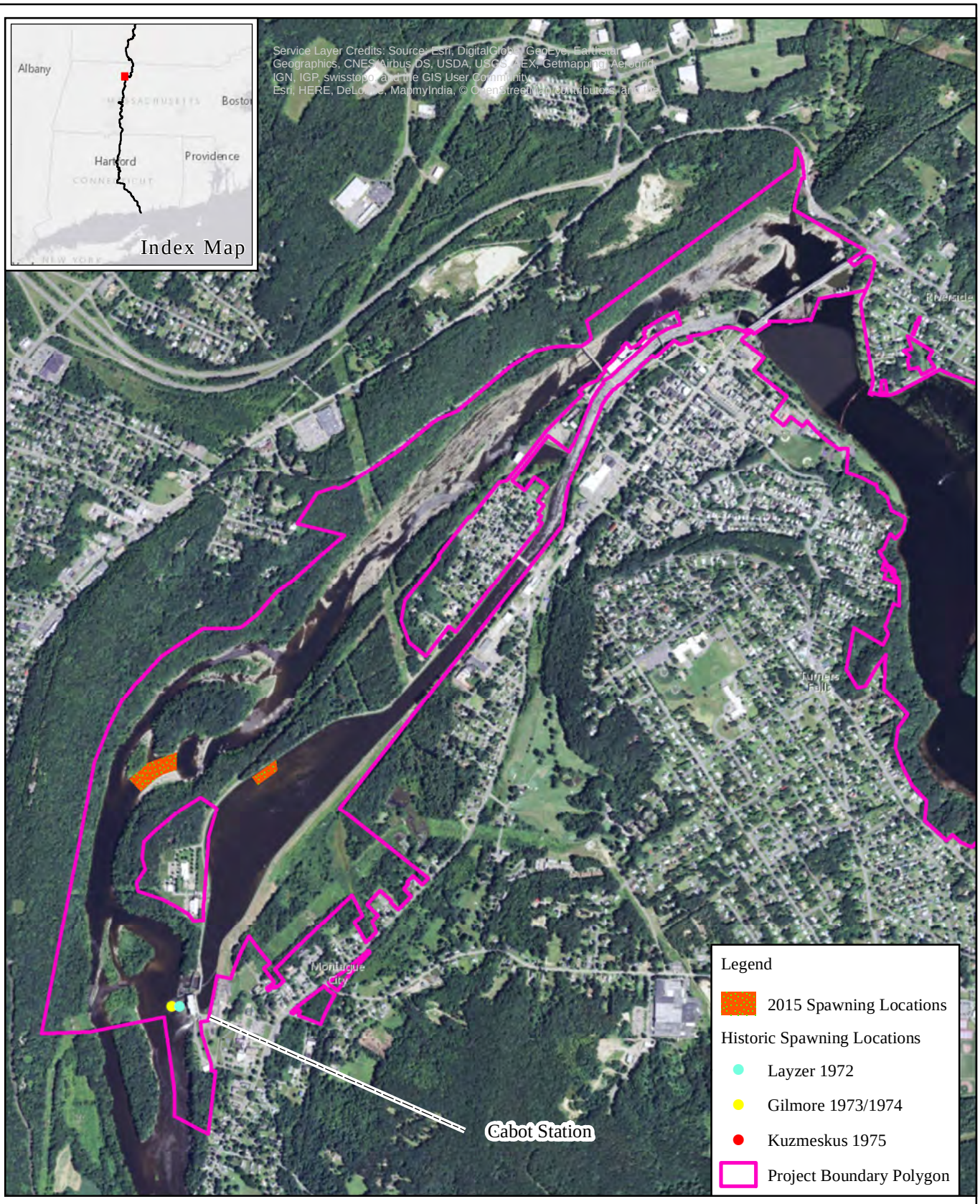
Northfield Mountain Pumped Storage Project (No. 2485) and Turners Falls Hydroelectric Project (No. 1889)
RELICENSING STUDY 3.3.6

N

0 0.75 1.5 3 Miles

Figure 2
Shad spawning location identified in
Turners Falls Impoundment

Path: W:\gis\studies\3_3_06\maps\USR_Summary\Figure_2.mxd



FirstLight™
GDF SUEZ

Northfield Mountain Pumped Storage Project (No. 2485)
and Turners Falls Hydroelectric Project (No. 1889)
RELICENSING STUDY 3.3.6

N

0 0.15 0.3 0.6 Miles

Figure 3
Shad spawning location identified in Turners Falls and Bypass Reach

Path: W:\gis\studies\3_3_06\maps\USR_Summary\Figure_3.mxd