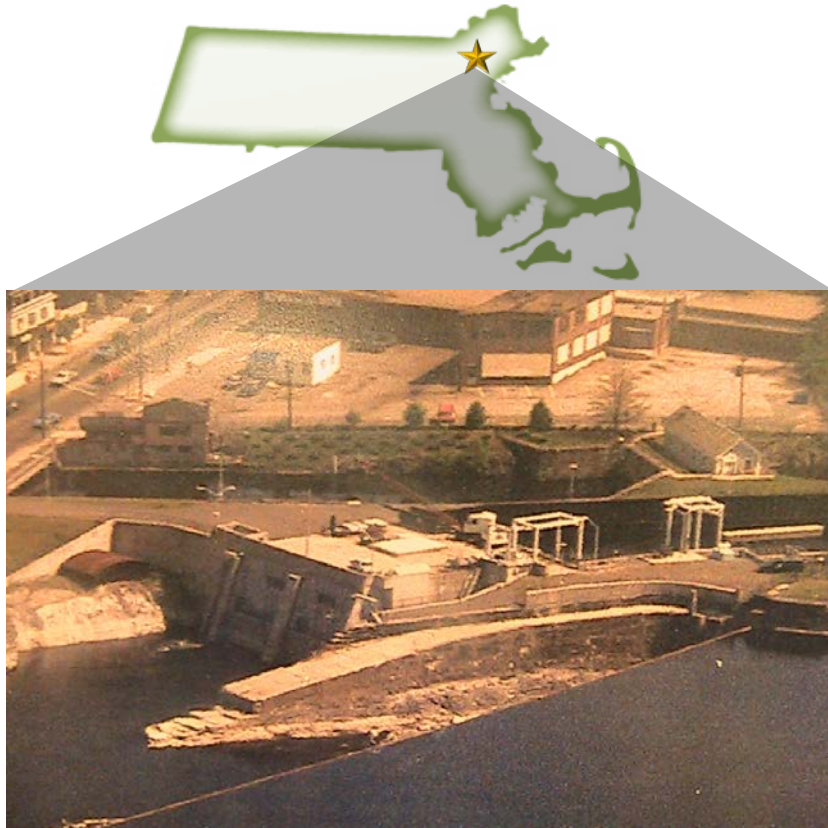


Full Application Review for Low Impact Hydropower Certification of Lawrence Hydroelectric Facility



Prepared by Peter Drown, Cleantech Analytics LLC

June 25, 2015

Cleantech
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I. Executive Summary

This report reviews the Certification Application for the Lawrence Hydroelectric Project (“Lawrence”) located on River Mile 31 of the Merrimack River in Lawrence, MA. Renewable Power Consulting, PA, on behalf of the project owner, Lawrence Hydroelectric Associates, a subsidiary of ENEL Green Power North America, Inc., submitted an application for Low Impact Certification to the Low Impact Hydropower Institute (“LIHI”) on February 27, 2015, along with supporting documentation. Lawrence is a 16.8 MW hydroelectric facility and consists of a dam, two power canals, fish passage facilities, powerhouse containing two 8.4 MW generating units, tailrace channel, and appurtenant facilities. The project received a FERC License (#2800) on December 4, 1978, and subsequent amendments on August 14, 1980 and June 19, 2007 for modifications described later in the report. The current license expires on November 30, 2028. Average annual generation is 64.6 GWh.

The 116-mile-long Merrimack River begins at the confluence of the Winnepesaukee and Pemigewasset rivers in Franklin, New Hampshire, flows southward into Massachusetts, and then travels northeast until it discharges into the Atlantic Ocean. The River and its tributaries have many hydroelectric projects throughout the traversed watersheds, reflecting the significant amount of industrial activities that originally took place in the towns supported by the River. Lawrence is the first facility upstream of the Atlantic Ocean, located 27 miles from the confluence in Newburyport, and 10 miles downstream of the 21 MW Boott Hydroelectric Facility in Lowell, also owned by ENEL Green Power. The stretch of the Merrimack River upstream and downstream of Lawrence are designated on the 303(d) list for Massachusetts, although these water quality issues are not attributable to the existence or operation of the project. Bald Eagle are known to nest in this region of Massachusetts, although it is unlikely they are near Lawrence due to its heavily urban location. No compliance issues were noted on the FERC e-library.

Lawrence Hydroelectric Associates (LHA,) the project’s operator, included fish passage facilities during the project’s original construction in 1980, and has continued to add new facilities and operational protocols when requested by agencies throughout the project’s history. Fish count data has shown steady improvements in the passage of American Shad and River Herring, while Atlantic Salmon counts have decreased¹. Operation of the fish passage facilities are governed by a FERC-approved Comprehensive Fish Passage Plan, and often change from year-to-year when requested by agencies based off flows and other river conditions. Conversations with Resource Agencies conducted throughout the course of this certification showed that Lawrence is a facility that is in compliance with requirements and has made incremental improvements over several years to reduce the environmental impact of its operations. Massachusetts Department of Fish and Wildlife reported that the project has made steady improvements in American Shad and River Herring, and has been adjusting location and operation of the eelway to improve effectiveness. The agency noted that flows at the facility were adequately protective of aquatic resources, and any significant changes in operations or new passage measures are not anticipated until the project’s relicensing.

¹ This is not unique to the Lawrence Project, or the Merrimack River. Atlantic Salmon stocking efforts have been discontinued by agencies in 2013, driven by low annual sea-run salmon returns and accelerated by budget cuts and shifting priorities to other species.

II. Recommendation

After review and consideration of the information provided by applicant, review of the FERC record, and conversations with agencies as noted in the Communications Log (Section VIII), **I believe the Lawrence Hydroelectric Project meets LIHI criteria for Low Impact Certification, and recommend this project is certified, subject to the following conditions:**

- Applicant will obtain a final letter from Massachusetts Department of Fish and Wildlife (or other agency recommended by MDFW) that confirms the facility and facility operations have no negative impact on the existence of Bald Eagle in the area, by August 1, 2015.
- Applicant will work with MDFW to improve effectiveness of eel passage at the site by July 15, 2016. This includes keeping elvers off dam by eliminating or rerouting leakage. Applicant will obtain letter from MDFW by July 15, 2016 that confirms passage measures are adequate.

III. Facility Description

The Lawrence Project is located on the Merrimack River on Mile 31 in the city of Lawrence, MA. The Project is located approximately 10 miles downstream of the Lowell Project and approximately 27 miles upstream of the Atlantic Ocean, comprising the first upstream facility on the Merrimack River. The 116-mile-long River begins at the confluence of the Winnepesaukee and Pemigewasset rivers in Franklin, New Hampshire, flows southward into Massachusetts, and then travels northeast until it discharges into the Atlantic Ocean. Several other rivers feed into the Merrimack throughout its course (see Figure 1.) The river drains a 5,010 square mile watershed throughout New Hampshire and north-eastern Massachusetts (comprising the largest watershed in New Hampshire.)



Figure 1 - Merrimack River Watershed

The Merrimack River has supported a wide variety of industrial and anthropogenic uses, including waste assimilation, drinking water (second largest surface drinking water source in New England,) hydropower production, recreation, etc. As a result, many towns have been built along its banks, particularly in the lower Merrimack River from Manchester, NH downstream. Between the confluence with the Atlantic Ocean and Lawrence, the river is affected by ocean tides. Salt water extends up to 10 miles and the river current can reverse in this area, depending on tide height and river flows. In low flow periods (typically during late summer,) water level in the Merrimack can be affected by tides for the entire stretch from the Lawrence Project to the Atlantic Ocean. Flows near the Lawrence Project are recorded by the closest gauge several miles upstream and show a low flow of 3,070 CFS in August to a high flow of 19,500 CFS in April (1923 – present.) The Project is required to operate in run-of-river mode, maintained through use of automatic Pond Level

Control (PLC) and has minimal bypass reach since the powerhouse is located adjacent to the dam. However, several flow modifications are required due to resource agency requirements: (1) 120 cfs attraction flow for fish elevator and (2) closure of South Canal annually during spring and fall outmigration seasons.

The Lawrence Project is a 16.8 MW hydroelectric facility and consists of (1) a 33-foot high, 900-foot-long dam of rubble masonry construction with five-foot-high inflatable flashboard system; (2) a 9.8-mile-long reservoir having a surface area of 655 acres at normal high water elevation 44.17 feet mean sea level (msl) and a maximum storage capacity of approximately 19,900 acre-feet; (3) the existing South Canal approximately 35 feet wide and 10 feet deep, originating at the south abutment of the Essex Dam and generally paralleling the Merrimack River bed, below the Essex Dam, for a distance of approximately 2,750 feet; (4) the existing North Canal, approximately 95 feet wide and 15 feet deep, originating at the north abutment of the dam and paralleling the Merrimack River below the dam for a distance of approximately 5,300 feet; (5) fish passage facilities including a fish elevator installed at the dam, a downstream fish bypass and an eel ladder; (6) a powerhouse containing two 8.4 MW hydroelectric generating units and a tailrace channel extending into the Merrimack River Channel; and (7) appurtenant facilities.



Figure 2 - Lawrence Reservoir (looking upstream)



Figure 3 - Lawrence Impoundment (spill conditions)



Figure 4 - Lawrence Powerhouse and Tailrace

The Project is located in the town of Lawrence, a town of 78,000 residents in a 7 square mile, heavily developed area surrounded by industrial activity. The project and the two canals on either side were the major economic driver that gave rise to the city as a textile producer in the late 1800s. Today, the city maintains its status as a manufacturer, producing electronic equipment, textiles, footwear (New Balance factory,) paper products, computers, and foodstuffs. Lawrence faces challenging economic and demographic trends, with a high crime rate, poor education attainment, and high unemployment. The urban industrial area extends to the riverbank almost continuously from Lawrence downstream to Haverhill (approximately 8 miles), and upstream (with small breaks,) to Lowell, MA (approximately 9 miles.) Water quality in this area is designated as Class 5, “Impaired” and included on the state’s 303(d) list. Despite this designation, recreational activity, including boating and fishing, remain popular in the project’s vicinity.

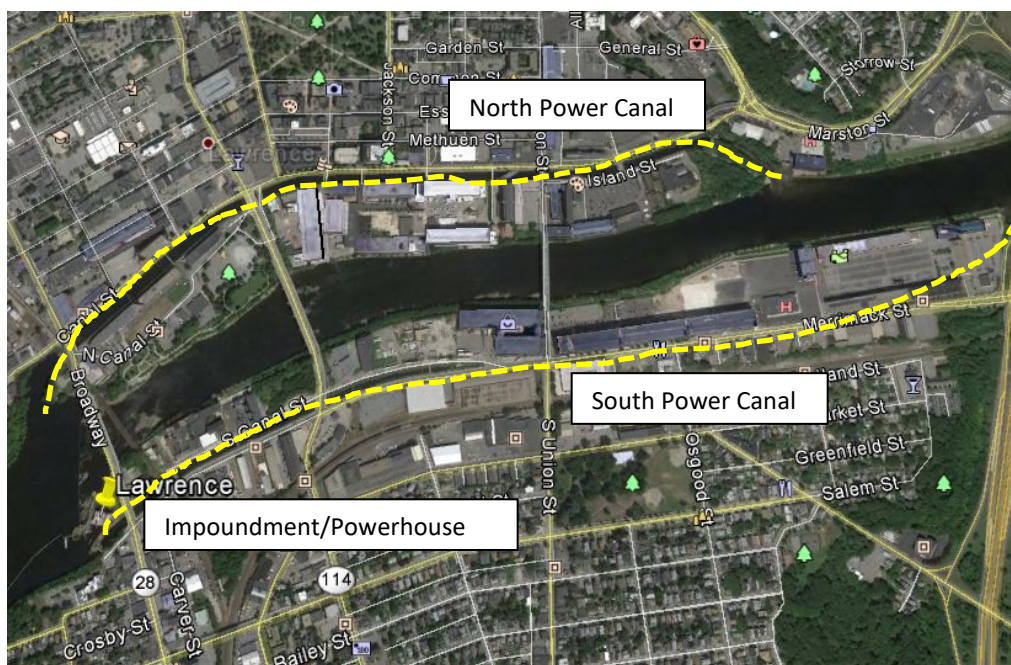


Figure 5 - Lawrence Hydroelectric Project Site Layout

IV. Regulatory Status

The Lawrence Hydroelectric Associates and the Essex Company jointly received a 50-year license (FERC #2800) to develop the Lawrence Hydroelectric Facility on December 1, 1978, and expiring on November 30, 2028. LHA was responsible for construction and operation of the project, and the Essex Company owned the water rights and easements for the proposed project. The project was built at the site of the existing “Great Stone Dam,” a historic structure built in the late 1800s to harness the power of the Merrimack to support an industrial base in Lawrence, MA. The Project received a Water Quality Certification on July 5, 1978, which provided a minimum flow release (951 CFS) adequate to maintain the status of the class “B” designation. The Project was developed in 1981 and acquired in 1986 by ENEL Green Power North America (LHA is now a subsidiary of ENEL.)

As the first facility upstream (and last downstream) on the Merrimack River prior to its confluence with the Atlantic Ocean, fish passage effectiveness at this facility is a priority to resource agencies. The project’s initial installation of fish passage facilities included an upstream fish lift, and subsequent requests by agencies have been met, including downstream bypass facilities, inflatable flashboards, upstream eel passage facilities, and operational protocols that often vary from year to year. Agency staff monitors and records the effectiveness of passage at the site, and data has shown the results have been steadily improving (See Detailed Criteria for “Fish Passage.”) Caleb Slater, Anadromous Fish Project Leader for Massachusetts Division of Fisheries and Wildlife (MDFW) was contacted during this review process. His comments are included in the Detailed Criteria, but essentially confirmed that the project has been achieving good success with passage of anadromous species (American Shad and River

Herring) and has achieved some moderate success with the passage of catadromous fish (American Eel) although ongoing efforts to improve passage are requested.

In 2012, the stretch upstream and downstream of the Lawrence Facility was designated at “Class 5 – Impaired or Threatened and requiring a TMDL,” by the Massachusetts Division of Watershed Management. This designation constitutes the 303(d) list for Massachusetts. The list noted the various reasons for the classification, which relate to PCBs, Phosphorous, and Bacteria present, and the causes are unrelated to the operation of the facility. Robert Kubit from the Massachusetts Department of Environmental Protection (MADEP) confirmed that the existence and/or operation of the facility did not affect the decision to list this body of water as “Impaired.” The current impairments are attributable to municipal point source discharges and atmospheric depositions.

The Facility has received two license amendments. On August 14, 1980, the Licensee accepted a proposed amendment from FERC that permitted the Licensee to grant permission for certain uses of project lands and waters and to convey certain interest in project lands without prior Commission approval, if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. On June 19, 2007, FERC amended the license to allow LHA to replace existing wooden flashboards on the crest of the project’s impoundment with an inflatable flashboard system.

V. Detailed Criteria Review

A.) Flows

1. *Is the Facility in Compliance with Resource Agency Recommendations issued after December 31, 1986 regarding flow conditions for fish and wildlife protection, mitigation and enhancement (including in-stream flows, ramping and peaking rate conditions, and seasonal and episodic instream flow variations) for both the reach below the tailrace and all bypassed reaches?*

The minimum flow for this project was established in the Water Quality Certificate issued July 5, 1978, and requires minimum flow of 951 CFS continuously released from impoundment behind the dam by “whatever means or combination of means necessary...unless or until the pool elevation behind the dam is so drawn down that it reaches the crest of the dam.” (There is minimal bypass reach at this project as the powerhouse is located adjacent to the impoundment.) During the period the flow is less than 951 CFS, outflow is required to equal inflow as recorded at upstream Lowell gage, and when flow exceeds 951 CFS the excess flow can be used to refill impoundment to top of the flashboards. Lawrence is located approximately two miles upstream of the Greater Lawrence Sanitary District Wastewater Treatment Plant, and the flow was required to ensure that the effluent from that plant during low flow conditions would not violate the class “B” classification of the Merrimack River. As mentioned in A.2 and A.3 below, it is highly unlikely that at any time the facility experiences flows less than 951 CFS, given the fact that the low flow month (August) for the nearest river gage upstream of the project experiences average flows of 3,070 CFS.

Lawrence Hydroelectric Associates has submitted annual minimum flow compliance statements to FERC, including the most recent for 2014.

In addition, there are several operational protocols developed in the Lawrence Comprehensive Fish Passage Plan (2000,) that effect flow operations at the site. This includes annual closure of South Canal during Spring and Fall outmigration season and seasonal operation of the downstream bypass facility. More details on these measures are included in “Fish Passage” (Criteria C.)

2. *If there is no flow condition recommended by any Resource Agency for the Facility, or if the recommendation was issued prior to January 1, 1987, is the Facility in Compliance with a flow release schedule, both below the tailrace and in all bypassed reaches, that at a minimum meets Aquatic Base Flow standards or “good” habitat flow standards calculated using the Montana-Tennant method?*

NO – Go to A3. Montana-Tennant method was developed and is used typically for facilities in the Northwest United States. New England Aquatic Base Flow Standards prescribe that Aquatic Base Flows for rivers should be approximately 0.5 CFS per square mile of drainage area. For this project, the drainage area is 4,460 square miles, so the ABF would be 2,230 CFS, above the required minimum flow of 951 CFS established for the site. In 2008, the Massachusetts Water Resources Commission adopted state-specific standards known as the *2008 Index Streamflows for Massachusetts*², noting their rationale as follows:

“...it was felt that the US Fish & Wildlife Service’s Aquatic Base Flow default streamflows, although widely used, were often not directly applicable to rivers in Massachusetts because they were derived from a group of stream gages in northern New England with larger drainage areas and more snow pack than typical in Massachusetts river basins. More state-specific analysis was needed.”

Massachusetts Index Streamflow policy recommends site-specific implementation of the ABF policy where data are available. An example of that methodology is provided in the report, and is used here to determine whether Lawrence meets the Aquatic Base Flow standard. The difference here is that the Lawrence facility is already constructed, so the “Area of Interest” would be the actual drainage area for the facility, and the lowest flow month would serve as the minimum flow standard. Lowell Gage was used as that is the nearest available flow gage on the Merrimack River. Given the data below, at the lowest flow month, August, the flow at the site is 3,070 CFS, higher than the USFWS minimum standard of 2230 (0.5 CFSM) and far above the required minimum flow at the site of 951 CFS. Given these standards, the facility’s minimum flow requirement of 951 CFS exceeds the Aquatic Base Flow Standards for Massachusetts.

² <http://www.mass.gov/eea/docs/eea/wrc/index-streamflows-2008.pdf>

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
CFS Mo. Mean	7380	7510	13000	19500	11800	6710	3730	3070	3150	4630	6980	8090
Drainage Area	4460	4460	4460	4460	4460	4460	4460	4460	4460	4460	4460	4460
CFSM	1.65	1.68	2.91	4.37	2.65	1.5	0.84	0.69	0.70	1.04	1.57	1.81

Figure 6 - Minimum Flow Calculation for Merrimack River (based off Lowell Gage)

3. *If the Facility is unable to meet the flow standards in A.2., has the Applicant demonstrated, and obtained a letter from the relevant Resource Agency confirming that demonstration, that the flow conditions at the Facility are appropriately protective of fish, wildlife, and water quality?*

Yes – PASS. Conversations with Caleb Slater from Massachusetts Department of Fish and Wildlife confirmed that flows at the facility are not a concern for fish passage since the location of the powerhouse is adjacent to the impoundment, leaving minimal bypass reach (See Appendix A.) USGS Stream flow data available from the upstream Lowell gage was obtained from 1923 – present, and showed that the typical inflows are well in excess of the established minimum flow for the site of 951 CFS (Figure x). In addition, Lawrence Hydroelectric Associates has submitted annual minimum flow compliance statements to FERC, including the most recent for 2014.

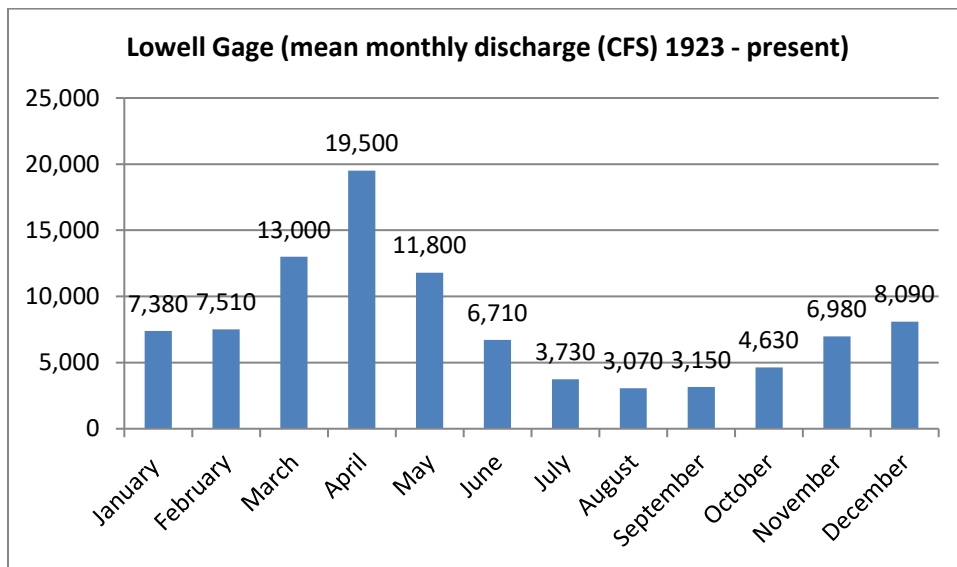


Figure 7 - 1923-Present Flow Data from Lowell Gage (upstream of Project)

B.) Water Quality

1. *Is the Facility either:*
- In Compliance with all conditions issued pursuant to a Clean Water Act Section 401 water quality certification issued for the Facility after December 31, 1986? Or*

Not Applicable – Water Quality Certificate issued July 5, 1978.

- b. *In Compliance with the quantitative water quality standards established by the state that support designated uses pursuant to the federal Clean Water Act in the Facility area and in the downstream reach?*

Yes – See B3.

2. *Is the Facility area or the downstream reach currently identified by the state as not meeting water quality standards (including narrative and numeric criteria and designated uses) pursuant to Section 303(d) of the Clean Water Act?*

Yes – See B.1. The most recent assessment for the Merrimack river upstream and downstream of the Lawrence project is contained in the *Massachusetts Year 2012 Integrated List of Waters* prepared by the Massachusetts Division of Watershed Management. The river upstream and downstream of the facility is classified as Massachusetts Class 5, “Impaired or threatened for one or more uses and requiring a TMDL.” This designation constitutes the 303(d) list for Massachusetts. The two stretches analyzed are the 8.8 mile stretch from the outfall of the Wastewater Treatment Plant in Lowell to the Lawrence Dam, and the 10 mile segment from the Lawrence Dam to the confluence with the Little River in Haverhill. The following tables list the designated use status for the two segments, and are available on the EPA’s Watershed Assessment, Tracking & Environmental Results webpage for the Merrimack River.

Designated Use	Designated Use Group	Status
Aesthetic	Aesthetic Value	Good
Fish Consumption	Aquatic Life Harvesting	Impaired
Fish, Other Aquatic and Wildlife	Fish, Shellfish, and Wildlife Protection and Propagation	Impaired
Primary Contact Recreation	Recreation	Impaired
Secondary Contact Recreation	Recreation	Impaired

Figure 8 - Upstream Segment Water Quality Impairments

Designated Use	Designated Use Group	Status
Aesthetic	Aesthetic Value	Good
Fish Consumption	Aquatic Life Harvesting	Not Assessed
Fish, Other Aquatic Life and Wildlife	Fish, Shellfish, and Wildlife Protection and Propagation	Impaired
Primary Contact Recreation	Recreation	Impaired
Secondary Contact Recreation	Recreation	Impaired

Figure 9 - Downstream Segment Water Quality Impairments

Causes of the impairments listed above are listed on the same EPA webpage. None of the probably sources for water quality impairments are attributable to the Lawrence or other hydroelectric facilities.

Designated Use	Cause of Impairment	Probable Source
Fish Consumption	Mercury in Fish Tissue	Atmospheric Deposition – Toxics & unknown sources
Fish, Other Aquatic & Wildlife	PCBs in Fish Tissue, Phosphorous	Municipal Point Source Discharges, Urban Stormwater, Upstream/Downstream Source
Primary & Secondary Contact Recreation	E. Coli	Point Source Discharges & Combination of Stormwater, SSO or CSO

Figure 10 - Causes of WQ Impairments at Lawrence

3. *If the answer to question B.2 is yes, has there been a determination that the Facility does not cause, or contribute to, the violation?*

Yes – PASS. Letter from Robert Kubit from Massachusetts Department of Environmental Protection sent May 4, 2015, confirmed that the listing of this facility on the 303(d) list is not attributable to the existence or operation of the facility (See Appendix A.) In my opinion, this confirmation, along with the data available from the EPA and the Massachusetts Division of Watershed Management and listed in the above tables is sufficient evidence to determine that the Facility does not cause or contribute to the violation. Existing water quality violations in the Merrimack River near Lawrence are caused by other sources, such as municipal point source discharges and stormwater runoff.

C.) Fish Passage and Protection

1. *Are anadromous and/or catadromous fish present in the Facility area or are they known to have been present historically?*

Yes – Go to C.2. Atlantic Salmon, American Shad, River Herring and American Eel are some of the anadromous or catadromous species that are present at the facility.

2. *Is the Facility in Compliance with Mandatory Fish Passage Prescriptions for upstream and downstream passage of anadromous and catadromous fish issued by Resource Agencies after December 31, 1986?*

Yes – Go to C.6. As the first facility upstream on the Merrimack River, and the furthest downstream prior to the confluence with the Atlantic Ocean, fish passage at this facility is paramount. The original 1978 license included provisions for design and installation of upstream and downstream fish passage facilities at the project, and for the evaluation of the effectiveness of the installed facilities. Since the original license, ongoing consultations with resource agencies have been conducted, new Prescriptions have been required for the site, and additional construction has been completed to improve the efficacy of fish passage. Current fish passage facilities include a fish elevator (with trapping facilities), downstream fish bypass system and upstream eel ladder. Below is a chronological history of fish passage improvements at the site, a description of the facilities and effectiveness, and agency consultations and approvals of the facilities.

1980 – Initial Fish Passage Facilities (Upstream Fish Elevator) The Fish Lift is operated in consultation with relevant resource agencies, and is based on river conditions (flow and temperatures,) and other

appropriate information. Operation of the lift commences on or about May 1 of each year, commencing daily at 6:00 A.M. with attraction water flow of 120 CFS. Daily duration and frequency of lifts are determined by agency personnel responsible for collecting fish data at the site. Fish lifts continue through mid to late July, and resume in mid-September through October for Atlantic Salmon passage and trapping³. Fish lift efficiency studies were conducted in 1993 and 1995, and resulted in operational changes to improve effectiveness. Agencies are responsible for monitoring fish passage at the lift and collecting data, and operation of the lift is conducted in coordination and with the recommendations of the agencies involved. LHA has committed (in the CFPP) to develop plans and schedules for monitoring of upstream fish passage effectiveness, and several results of these studies are included in the Fish Passage Plan referenced below.



Figure 11 - Upstream Passage Hopper Pit



Figure 12 - Upstream Passage Exit Channel

1992 – Installation of Downstream Fish Bypass Facility

On October 26, 1992, FERC issued an Order approving functional design drawings for a downstream fish passage facility at Lawrence. The USFWS, Massachusetts Division of Fisheries and Wildlife (MDFW), and the National Marine Fisheries Services (NMFS), all reviewed the functional design drawings and endorsed construction of the facility. The owner noted that the design of the facilities is “an inexact science and fine-tuning of the facility may be necessary.” In the FERC Order approving the CFPP, the agency noted that the USFWS disagreed with the licensee’s characterization of the downstream passage facility as being highly effective, and the facility is in fact, not effective in passing these fish. They recommended CFPP be amended to include initiation of further consultation with agencies and evaluation of potential modifications to facility to improve passage success. The FERC order concluded that the licenses should consult with resource agencies to develop a plan and schedule to conduct and implement such studies and improvements. Article 31 of the project license requires the licensee to

³ On September 5, 2013, the USFWS announced they would be ending its 30-year long program to restore Atlantic Salmon populations to the Merrimack River, citing poor results of the program. Efforts have since shifted to improve habitat and upstream fish passage for migratory fish such as America eels, shad and river herring.

conduct studies to assess effectiveness of these measures, and constitutes a Prescription that the applicant is bound to comply with, and the applicant has reaffirmed that commitment in the Fish Passage Plan referenced below. It should be noted that for the latest year data is available, 2013, American Shad experienced a 10-year record high number of returns, and River Herring experienced a 13-year high⁴. As of July 2014, American Shad returns had almost matched their entire 2013 returns, and River Herring had already exceeded their 2013 returns.



Figure 13 - Downstream Fish Passage Entrance



Figure 14 - Downstream Fish Passage Bypass Chute

2000 - Comprehensive Fish Passage Plan

On November 1, 1999, Lawrence Hydroelectric Associates filed its Comprehensive Fish Passage Plan (“CFPP”) for the Lawrence Project. After receiving comments from resource agencies and revising the plan, FERC approved and modified the plan by order issued July 20, 2000. The CFPP details the facilities and operational measures to be implemented by LHA to provide protection to upstream and downstream migrating anadromous fish. The CFPP includes protocols for operation of the fish lift at the site (May through July, and September through October,) as determined by the resource agencies. The CFPP also includes protocols for operation of the downstream bypass facility, (April through July and September through November,) as determined by resource agencies. In addition, the CFPP requires LHA to close the South Canal annually during spring and fall, and describes the results of past studies and outlines mechanisms for conducting future studies of upstream and downstream fish passage.

2007 – Inflatable Flashboards Installation

On October 10, 2006, Resource Agencies (incl. USFWS, NOAA-Fisheries, MA Division of Fisheries and Wildlife, MA Division of Marine Fisheries, U.S. Forest Service, and NH Fish and Game Department,) collectively wrote a letter to Enel North America regarding fish passage recommendations to improve effectiveness at the Lawrence Project. They noted steadily improving results at the dam, but due to a 100 year flood event in May 2006, and persistent high water during the 2005 fish passage season, explained that specific problems related to flashboard failure/repair and inability to lower fishway from river in high tailwater levels has hindered passage effectiveness. They recommended two engineering

⁴ <http://www.fws.gov/northeast/cnefro/returns.html#ESSEX>

measures: (1) Fish Lift Entrance Gate designed and installed at fishway entrance which could be closed to isolate the lower entrance channels from the tailrace when levels are below 40,000 CFS, and (2) Inflatable Flashboard System to allow sections of dam crest to respond quickly to changes in water levels. The Inflatable Flashboard System was installed at the project and pictures are included below.

2012 – Eel Passage Construction

Plans to install eel passage at Lawrence were documented to have taken place as early as May 2009. On April 2, 2012, USFWS and other agencies spoke with project owner to discuss revisions to a plan to install upstream eel passage facility at the site. On May 2, 2012, USFWS sent a review of the planned eel passage facility at the site to ENEL Green Power regarding their submission of design drawings for eel passage at Lawrence. The permanent eel ladder is located in the pool below the south end of the dam, and includes a separate attraction water source to discharge at the bottom end of the eelway. The eelway was installed in 2012, and 2013 was the first full season in operation. In 2014, Enel Green Power completed an eelway internal efficiency study to see how the eel performed climbing the ladder. In 2015, they are implementing the recommendations from the 2014 study, and have been working closely with the Technical Committee for the Restoration of Anadromous Fish to the Merrimack River on the eelway plans.

Caleb Slater from MDFW commented that last year the eelway was not as effective, but now seems to be “located in the right spot.” However, he requested that LHA continue to work with MDFW to improve effectiveness of the eelway as a condition of LIHI certification. A recent site visit revealed thousands of eels right under the dam, but only several hundred in the eelway. Slater also noted that the facility has “Good” Shad and Herring passage, and any additional big-ticket improvements would not be considered or requested until the project is up for relicensing. Finally, he noted that flows at the project are not an issue due to the location of the powerhouse being adjacent to the impoundment, resulting in minimal bypass reach.



Figure 16 - Upstream Eel Passage System



Figure 15 - Upstream Eel Passage Collection Tank

8. *Is the Facility in Compliance with Mandatory Fish Passage Prescriptions for upstream and/or downstream passage of Riverine fish?*

Yes – Go to C9. See C2.

9. *Is the Facility in Compliance with Resource Agency Recommendations for Riverine, anadromous and catadromous fish entrainment protection, such as tailrace barriers?*

Yes – PASS. See C2.

D.) Watershed Protection

1. *Is there a buffer zone dedicated for conservation purposes (to protect fish and wildlife habitat, water quality, aesthetics and/or low-impact recreation) extending 200 feet from the average annual high water line for at least 50% of the shoreline, including all of the undeveloped shoreline?*

NO – Go to D.2.

2. *Has the Facility owner/operator established an approved watershed enhancement fund that: 1) could achieve within the project's watershed the ecological and recreational equivalent of land protection in D.1, and 2) has the agreement of appropriate stakeholders and state and federal resource agencies?*

NO – Go to D.3.

3. *Has the Facility owner/operator established through a settlement agreement with appropriate stakeholders, with state and federal resource agencies agreement, an appropriate shoreland buffer or equivalent watershed land protection plan for conservation purposes (to protect fish and wildlife habitat, water quality, aesthetics and/or low impact recreation)?*

NO – Go to D.4.

4. *Is the facility in compliance with both state and federal resource agencies recommendations in a license approved shoreland management plan regarding protection, mitigation or enhancement of shorelands surrounding the project?*

Not Applicable - Pass. The original license did not require the development of a shoreline management plan. Article 35 of the license requires the Licensee to ensure that authorized usage of Project lands are consistent with shoreline aesthetics, are maintained in good condition and comply with state and local regulations. The project is located in a heavily developed industrial area in downtown Lawrence, MA, and no record of any violation exists. On August 14, 1980, the applicant filed a letter accepting an amendment, pursuant to FERC's recommendation, to replace Article 35 with new Article 43, which allows the applicant to authority to grant permission for certain uses of project lands and waters and to convey certain interests in project lands, without prior Commission approval. The new article allowed the Licensee to exercise this authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the

project. However, since no “license approved shoreland management plan” is required, in my opinion this question is not applicable, and the applicant passes this criteria.

E.) Threatened and Endangered Species Protection

1. *Are threatened or endangered species listed under state or federal Endangered Species Acts present in the Facility area and/or downstream reach?*

Yes, Go to E2. See Appendix A, Resource Agency Communications. The Bald Eagle is state-listed in Massachusetts as “Threatened.”

2. *If a recovery plan has been adopted for the threatened or endangered species pursuant to Section 4(f) of the Endangered Species Act or similar state provision, is the Facility in Compliance with all recommendations in the plan relevant to the Facility?*

N/A – See E.5.

3. *If the Facility has received authorization to incidentally Take a listed species through: (i) Having a relevant agency complete consultation pursuant to ESA Section 7 resulting in a biological opinion, a habitat recovery plan, and/or (if needed) an incidental Take statement; (ii) Obtaining an incidental Take permit pursuant to ESA Section 10; or (iii) For species listed by a state and not by the federal government, obtaining authorization pursuant to similar state procedures; is the Facility in Compliance with conditions pursuant to that authorization?*

N/A – Go to E.5

5. *If E.2 and E.3 are not applicable, has the Applicant demonstrated that the Facility and Facility operations do not negatively affect listed species?*

Yes – Pass (See condition) Based off previous conversations with resource agency officials, the ongoing operation of a hydropower project does not pose any likely threat to the existence of the Bald Eagle, as long as no new habitat modification is planned. Lawrence Hydroelectric Project is located in a dense urban area (Lawrence, MA,) and limited available habitat for the Bald Eagle is located immediately near the site. However, the project location is located near nesting habitat for Bald Eagle in Massachusetts. In my opinion, the applicant passes this criterion, but I am including a condition that the applicant receives a letter from MDFW that confirms the existence and operations of the facility do not negatively affect the listed species.

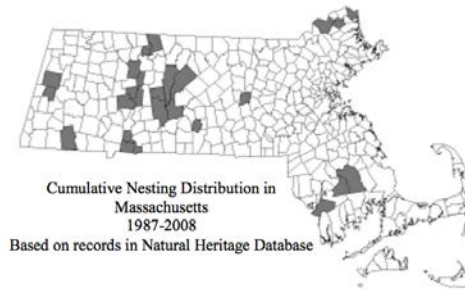


Figure 17 - Bald Eagle Nesting Habitat in MA

F.) Cultural Resource Protection

1. *If FERC-regulated, is the Facility in Compliance with all requirements regarding Cultural Resource protection, mitigation or enhancement included in the FERC license or exemption?*

YES – Pass, Go to G. Article 29 of the License requires the Licensee to cooperate with the Massachusetts Historical Commission (MHC) in order to avoid any adverse impact on identified historic structures at the project. The project impoundment, (also known as the Great Stone Dam - completed in 1848), the North and South Canals, and the associated gatehouse are listed in the National Register of Historic Places. The MHC determined that the dam, the North and South Canals, and associated gatehouses would not be adversely affected by the construction of the project. The Licensee has consulted when necessary to comply with this requirement. For example, in 2007 the Licensee consulted with MHC on project plans to construct the inflatable flashboard system – MHC reviewed the proposal and determined that the installation would have no adverse effect on any significant historic or archaeological resources. On August 29, 2006, a FERC Environmental Inspection of the site concluded that “The licensee appears to be in compliance with its requirements with regard to cultural resources.” In my opinion, the evidence is sufficient that the project complies with Article 29 requirements regarding Cultural Resource Protection.

G.) Recreation

1. *If FERC-regulated, is the Facility in Compliance with the recreational access, accommodation (including recreational flow releases) and facilities conditions in its FERC license or exemption?*

YES – Go to G.3. As mentioned previously, the project is located in a heavily-developed area surrounded by much industrial activity. The License noted that “the industrial nature of the area limits recreational development at the Lawrence Project.” Notwithstanding this limitation, the Applicant submitted a recreation plan to allow public access of the historical aspects of the project and the new power generating facility. This plan was filed as Exhibit R in the License, and included a parking area, sanitary facilities, access walkways to fish viewing facilities, picnic tables, and trash receptacles, and additional historical education resources. More recent information indicates improved recreational value at the site. A 2006 FERC Environmental Inspection Report noted that the licensee had restored the gatekeeper’s Carriage House on the North Canal, and provides tours, video displays and interactive

exhibits. The City of Lawrence and the State of Massachusetts maintains boat launches and fishing areas upstream and downstream of the project, and LHA has noted that these facilities experience significant use. The Report further noted that the applicant “appears to be in compliance with its requirements regarding recreational access.” On March 30, 2015, LHA requested a deadline for submission of its Recreation Use Monitoring Report to June 1, 2015. This report was filed on May 29, 2015, and recorded a total of 21,355 annual visits to all recreational areas at project, (this includes areas maintained by the project owner and other local municipal entities,) and mentions the applicant spent \$5,000 in 2014 to support recreational activities at the project. Given the information available, in my opinion the applicant has maintained compliance with recreational provisions in the license.

3. *Does the Facility allow access to the reservoir and downstream reaches without fees or charges?*

Yes – Pass.

H.) Facilities Recommended for Removal

1. *Is there a Resource Agency Recommendation for removal of the dam associated with the Facility?*

No – Pass, Facility is Low Impact

VI. Public Comments

There were no public comments received during the comment period.

Appendix A
Supporting Communications Log (Reverse Chronological Order)

Date: June 10, 2015

Contact Person: Thomas French

Agency: Massachusetts Department of Fish and Wildlife

Title: Assistant Director



Commonwealth of Massachusetts

Division of Fisheries & Wildlife

Jack Buckley, Director

June 10, 2015

Peter Drown
Low Impact Hydropower Institute
266 Prosperity Ave, #320
Fairfax VA 22031

RE: Project Location: Merrimack River, Lawrence Hydroelectric Project
 Town: LAWRENCE, NORTH ANDOVER
 NHESP Tracking No.: 15-34520

To Whom It May Concern:

Thank you for contacting the Natural Heritage and Endangered Species Program of the MA Division of Fisheries & Wildlife (the "Division") for information regarding state-listed rare species in the vicinity of the above referenced site. Based on the information provided, this project site, or a portion thereof, is located within *Priority Habitat 1321* (PH 1321) and *Estimated Habitat 65* (EH 65) as indicated in the *Massachusetts Natural Heritage Atlas* (13th Edition). Our database indicates that the following state-listed rare species have been found in the vicinity of the site:

<u>Scientific name</u>	<u>Common Name</u>	<u>Taxonomic Group</u>	<u>State Status</u>
<i>Haliaeetus leucocephalus</i>	Bald Eagle	Bird	Threatened

The species listed above is protected under the Massachusetts Endangered Species Act (MESA) (M.G.L. c. 131A) and its implementing regulations (321 CMR 10.00). State-listed wildlife are also protected under the state's Wetlands Protection Act (WPA) (M.G.L. c. 131, s. 40) and its implementing regulations (310 CMR 10.00). Fact sheets for most state-listed rare species can be found on our website (www.mass.gov/nhesp).

Please note that projects and activities located within *Priority and/or Estimated Habitat* **must** be reviewed by the Division for compliance with the state-listed rare species protection provisions of MESA (321 CMR 10.00) and/or the WPA (310 CMR 10.00).

Wetlands Protection Act (WPA)

If the project site is within *Estimated Habitat* and a Notice of Intent (NOI) is required, then a copy of the NOI must be submitted to the Division so that it is received at the same time as the local conservation commission. If the Division determines that the proposed project will adversely affect the actual Resource Area habitat of state-protected wildlife, then the proposed project may not be permitted (310 CMR 10.37, 10.58(4)(b) & 10.59). In such a case, the project proponent may request a consultation with the Division to discuss potential project design modifications that would avoid adverse effects to rare wildlife habitat.

A streamlined joint MESA/WPA review process is available. When filing a Notice of Intent (NOI), the applicant may file concurrently under the MESA on the same NOI form and qualify for a 30-day www.mass.gov/nhesp

Division of Fisheries and Wildlife

Field Headquarters, One Rabbit Hill Road, Westborough, MA 01581 (508) 389-6300 Fax (508) 389-7890
An Agency of the Department of Fish and Game

Date: May 14, 2015
Contact Person: Caleb Slater
Agency: Massachusetts Department of Fish and Wildlife
Title: Anadromous Fish Project Leader

Caleb and I spoke by phone May 12th. I drafted notes from the call and sent him to him to review. These are his edits of my notes.

Slater, Caleb (MISC) <caleb.slater@state.ma.us>

8:17 AM (22 hours ago)

to Peter

Crescent Project

- American Eel upstream passage required, all projects downstream have installed 3/4" clearspace racks ***for downstream eel passage protection***
- Requested LIHI condition to install upstream eelway
- ~~Eelway~~ *** Exclusion (full depth 3/4 inch racks)*** probably most effective measure/ previous efforts to conduct seasonal shutdowns looking less effective
- American Shad upstream passage not necessary or required/ due primarily to natural river features (2 dams downstream without passage, + a natural ***fall*** dam at Woronoco and a natural fall <1 mile above that
- Flows not a problem since the powerhouse is at the dam so no bypass reach

Lawrence Project

- Requested LIHI condition to continue to work with Mass DFW to finalize eel passage and improve effectiveness
- Eelway is now "in the right spot", last year it didn't work out as well
- Site Visit still shows room for improvement/ thousands of eels identified at the dam, but only several hundred in the eelway
- Good Shad and Herring Passage due to rubber flashboard system installed several years ago
- Flows not a problem since the powerhouse is at the dam so no bypass reach
- Any additional issues would be revisited during re-licensing

Caleb Slater, PhD
Anadromous Fish Project Leader
Massachusetts Division of Fisheries and Wildlife
1 Rabbit Hill Road
Westborough, MA 01581
[508-389-6331](tel:508-389-6331)
www.mass.gov/masswildlife

Date: May 4, 2015
Contact Person: Robert Kubit
Agency: Massachusetts Department of Environmental Protection
Title: Environmental Engineer, Division of Watershed Management

Kubit, Robert
(DEP) <robert.kubit@state.ma.us>

May 4 (9 days ago)

Hi Peter,

Bacteria, Phosphorus and PCBs in fish tissue are the reasons why this segment of the Merrimack River is designated Category 5 on the 2012 Integrated List and requiring a TMDL. The existence and/or operation of the Lawrence Hydroelectric Facility (FERC #2800) has no influence on the decision to list this segment as a Category 5.

I hope this helps.

Bob

Robert Kubit, P.E.
MassDEP
Division of Watershed Management
8 New Bond Street
Worcester MA 01606
Telephone: [\(508\) 767-2854](tel:(508)767-2854)
Email: robert.kubit@state.ma.us
Fax: [\(508\) 791-4131](tel:(508)791-4131)

Peter Drown <peter.drown@cleantechanalytics.com>

Mon, May 4, 2015 at 6:29 AM

To: robert.kubit@state.ma.us

Hi Robert,

I am conducting some reviews for Low Impact Hydropower Institute certification for several of Enel Green Power's facilities in MA. The first of these projects is the Lawrence Facility (FERC #2800) a 16.8 MW project located in Lawrence, MA on the Merrimack River. During the review, I came across the latest 303(d) list published by your office, the 2012 Integrated List of Waters, which mentions that this part of the Merrimack River is Class 5 "Impaired or threatened for one or more uses and requiring a TMDL."

In your estimation, is this listing due to the existence and operation of the Lawrence Hydroelectric Facility?

Your thoughts are highly valued in this process. Please let me know if I can provide you with further information to arrive at your determination.

Thanks,

Peter Drown, Principal

Cleantech Analytics LLC