



Photo – View of Flooding Over Jackson Mills Dam

*Low Impact Hydropower Institute
Reviewer's Report on Stage II
Recertification for the Jackson Mills
Power Project*

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7/14/2016**

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**LOW IMPACT HYDROPOWER INSTITUTE
REVIEW OF APPLICATION FOR STAGE II
RECERTIFICATION OF THE
JACKSON MILLS PROJECT**

*Prepared by:
Gary M. Franc
July 14, 2016*

1. INTRODUCTION

This report summarizes a Stage II review by the Low Impact Hydropower Institute (LIHI) for the Jackson Mills Hydroelectric Project (JMHP, or Project), LIHI Certification No. 54. A Stage II review follows the same process as an original certification application, culminating with a reviewer's report and decision making involving the LIHI Governing Board.

The owner of the Project is the City of Nashua, New Hampshire (City or Owner).¹ The LIHI application for recertification was submitted in October 28, 2015 by Essex Power Services, Inc. (EPS), a power consultant and construction company representing the City in this endeavor. EPS's contact is Mr. Andrew Locke.²

In March of 2016, I reviewed this submitted application for recertification and determined that a Stage II review was required since material changes had occurred at the facility during the prior certification period. These changes included a new pneumatic flashboard crest gate system and new fish passage concerns that had not been completely resolved with the U.S. Fish and Wildlife Service (USFWS)³ as documented in a FERC letter to the city on February 18, 2016⁴.

On March 28, 2016, LIHI notified the City and EPS that a Stage II review was required for certification and that additional information and funding was needed to complete this review. On May 23, 2016, LIHI received payment for the Stage II review along with the requested documentation from EPS.

¹ Project Owner - Sarah Marchant, City of Nashua, PO Box 2019, Nashua, NH 03061 – (603-589-3095), marchants@nashuanh.gov.

² LIHI coordinator – Andrew Locke, Treasurer, Essex Power Services, Inc., 55 Union St., 4th Floor, Boston, MA 02108 - (617-367-0032), alocke@essexhydro.com.

³ This FERC submittal contains a June 5, 2015 USFWS report documenting a May 19, 2015 inspection of the fish passage facilities at the Project along with recommendations for new operation and physical repairs to the facilities - <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13968760>

⁴ A FERC response to the City pertaining to USFWS issues - <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14148841>

2. BACKGROUND

On February 16, 1981, the City received a FERC license for a project involving the construction of a new powerhouse on the right bank of the Nashua River in Nashua, New Hampshire (See Figure 1) at the base of the Jackson Mills dam. On May 21, 1981, the City's April 22, 1980 request to construct a powerhouse and temporary cofferdam was approved by the State of New Hampshire Water Supply and Pollution Control Commission (NHWSPPC) and the project was issued a 401 water quality certificate (WQC).

On February 16, 1983, the City selected Essex Development Associates, Inc. (EDA) as the developer of the Project. EDA concluded that the most cost-effective development would be on the left bank of the Nashua River which differed from the right bank development originally licensed. EDA filed a Notice of Exemption for the Project with FERC on September 18, 1983. In 1984, EDA formed Nashua Hydro Associates (NHA), a New Hampshire Limited Partnership to develop the Project. EDA signed a 30-year variable rent lease with the City of Nashua on July 18, 1984, which expired in December 2014.

An order by the Federal Energy Regulatory Commission (FERC), granting the Project (P-7590) exemption from licensing was issued on April 24, 1984⁵. On May 21, 2014⁶, FERC issued an Order Modifying and Approving an Operations Plan for the Project.

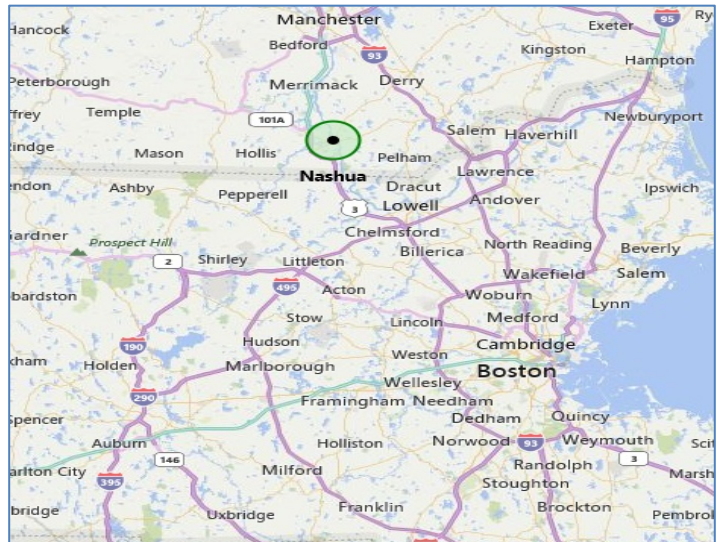


Figure 1 - Location Map

3. PROJECT LOCATION

The Nashua River basin has a total drainage area of 529 square miles, with 88 square miles being in New Hampshire, and 441 square miles in Massachusetts. From the central valley of the main stem of the Nashua River to the limits of the watershed, the landscape is broad, forested, and rural, with small towns and cities scattered throughout. The bedrock of the Nashua River watershed is mostly granite and is covered with a mantle of soils, sand, gravel, and rock.

The Nashua River flows easterly into the Merrimack River. The Merrimack River continues to flow in a southeasterly direction approximately 15 river miles (RMs) through Lowell, Massachusetts, then turns in a northeasterly direction flowing another 12 RMs through North Andover, Massachusetts and eventually emptying into the Atlantic Ocean near Newburyport, Massachusetts some 50 RMs from its confluence with the Nashua River.

⁵ License exemption - <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=12757760>

⁶ Amended license exemption - <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13552104>

Construction of the Jackson Mills Dam was completed in 1920 (See Figure 2). The dam is comprised of a gravity-type stone masonry spillway, with a concrete cap and a concrete extension and concrete-faced stone gravity-type abutments. The height of the dam is 33 feet and the length is 178 feet. In January of 2014, NHA completed the installation of a pneumatic flashboard system to help in the passing of flood flows.

NHA constructed the Project powerhouse on the left bank of the Nashua River in downtown Nashua, New Hampshire about 1.25 RMs above the confluence with the Merrimack River near the base of the Jackson Mills Dam. The dam is approximately 700 feet downstream from the crossing of Main Street over the Nashua River. The Jackson Mills Dam, with latitude and longitude of 42.763993 N, 71.463412 W forms the headworks for the Project and drains an area of 414 square miles (SQMI).



Figure 2 - Jackson Mills Dam

The watershed area formed by the dam impounds approximately 40 acres with a gross reservoir volume of 450 acre-feet. The area surrounding the impoundment is urban in character and highly developed with privately owned mill buildings, shopping malls and homes.

The area in the vicinity of the dam is urban in character and typical of an old New England manufacturing city. A former powerhouse on the north bank houses a restaurant, which contains some of the features of the old facility.

The new powerhouse is constructed adjacent to the old powerhouse with its turbine inlet located beneath the restaurant. The land use along the north side of the river to the east of the restaurant is predominantly industrial and to the west is commercial. On the south side of the river the land usage to the east of the library is predominantly urban residential with commercial uses lying to the west. Along both banks above and below the dam the vegetation consists of planted ornamentals and those types typical of disturbed ground.

A semi-Kaplan Turbelec turbine is installed in the powerhouse. The generating unit consists of one single-regulated propeller-type turbine. The installed capacity of the unit is 1.1 MW. The facility is operated as a fully automated run of river (ROR) project. The project is required to release a minimum flow of 207 cubic feet per second (cfs) or inflow whenever inflow is less than 207-cfs. The Project produces about 4.4 gigawatt-hour (GWH) of energy annually, operating at a plant factor of 45.7%

One additional hydro project operates on the Nashua River upstream of the Project. The Mines Falls Project (P-3442) is owned and operated by Eagle Creek Renewable Energy (ECRE).

3. PROJECT DESCRIPTION

3.1 Major Project Works

Prior to January of 2014, the project consisted of:

- a 33-foot-high, 178-foot-long stone-masonry gravity dam with a crest elevation of 115.6-feet and one-foot-high wooden flashboards along 38 feet of the dam's overflow spillway;
- a 40-acre reservoir with no usable storage capacity;
- a powerhouse containing a single 1 MW turbine-generator unit, and;
- a fishway located adjacent to the dam consisting of a downstream fish bypass and upstream fish ladder.



Figure 3 - Pneumatic Crest Gates – Looking Upstream

Beginning in January of 2014, a pneumatic crest gate system (NCGS) was integrated into the 178-foot-long spillway section of the Jackson Mills Dam, to alleviate upstream flooding (See Figure 3).

The construction required reducing 140-feet of the Jackson Mills Dam's elevation by six feet, and replacing this section of the spillway with 7 twenty-foot-long by six-foot-high crest gates hinged together to operate as one 140-foot-long gate. Each crest gate is comprised of a steel panel supported on the downstream side by tubular, air-filled, rubber bladders. Restraining straps attached to each gate panel prevent the panel from being raised above the six foot effective height above the newly lowered dam crest. The NCGS activates automatically during times of high water, when river inflows exceed 7,500-cfs.



Figure 4 - 38 Foot Section of Spillway Above Upstream Fish Passage

Also, the 38-foot-long section of temporary 1-foot-high flashboards located near the fishway is no longer used. The height of this section of the spillway remains unchanged (See Figure 4).

3.2 Mode of Operation

The project is operated as a ROR facility. The project is required to discharge an instantaneous flow of 207-cfs or inflow whichever is less.

As of May 21, 2014, the Project must operate in accordance with an Operations Plan (OP). The OP requires the project to continue to operate in a run-of-river mode such that it maintains the normal water surface elevation of 116.1-foot National Geodetic Vertical Datum (NGVD) at the top of the spillway portion of the dam for flows up through the maximum turbine flow of approximately 800-cfs.

The Project passes river inflows in excess of 800-cfs over the spillway portion of the dam which includes a NCGS with a crest elevation of 116.1-foot NGVD. The gate operates as a single unit and a programmable logic controller (PLC) controls the lowering and rising of the gate. The PLC control can be overridden using manual control. The OP discusses the operations of the pneumatic crest gate system for varying flow and drawdown conditions, and describes procedures for refilling the reservoir.

4. REGULATORY STATUS

4.1 Summary of Project Licensing and Agency Consultation Process

As previously stated, FERC granted the Project (P-7590) exemption from licensing on April 24, 1984. On September 20, 2012⁷, NHA filed an application for an amendment of the exemption to allow the installation of a 6-foot high pneumatic crest gate along 140 feet of the spillway at the Jackson Mills Dam. By letter filed December 21, 2012⁸, the New Hampshire Department of Environmental Services (NHDES) stated it would not be amending the existing WQC issued in 1983 as part of this exemption amendment.

On January 11, 2013⁹, the FERC issued an Order Amending Exemption. As part of this order, Article 31 required the NHA to submit an OP for FERC approval by December 31, 2013. The OP was required to contain documentation of consultation with NHDES, copies of the consulted entities' comments and recommendations on the completed plan, and descriptions of how the comments are accommodated by the plan.

On November 7, 2013, NHA filed a request for a time extension until March 31, 2014 in order to file the new OP and on April 3, 2014¹⁰, NHA submitted the OP. FERC accepted NHA's April 3, 2014 filing of the OP and issued an Order Modifying and Approving Operations Plan of the Project on May 21, 2014.

On January 16, 2015¹¹, the FERC was notified that effective December 21, 2014, the FERC exemption from licensing for the Jackson Mills Project was transferred from NHA to the City of Nashua, New Hampshire.

4.2 Compliance Issues

LIHI certification for the Jackson Mills Hydroelectric Project – LIHI Certification No. 54 was granted for a 5-year term beginning on January 31, 2010 and ending on January 30, 2015. On April 13, 2015¹², LIHI extended the Project's certification to July 30, 2015 and subsequently on July 9, 2015¹³ granted another extension until December 31, 2015 to allow for public comment and review.

Throughout this period, there have been no major compliance issues and only a few "extension of time" requests by the Project owner.

⁷ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13067786>

⁸ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13139682>

⁹ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13152451>

¹⁰ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13503499>

¹¹ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13749131>

¹² http://lowimpacthydro.org/wp-content/uploads/2010/07/ExtensionLetter_RecertReminder_JacksonMills-2015.pdf

¹³ http://lowimpacthydro.org/wp-content/uploads/2010/07/ExtensionLetter_20150709_JacksonMills.pdf

5. PUBLIC COMMENTS RECEIVED

LIHI received an application for recertification for the Project on October 28, 2015. LIHI notified and requested public comment on the application for LIHI certification on October 30, 2015. Public comments needed to be received on or before 5 pm Eastern time on December 30, 2015 to be considered.

On December 30, 2015¹⁴, the US Fish and Wildlife Service (USFWS) provide comments. In their letter, the agency stated, "... the Service supports re-certification if certain fish passage measures are implemented ..."

Details of these fish passage measures are discussed in detail in section Criterion C – Fish Passage and Protection.

The lists of resource agency contacts contained within the LIHI certification application that have been acknowledged to be knowledgeable on the operational issues with the Project are:

- John Warner, USFWS – (603-223-2541 x 15 -John.Warner@fws.gov),
- Ted Walsh, NHDES – (603-271-2083 -Ted.Walsh@des.nh.gov),
- Sara Cairns, NH Department of Resources and Economic Development – (603-271-2215 x 9302 -Cairns@dred.state.nh.us)

On January 7, 2016, this reviewer emailed these individuals the following:

"I am the LIHI reviewer tasked with determining whether the Jackson Mills Project should be LIHI recertified. I would appreciate your perspective regarding the project's proposed operation with regard to satisfying its licensed environmental obligations and your views pertaining to the project being "low impact". Without your input my review can only be based on the documents received from the applicant and a FERC docket review. Thank you for your time in this matter.

Please refer to the LIHI website for more details on the Jackson Mills' application and LIHI low impact criteria. <http://lowimpacthydro.org/>."

On January 7, 2016, I received an email from John Warner containing the previously mentioned USFWS's December 30, 2015 letter to LIHI as an attachment.

Also, on January 7, 2016, I received an email response from Ted Walsh with an attached letter dated October 7, 2015 to NHA pertaining to NHDES concerns. Mr. Walsh states that NHA, "... has not submitted to NHDES all the information we have requested ...". This letter is similar to and raises analogous environmental concerns as contained in October 5, 2015 and October 7, 2015 letters pertaining to the Lower and Upper Penacook Hydroelectric Projects, both of which I reviewed.

¹⁴ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14094118:1>

6. CONSISTENCY WITH LIHI CRITERIA AND ISSUES IDENTIFIED

This section summarizes the record for Stage II recertification. A FERC e-library search was conducted to verify claims in the application. The docket search contains documents from as far back as 1983.

6.1 Summary of the Reviewer's Findings

Criterion A – Flows

Since receiving its license exemption in April of 1984, the project has operated as a ROR facility. The project has also been required to discharge an instantaneous flow of 207-cfs or inflow whichever is less.

As of May 21, 2014, the Project must operate in accordance with an OP. As part of this plan the Project must continue to operate as ROR and pass a minimum flow of 207-cfs or inflow whichever is less. The OP is also integrated with the use of the NCGS which became operational in January of 2014.

The NCGS gates operate as a single unit and a programmable logic controller (PLC) controls the lowering and rising of the gate using a compressor that regulates air pressure to the gate. The PLC receives water level elevation signals from a pressure transducer mounted on the upstream side of the gate. The PLC is programmed with a pulse pause timer to lower (open) or raise (close) the crest gate as a function of the sensed water level elevation. The set-point to lower the crest gate is 118.3-feet NGVD and 118.1-feet NGVD to raise the crest gate. The PLC control can be overridden using manual control.

The OP requires the Project to continue to operate in a ROR mode such that it maintains the normal water surface elevation of 116.1-feet NGVD at the top of the spillway portion of the dam for flows up through the maximum turbine flow of approximately 800-cfs. The Project passes river inflows in excess of 800-cfs over the spillway. The OP states that under normal flow conditions (800-cfs turbine flow plus less than 2.2 feet of water flowing over the spillway (elevation 118.3-feet NGVD)), the crest gate is maintained at its full raised position of 116.1-feet NGVD.

During high flow conditions, when the flow of water over the spillway equals or exceeds 2.2 feet (elevation 118.3-feet NGVD), the crest gate lowers at a rate that keeps the river level near elevation 118.3 NGVD until the crest gate is fully lowered. The gate begins to rise again when the water level reaches 118.1-feet NGVD.

In effect, this procedure attempts to maintain the pond within a 0.2 foot band as much as possible when flooding occurs. The procedure is also designed to minimize impacts on downstream and upstream fish passage since the crest gate operation maximizes the time that water levels are maintained above the bottom sill elevation of the fish passage (113.8-feet NGVD).

The OP is also integrated in accordance with its Emergency Action Plan (EAP) with regard to emergency drawdowns. An emergency drawdown begins at a lowering rate of 0.5 foot per hour using a combination of turbine flow and/or crest gate lowering. When the EAP notifications are complete and the operations staff on-site makes a further evaluation of site conditions, the lowering rate may be increased as needed as long as the Project is manned and a monitor is stationed approximately 1/8th mile downstream of the near the railroad bridge crossing. The emergency drawdown may continue until it mitigates or corrects emergency conditions.

The OP allows for consultation with Federal, state, and city agencies 30 days prior to any crest gate maintenance requiring a river drawdown. This scheduled maintenance is not allowed from April 15 through June 30 and October 1 through November 30. Scheduled maintenance typically occurs during low flow river conditions in August and September. When conducting scheduled drawdowns and refills, only turbine passage is used. When lowering the pond turbine flow will be limited to 75% of maximum hydraulic flow (600-cfs). When raising the pond, the turbine flow will be limited to a maximum hydraulic flow of 25% of maximum flow (200-cfs).

A review of the FERC docket indicates the Project has successfully provided required minimum flows. No notices of minimum flow violations have occurred. Also, since implementation of the OP no concerns have been raised by FERC or State environmental agencies concerning inadequate releases of minimum flows. Therefore, this LIHI criterion is satisfied.

Criterion B – Water Quality

The entire Nashua River within New Hampshire has been assigned a water quality standard of Class C, Category 5 by the NHWSPCC. Category 5 waters are "Impaired or threatened for one or more designated uses by a pollutant(s), and the classification is based on a Total Maximum Daily Load (TMDL) determination. These conditions existed prior to development of the Project.

As part of the original WQC from the NHWSPCC, it was determined that the *"construction, operation and maintenance of the project would not cause a violation of any applicable water standards"*. Since the WQC was issued in 1983, in 2010, the NHA consulted with Ted Walsh at the NHDES to revisit the water quality. NHA conducted a water quality monitoring program to confirm the minimal impact of the project on ambient water quality criteria, the impact of pond fluctuations on aquatic habitat, the maintenance of adequate minimum flows to protect downstream aquatic habitat and the existence of adequate upstream and downstream fish passage.

In the October 7, 2015 letter to NHA emailed to me on January 7, 2016, the NHDES requested an updated assessment to the 2010 water quality. As documented in the LIHI application, NHA states that, *"... water quality tests are currently being conducted. All results from this monitoring program will be forwarded to the LIHI and all relevant hydroelectric Federal and State agencies upon its completion ..."*

In the USFWS's December 30, 2015 letter to LIHI, the USFWS deferred to the NHDES regarding the Project's water quality compliance.

A review of the FERC docket indicates the Project has been operated in accordance with its water quality requirements. Given that LIHI remains informed regarding the ongoing water quality investigations and that these studies continue to indicate that operation and maintenance of the project is not a contributing cause to any violations of any applicable water standards, this LIHI criterion is satisfied.

Criterion C – Fish Passage and Protection

Migratory fish pass the facility using upstream and downstream passage in accordance with the design criteria of the USFWS. As a condition of the 1984 FERC Exemption, the Project must comply with all terms and conditions that Federal and State fish and wildlife agencies have determined to be appropriate. Non-compliance can result in having the Project's license exemption revoked.

As part of the Project's License Exemption application in September of 1983, NHA agreed to comply with recommendations from the National Oceanic and Atmospheric Administration (NOAA), the USFWS and the NHDFG resulting in the installation of fish passage facilities. A single Denil fishway with two entrances (tailrace and spillway) was constructed in 1984 at the site and has been operated annually since. Periodically during the exemption term, the USFWS has reviewed the fish passage facilities and recommended modifications both to fishway structures (weir boards) and operations (how each fishway entrance should be operated, flows through the ladder, etc.).

On September 19, 2007¹⁵, FERC notified NHA concerning a letter received from the USFWS dated September 13, 2007, recommending operational changes regarding required fish passage. The USFWS requested that NHA release 3% of turbine capacity or roughly 25-cfs into the tailrace entrance of the fishway, provide supplemental attraction water discharge into the turn pool where the two ascending limbs of the ladder come together, and increase velocity at the spillway entrance gate to 4 to 6-cfs.

NHA acknowledged the USFWS request on September 26, 2007¹⁶ and on October 22, 2007¹⁷ responded to FERC. NHA stated they met with USFWS personnel on October 3, 2007 and discussed their concerns with the fish passage operation that had deviated somewhat from the USFWS's original design. The changes in the operating regime resulted from fish passage tests conducted with the NHDFG. However, the USFWS stated that the failure to communicate these modifications to USFWS was NHA's responsibility. A corrective action plan was agreed to such that going forward NHA will submit any future proposed modifications for prior approval to all appropriate State and Federal agencies.

NHA also agreed to permanently incorporate the release of the 25-cfs tailrace entrance flow and supplemental attraction flow into the turn pool as part as the upcoming 2008 upstream passage season. Regarding the recommended velocity increase at the spillway entrance, NHA began consultation with the USFWS to review the fishway baffle configuration. NHA notified FERC by phone on June 18, 2008, that the fish passage facility at the Project was operational as requested by the USFWS.

On August 8, 2008¹⁸, FERC notified NHA that their actions to agencies concerns were admirable and proactive and therefore no violation of the fish passage requirements was warranted. However, similar incidents of this type in the future may be considered a violation.

On August 26, 2015¹⁹, the USFWS filed a letter with FERC containing fish passage recommendations based on a June 5, 2015 site inspection. The USFWS staff recommended:

- Operate the fish ladder 24 hours per day during the migration season rather than only from dawn to dusk;
- Divert spill from the top of the dam during high water events so that it does not damage the fish ladder;
- Meet with USFWS engineers to examine the condition of the ladder baffles, and;
- Address issues of plunging flow at the ladder entrances.

¹⁵ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=11463243>

¹⁶ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=11482697>

¹⁷ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=11502014>

¹⁸ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=11773326>

¹⁹ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13968760>

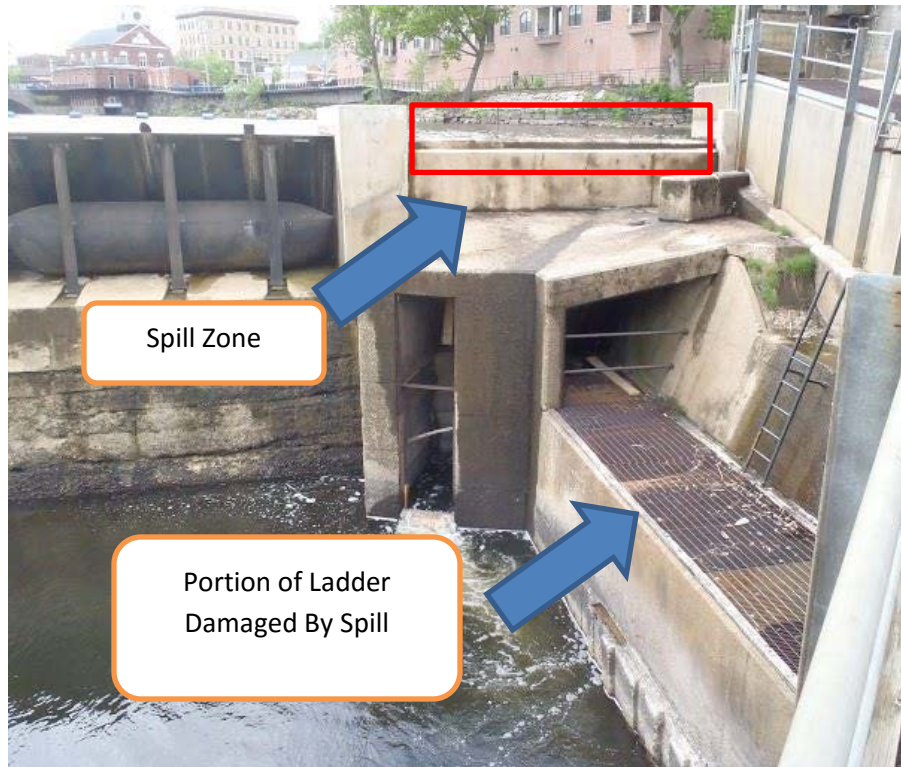


Figure 5 - Fishway Damage Issues

On December 22, 2015²⁰, the FERC request that the City file their response to the USFWS recommendations by January 22, 2016.

On December 30, 2015, the USFWS sent a letter to LIHI stating, "... the Project has some fish passage measures in place and the licensee has generally operated those facilities and been responsive to comments and recommendations from the USFWS and the NHDFG since the issuance of the exemption from licensing ...". The USFWS also expressed general upstream and downstream fish passage concerns and recommended that LIHI require the project owner to implement the measures identified in their August 26, 2015 as conditions for LIHI certification.

A new concern rose pertaining to the American Eel. Due to increased concerns about the declines in the population of American eel, implementation of upstream and downstream passage measures for eels were now being recommended.

Eel passage measures have been or are in the process of being installed on hydro projects throughout the Merrimack River watershed and measures to pass eels safely and effectively past the Project are also needed as follows:

- For upstream eel passage, interim measures such as temporary eel ramps in the lower end of the fishway entrances should be deployed in the first spring/summer/fall passage season after certification. Permanent measures should be installed within 3 years after certification, with the design and location of permanent facilities based on the effectiveness of the interim facilities. The interim and permanent facilities and operation plans for the facilities should be designed in consultation with the USFWS;

²⁰ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14080242>

- For downstream passage, interim downstream passage measures for American eel during the first downstream passage season (August 15 through November 15) should be deployed following certification. Interim measures include the retention of 1-inch-spaced trashrack overlays and downstream fish bypass operations throughout the passage season, and implementation of nighttime (dusk to dawn) shutdowns for 3 days after a significant rain event. A significant rain event is defined as 0.5 inch or more of rain during a 24-hour period, and;
- Implement permanent downstream eel passage measures 8 years after the installation of interim upstream eel passage measures. Permanent eel passage measures will include modifying the trashrack/fish screening structure to ¾-inch spacing with no gaps larger than ¾-inch in the rack structure and a maximum approach velocity of 1.5 feet per second. The downstream fish bypass should be operated throughout the eel downstream passage season (August 15 through November 15). The rack structure must be designed in consultation with and be approved by the USFWS. The downstream passage measures, including the fish screening and bypass pipe, should be operated on a 24-hour basis. In lieu of modified trashracks, the project could cease operation daily from dusk to dawn during the downstream eel passage season.

On January 18, 2016²¹, the City filed their response with the FERC, addressing each issue raised in the USFWS's August 26, 2015 letter. The City stated:

- Beginning with the 2016 fish migration season and for all future fish migration seasons, the fish ladder will be operated on a 24-hour basis;
- The City and the Project's operator, EPS will consult with USFWS to develop a diversion structure or methodology (i.e. lowering the crest gate) to ensure the spill at the top of the dam during high water events does not damage the fish ladder. EPS and or the City will develop a proposal for USFW's review no later than February 15, 2016 with the goal of implementing an agreed upon solution no later than the start of the 2016 fish migration season;
- The City and or EPS will meet with USFWS engineers to examine the condition of the ladder baffles. EPS will coordinate a date for a meeting and site visit no later than January 29, 2106.
- The City and or EPS will redesign the entrance weirs at the ladder entrances to eliminate the plunging issue identified in the June 5, 2015 USFW letter. The entrance redesign will be reviewed with USFWS engineers prior to its implementation for the 2016 fish migration season. In addition, when the fish ladder is operating, station operators during scheduled station checks will monitor the entrance flow and make changes as necessary to ensure there is no plunging flow and the drop in water surface elevation from within the entrance channel to the tailwater is approximately 4-6 inches.

On February 18, 2016²², the FERC responded and summarized the City's response. FERC stated that if it is determined that significant changes to the fish ladder, or project structures are necessary, they be notified prior to implementing any major changes. A review of the FERC docket indicates this is the last time FERC has been contacted pertaining to these ongoing fish passage issues at the Project which precipitated LIHI's April 18, 2016 request for additional information as part of the Stage II recertification review.

²¹ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14122367>

²² <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=14148841>

On March 19, 2016, LIHI received an update from the City pertaining to fish passage at the Project. The City states again that starting with the spring 2016 migration season, the Denil fish ladder at the facility will be operated 24 hours per day²³ rather than only during nighttime hours as was previously done. This action is taken in response to the August 26, 2015 USFWS recommendation based on their June 5, 2015 site inspection.

A site visit and meeting took place at the Project on March 9, 2016 with the EPS (Andrew Locke, Dave Sherman, Dave Wyatt and Elise Anderson), the City (Madeleine Mineau), and USFWS staff (Bryan Sojkowski and Michael Bailey) to address the remaining issues raised in the USFWS August 26, 2015 letter:

- Find ways to ensure that spill flows do not damage the fish ladder;
- Inspect and address ladder baffles;
- Plunging flow issue at ladder entrance

At the meeting the City proposed a methodology to ensure that spill flows do not damage the fish ladder. In the event of high flow events, the crest gate will be lowered and flow should not damage the fish ladder. Additionally, the City proposed placing a deflector to ensure that if spill flow occurs in the area above the fish ladder, flow will be deflected away from the ladder to prevent any damage. USFWS staff agreed that this approach was satisfactory. This fix was completed and in place and checked during the May 18, 2016 inspection by USFWS personnel.

The March 9, 2016 site visit and meeting also resulted in a plan to address the baffle issue. A new baffle has been designed and added and the Bryan Sojkowski revisited the site to verify and test flow and turbulence on March 24, 2016. These baffle modifications were found to be satisfactory and were re-checked during the May 18, 2016 inspection.

Finally, to address plunging flows at the ladder entrance, the City proposed installing a floating gate to ensure that a 4 to 6 inch differential will be maintained between the tailwater and the water level inside the fishway entrance gallery. USFWS also agreed that this approach would be satisfactory.

Accordingly, a floating gate was installed prior to the May 18, 2016 inspection but did not maintain the required 4-6" differential between the entrance to the fish way and the tailgate pond elevations. The floating gate was removed and manual adjusted stop logs were installed.

The City has also installed video monitors on the fish way entrances and the temporary eel ramp that will be monitored daily to ensure the proper differential is maintained. Operators will be dispatched and adjustments will be made as needed for proper entrance differentials. The City will also use cameras to monitor additional locations for upstream eel migrants, as well as, the eel ramp operation.

The City remains in compliance with fish passage requirements at the dam and has been proactively working with the USFWS and NHDFG in meeting their upstream and downstream fish passage concerns. However, I cannot find any evidence the FERC has been notified of any actions taken since January of 2016. As stated in FERC's February 18, 2016 letter, "*... if any significant changes to the fish ladder, or project structures are necessary, they be notified prior to implementing any major changes ...*" If FERC is still out of the loop, the City needs to provide them a summary of actions taken since February of 2016

²³ Start 2 days from the first day shad or river herring pass the Lowell Project (FERC No. 2790), provided there are real time counts of fish passage at the Lowell Project fish lift and spillway fish ladder. If there are no real time counts at both Lowell fishways, operation of the Project's Denil fishway should commence 4 days after the first passage of shad or river herring at the Lawrence Project (FERC No. 2800). Fishway operation should continue until upstream passage operations are ended at the Lowell Project or earlier, upon agreement with the USFWS and the NHDF.

for FERC approval.

Once LIHI receives confirmation of FERC's approval, I will recommend that the Project is compliance with LIHI's fish passage and protection criterion.

Criterion D – Watershed Protection

There is no buffer zone dedicated for conservation purposes dedicated to the protection of fish and wildlife habitat, water quality, aesthetics and/or low-impact recreation nor has the City established an approved watershed enhancement fund. Additionally, no shore land buffer or watershed protection plan has been established through settlement agreements or ever recommended for the Project as part of FERC licensing.

A 200-foot boundary zone extending around the impoundment is bordered by mill buildings, shopping malls and homes. All of the land in the immediate vicinity of the dam is urban in character, highly developed and privately owned. The flows below Project have minimal effect on shoreline erosion due to the predominantly granite and gravel substrates in the tailrace areas. There has been minimal colonization of exposed shorelines by emergent plants within the 200-foot boundary area due to the inhospitable urban landscape.

Ornamentals such as crabapple trees, cherry trees and roses were planted on the south side of the dam when the Nashua Public Library was built. Layout and landscaping of the powerhouse grounds was designed in a manner to minimize visual impact and mitigate the Project's impact on the surrounding shoreline.

My review found no issues related to watershed protection. Therefore, this LIHI criterion is satisfied.

Criterion E – Threatened and Endangered Species Protection

The Project is located in an urban area with virtually no vegetation present. The following plant species have been reported to be present at stations in the area near the Project.

- Wildrice (*Zizania aquatica* L. var. *augustifolia* Hitchc);
- Wild garlic (*Allium canadense*) ;
- American Plum (*Prunus Americana* Marsh);
- Goat's Rue (*Tephrosia virginiana* L. Pers.);
- Northern Prickly Ash (*Xanthoxylum americanum* Miller);
- Birdfoot Violet (*Viola pedata* L. var. *Lineariloba* DC)

These species are considered rare by the New England Botanical Club. However, as some of the stations date back to the 1800's, the presence of these plants is questionable. They were not found in the original vegetation surveys done as part of the application for license exemption, circa 1983.

As of October 16, 2016, the New Hampshire Natural Heritage Bureau (NHNHB) listed the following rare wildlife species near the Project area:

- Bald Eagle - Threaten
- Blanding's Turtle - Endangered
- Peregrine Falcon - Threaten
- Spotted Turtle - Threaten

- Wood Turtle - Special Concern

Also, no federally listed threatened or endangered plant species are known to occur within the facility area. There have been no deficiencies noted by any agency with jurisdiction in the area.

Since there is no indication that the Project area and operations negatively affect federally listed or state listed endangered and threatened species and given that no formal recovery plans have been requested by resource agencies for the any threatened and endangered species at the Project, the project passes this criterion.

Criterion F – Cultural Resources

Under section 106 of the National Historic Preservation Act (NHPA), Federal agencies must take into account the effect of any proposed undertaking on properties listed or eligible for listing in the National Register of Historic Places and afford the Advisory Council on Historic Preservation a reasonable opportunity to comment on the undertaking.

As part of the FERC's license exemption process for the Project, the FERC consulted with the State Historic Preservation Officer (SHPO) to determine whether and how the Project might affect historic properties, and to seek ways to avoid or minimize any adverse effects. By letter dated October 5, 2012²⁴, the New Hampshire SHPO provided a finding of "no effect" because there are no known properties of archaeological significance within the Project area.

Additionally, as part of the licensing process no Historic Properties Management Plan (HPMP) or Cultural Resources Management Plan (CRMP) was required.

The City is in compliance with all requirements regarding cultural resource protection, mitigation or enhancement. Therefore, the project passes this criterion.

Criterion G – Recreation

The Project is not obligated by its FERC Exemption to provide recreational access, accommodations or facilities. The majority of the perimeter of the impoundment is bordered by mill buildings, shopping malls and houses. The reach of river immediately downstream of the facility is bounded by high steep banks, topped by industrial and commercial buildings.

There has been no change in the regulatory status of the project since 1984 nor has there been any agency comments noting deficiencies regarding recreational conditions, therefore the project passes this criterion.

Criterion H – Dam Removal

No state or federal agencies have recommended that any dams at the Project be removed. Therefore, the project passes this criterion.

²⁴ <http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13092026>

6.2 Recommendations of the Reviewer

Based on my review of information submitted by the applicant, the additional documentation noted herein, public comments submitted in writing and communications with resource agencies and other entities, I find that the project conforms to current LIHI criteria. I recommend that the Jackson Mills Hydroelectric Project (P-7590), LIHI Certification No. 54 be recertified, with a certification term of five years, conditioned on the following:

1. As documented in the LIHI application, the Owner is currently conducting water quality tests in concert with NHDES. All results from this monitoring program should be forwarded to the LIHI upon its completion no later 120 days after LIHI certification. Given that the water quality results continue to indicate, as they did in 2010, that operation and maintenance of the Project is not a contributing cause to any violations of any applicable water standards, this condition is satisfied. If water quality issues are discovered, the Owner will need to provide LIHI a resolution plan reviewed and approved by the USFWS and the NHDES.
2. The Owner has been proactively working with the USFWS and NHDFG in meeting their upstream and downstream fish passage concerns. Site visits, meetings and agreements with State agencies have occurred in recent months. LIHI requires that documentation verifying FERC’s approval of actions taken since February of 2016 is needed no later and 45 days after LIHI certification.

7. DETAILED CRITERIA EVALUATION

7.1 Flows

LIHI Goal: The Flows Criterion ensures that healthy flows for fish, wildlife and water quality are provided downstream of the project and in all bypassed reaches, including, where appropriate, seasonal flow fluctuations characteristic of a natural system.	
A.1	<i>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)</i>
	<p>Reviewer Analysis: The WQC is incorporated within the original 1984 FERC License Exemption and the 2014 amended exemption. The Project includes the requirement to release a minimum flow of 207-cfs and follow an Operations Plan.</p> <p>Conclusion: Pass A.1; go to the Water Quality Criterion.</p>
A.2	<i>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?</i>
	Reviewer Analysis and Conclusion: N/A.

A.3	<i>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?</i>
	Reviewer Analysis and Conclusion: N/A.

7.2 Water Quality

LIHI Goal: The Water Quality Criterion ensures that water quality in the river is protected.	
B.1	<p><i>Is the Facility either:</i></p> <p><i>a) 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</i></p> <p><i>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?</i></p>
	<p>Reviewer Analysis: In 2010, the NHDES certified that the operation and maintenance of the Project does not cause a violation of the WQC and is in compliance with sections 301, 302, 303, 306, and 307 of the Federal Clean Water Act.</p> <p>Conclusion: YES, Pass B.1(a); Go to B.2</p>
B.2	<p><i>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?</i></p>
	<p>Reviewer Analysis: The entire Nashua River within New Hampshire has been assigned a water quality standard of Class C, Category 5 by the NHWSPCC. Category 5 waters are "Impaired or threatened for one or more designated uses by a pollutant(s), and the classification is based on a Total Maximum Daily Load (TMDL) determination. These conditions existed prior to development of the project.</p> <p>Conclusion: Go to B.3</p>
B.3	<p><i>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?</i></p>
	Reviewer Analysis and Conclusion: Yes. Go to Fish Passage Criterion.

7.3 Fish Passage and Protection

LIHI Goal: The Fish Passage and Protection Criterion ensure that, where necessary, the Facility provides effective fish passage for Riverine, anadromous and catadromous fish, and protects fish from entrainment.

C.1	<p><i>Are anadromous and/or catadromous fish present in the Facility area or are they know to have been present historically?</i></p>
	<p>Reviewer Analysis: Yes.</p> <p>Conclusion: go to C.2</p>
C.2	<p><i>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?</i></p>
	<p>Reviewer Analysis: Yes, fish passage facilities have been installed on site since 1984. In 2007, the Project agreed and implemented operational changes to upstream and downstream fish passage as recommended by the USFWS.</p> <p>Conclusion: go to C.3</p>
C.3	<p><i>Are there historic records of anadromous and/or catadromous fish movement through the Facility area, but anadromous and/or catadromous fish do not presently move through the Facility area (e.g., because passage is blocked at a downstream dam or the fish no longer have a migratory run)?</i></p> <p><i>a) If the fish are extinct or extirpated from the Facility area or downstream reach, has the Applicant demonstrated that the extinction or extirpation was not due in whole or part to the Facility?</i></p> <p><i>b) If a Resource Agency Recommended adoption of upstream and/or downstream fish passage measures at a specific future date, or when a triggering event occurs (such as completion of passage through a downstream obstruction or the completion of a specified process), has the Facility owner/operator made a legally enforceable commitment to provide such passage?</i></p>
	<p>Reviewer Analysis: NA</p>
C.4	<p><i>If, since December 31, 1986:</i></p> <p><i>a) Resource Agencies have had the opportunity to issue, and considered issuing, a Mandatory Fish Passage Prescription for upstream and/or downstream passage of anadromous or catadromous fish (including delayed installation as described in C.3.a above), and</i></p> <p><i>b) The Resource Agencies declined to issue a Mandatory Fish Passage Prescription,</i></p> <p><i>c) Was a reason for the Resource Agencies' declining to issue a Mandatory Fish Passage Prescription one of the following: (1) the technological infeasibility of passage, (2) the absence of habitat upstream of the Facility due at least in part to inundation by the Facility impoundment, or (3) the anadromous or catadromous fish are no longer present in the Facility area and/or downstream reach due in whole or part to the presence of the Facility?</i></p>
	<p>Reviewer Analysis: NA</p>

<p>C.5</p>	<p><i>If C4 was not applicable:</i></p> <p>a) <i>Are upstream and downstream fish passage survival rates for anadromous and catadromous fish at the dam each documented at greater than 95% over 80% of the run using a generally accepted monitoring methodology? Or</i></p> <p>b) <i>If the Facility is unable to meet the fish passage standards in 5.a, has the Applicant either i) demonstrated, and obtained a letter from the U.S. Fish and Wildlife Service or National Marine Fisheries Service confirming that demonstration, that the upstream and downstream fish passage measures (if any) at the Facility are appropriately protective of the fishery resource, or ii) committed to the provision of fish passage measures in the future and obtained a letter from the U.S. Fish and Wildlife Service or the National Marine Fisheries Service indicating that passage measures are not currently warranted?</i></p> <p>Reviewer Analysis: NA</p>
<p>C.6</p>	<p><i>Is the Facility in Compliance with Mandatory Fish Passage Prescriptions for upstream and/or downstream passage of Riverine fish?</i></p> <p>Reviewer Analysis: Migratory fish pass the facility using upstream and downstream passage in accordance with the design criteria of the USFWS since 1984. Passage recommendations were made in 2008 and the Project is currently in discussions with the USFWS on new enhancements to passage and protection.</p> <p>Finding: Yes and go to the C.7.</p>
<p>C.7</p>	<p><i>Is the Facility in Compliance with Resource Agency Recommendations for Riverine, anadromous and catadromous fish entrainment protection, such as tailrace barriers?</i></p> <p>Reviewer Analysis: The Project is in compliance with resource agency recommendations for fish entrainment protection.</p> <p>Finding: Pass; Go to the Watershed Protection Criterion.</p>

7.4 Watershed Protection

<p>LIHI Goal: The Watershed Protection criterion is designed to ensure that land resources are being protected within and around the facility boundary. The term of certification is extended from five to eight years for projects that have either a shoreline buffer zone or a watershed enhancement fund.</p>	
<p>D.1</p>	<p><i>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 high water mark in an average water year around 50 - 100% of the impoundment, and for all of the undeveloped shoreline?</i></p>
	<p>Reviewer Analysis: No, Go to D.2</p>
<p>D.2</p>	<p><i>Has the facility owner/operator established an approved watershed enhancement fund that: a) could achieve within the project’s watershed the ecological and recreational equivalent of land protection in D.1.,and b) has the agreement of appropriate stakeholders and state and federal resource agencies?</i></p>
	<p>Reviewer Analysis/Conclusions: No, Go to D.3</p>
<p>D.3</p>	<p><i>Has the facility owner/operator established through a settlement agreement with appropriate stakeholders and that has state and federal resource agencies agreement an appropriate shoreline buffer or equivalent watershed land protection plan for conservation purposes (to protect fish and wildlife habitat, water quality, aesthetics and/or low impact recreation).</i></p>
	<p>Reviewer Analysis: N/A, Go to D.4</p>
<p>D.4</p>	<p><i>Is the facility in compliance with both state and federal resource agencies recommendations in a license approved shoreline management plan regarding protection, mitigation or enhancement of shoreline surrounding the project?</i></p>
	<p>Reviewer Analysis: There is no buffer zone dedicated for conservation purposes dedicated to the protection of fish and wildlife habitat, water quality, aesthetics and/or low-impact recreation nor has the City established an approved watershed enhancement fund. Additionally, no shore land buffer or watershed protection plan has been established through settlement agreements or ever recommended for the Project as part of FERC licensing.</p> <p>Conclusion: Pass D.4 and Go to Threatened/Endangered Species Criterion.</p>

7.5 Threatened and Endangered Species Protection

<p>LIHI Goal: The Threatened and Endangered Species Protection Criterion is designed to ensure that the Facility does not negatively impact state or federal threatened or endangered species.</p>	
E.1	<p><i>Are threatened or endangered species listed under state or federal Endangered Species Acts present in the Facility area and/or downstream reach?</i></p> <p>Reviewer Analysis: The Project is located in an urban area with virtually no vegetation present. There are six rare plant species and six wildlife reported to be present at stations in the area near the Project. Also, no federally listed threatened or endangered plant species are known to occur within the facility area.</p> <p>Conclusion: YES; Go to E2.</p>
E.2	<p><i>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?</i></p> <p>Reviewer Analysis: There are no formal recovery plans for the threatened and endangered species at the Project.</p> <p>Conclusion: N/A; Go to E3.</p>
E.3	<p><i>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?</i></p> <p>Reviewer Analysis: NA; Go to E5.</p>
E.4	<p><i>If a biological opinion applicable to the Facility for the threatened or endangered species has been issued, can the Applicant demonstrate that:</i></p> <p>a) <i>The biological opinion was accompanied by a FERC license or exemption or a habitat conservation plan? Or</i></p> <p>b) <i>The biological opinion was issued pursuant to or consistent with a recovery plan for the endangered or threatened species? Or</i></p> <p>c) <i>There is no recovery plan for the threatened or endangered species under active development by the relevant Resource Agency? Or</i></p> <p>d) <i>The recovery plan under active development will have no material effect on the Facility's operations?</i></p> <p>Reviewer Analysis: NA: Go to E5</p>

E.5	<p><i>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?</i></p>
	<p>Reviewer Analysis: There have been no deficiencies noted by any agency with jurisdiction in the area.</p>
	<p>Pass; Go to Cultural Resources.</p>

7.6 Cultural Resources

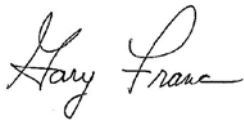
<p>LIHI Goal: The Cultural Resource Protection Criterion is designed to ensure that the Facility does not inappropriately impact Cultural Resources.</p>	
F.1	<p><i>If FERC-regulated, is the Facility in Compliance with all requirements regarding Cultural Resource protection, mitigation or enhancement included in the FERC license or exemption?</i></p> <p>Reviewer Analysis: By letter dated October 5, 2012, the New Hampshire SHPO provided a finding of "no effect" because there are no known properties of archaeological significance within the Project area.</p> <p>Additionally, as part of the licensing process no Historic Properties Management Plan (HPMP) or Cultural Resources Management Plan (CRMP) was required.</p> <p>Finding: YES; PASS and go to Recreation Criterion.</p>

7.7 Recreation

<p>LIHI Goal: The Recreation Criterion is designed to ensure that the Facility provides access to the waters and accommodates recreational activities.</p>	
G.1	<p><i>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?</i></p> <p>Reviewer Analysis: The Project is not obligated by its FERC Exemption to provide recreational access, accommodations or facilities. The majority of the perimeter of the impoundment is bordered by mill buildings, shopping malls and houses. The reach of river immediately downstream of the facility is bounded by high steep banks, topped by industrial and commercial buildings.</p> <p>There has been no change in the regulatory status of the project since 1984 nor has there been any agency comments noting deficiencies regarding recreational conditions, therefore the project passes this criterion.</p> <p>Finding: N/A; PASS and go to Dam Removal Criterion.</p>

7.8 Dam Removal

<p>LIHI Goal: The Dam Removal Criterion is designed to ensure that the Facility is not certified if a Resource Agency has recommended that a dam associated with the Facility should be removed.</p>	
H.1	<p><i>Is there a Resource Agency Recommendation for removal of the dam associated with the Facility?</i></p> <p>Reviewer Analysis: There is no evidence that any agencies have requested that the Project dam be removed.</p> <p>Conclusion: NO, pass H.1 and pass on all LIHI criteria.</p>



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APPENDIX A

*FERC DOCKET*²⁵

²⁵ Click on the hyperlink in the table to view the referenced FERC documents in FERC's library. You need to be connected to the web. The initial click will return the file's properties (author, recipient, etc.). Clicking on the [File List] tab will return a document list. Clicking on a document name will open the document for viewing.