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Review for Upper Raquette River Hydroelectric Project Recertification by the Low Impact Hydropower Institute's (LIHI)

Prepared by Gary M. Franc
November 1, 2022

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I. INTRODUCTION

In 2004, the Raquette River Project (RRP) was certified as LIHI #14. The RRP was comprised of fourteen Erie Boulevard Hydropower (EBH)[1] hydro developments, and the Project was recertified in 2009. During LIHI recertification in 2014, the RRP was separated into three smaller LIHI certificates, the Upper Raquette River Project (URRP), the Middle Raquette River Project (MRRP) and the Lower Raquette River Project (LRRP) to help reduce the overall size and complexity of the issues.

The developments of Higley, Colton, Hannawa and Sugar Island, are now defined as the MRRP (LIHI #14B). The developments of Norwood, East Norfolk, Norfolk and Raymondville, are now defined as the LRRP (LIHI #14C).

The URRP (LIHI #14A) includes the developments of Carry Falls storage impoundment, and the Stark Falls, Blake Falls, Rainbow Falls, Five Falls, and South Colton hydro developments. This Stage II review report is limited to the recertification of the URRP.

On February 13, 2002, the FERC issued licenses for Carry Falls (P-2060) and the Upper Raquette hydro developments (P-2084) for a term of 31 years and 11 months, ending on December 31, 2033.[2] The New York State Department of Environmental Conservation (NYSDEC) issued a Section 401 Water Quality Certification (WQC) for the entire Raquette River Project on June 11, 1998. Additionally, the NYSDEC responded on June 8, 2022 to an EBH request stating that the existing WQC is valid for the duration of the FERC license, as documented in Appendix D of the LIHI recertification application.

The developments were originally constructed and began operation over a five-year period from 1952 to 1957. The authorized total installed capacity is 102.389 megawatts (MW). The LIHI application states that from October 1, 2016 through September 30, 2021, the URRP produced an average annual generation (AAG) of 453,433 megawatt-hours (MWh), which corresponds to an annual plant factor of 50.6%.

The current LIHI certification was issued on July 9, 2014, with one condition, *"Within 90 days after certification, EBH needs to provide LIHI a schedule for the completion of trashrack installations at the developments of the URRP. Additionally, EBH needs to provide a letter report on the status of trashrack installations as they become due at Rainbow Falls in 2016, Five Falls in 2017, Stark in 2019 and Blake in 2020, describing any and all events, if any, that cause delay, and actions being taken by EBH to resolve further delay. The report is due at the same time as the annual compliance statement and payment of the annual certification fee. Based on LIHI's review of this report, and at LIHI's sole discretion, certification may be rescinded or modified."* This condition was fully satisfied in 2021.

On January 13, 2022, EBH was reminded by LIHI that the current URRP certification would expire on July 9, 2022. On July 8, 2022, LIHI sent notice to EBH that the current certification for the URRP would be

[1] In 1999, Niagara Mohawk Power Company (NMPC) sold their entire hydropower portfolio to Orion Power. EBH was created as a subsidiary of the newly formed company dealing with the operation of the prior NMPC hydropower assets. Orion Power was eventually acquired through a series of sales and purchases by Brookfield Renewable Energy Group (BREG), the current owner of EBH. Mr. Daniel J. Maguire, P.E., Compliance Manage, BREG, 184 Elm Street, Potsdam, NY 13676 - (315-267-1036) - Danny.Maguire@brookfieldrenewable.com has been assigned as the application coordinator.

[2] FERC License 2060 - https://elibrary.ferc.gov/eLibrary/filedownload?fileid=00105941-66E2-5005-8110-C31FAFC91712
FERC License 2084 - https://elibrary.ferc.gov/eLibrary/filedownload?fileid=00105942-66E2-5005-8110-C31FAFC91712

extended until December 31, 2022 to allow time for the recertification process. EBH submitted a recertification application on July 9, 2022. On July 21, 2022, LIHI notified EBH that the Stage I review for the Project was complete. The review found the recertification application required only minor additional information, corrections and supporting documentation to perform a full Stage II recertification review. On August 30, 2022 the LIHI posted the application for public comment. The 60-day public comment period ended on October 29, 2022.

II. PROJECT GEOGRAPHIC LOCATION

The Raquette River, with a total drainage basin of 1,269 square miles (SQMI), originates in the Adirondack highlands at Blue Mountain Lake, Raquette Lake and Long Lake. The river flows predominately north-northwest for 146 miles emptying into the St. Lawrence River below Massena, New York. The area experiences cold, snowy winters and short summers. Annual precipitation is about 40 inches. The river transitions from cold water habitat in the headwaters to a cool water aquatic fishery as the river reaches lower gradients. Most of the basin is sparsely populated, with much of the land forested.

In the Raquette River headwaters, EBH's Piercefield development (FERC No. 7387, LIHI #156) at river mile (RM) 88.5 releases flow into the Carry Falls impoundment which impounds 877 SQMI of drainage (see Figure 1). Carry Falls' seasonal storage is the largest on the Raquette River and is used to store and regulate the majority of this upstream flow through the remaining URRP developments and EBH's downstream MRRP and LRRP developments, and other developments in between them.

The URRP developments include:

- Carry Falls Development, located at RM 68 and licensed as P-2060.
- Stark Development, located at RM 66 and licensed as P-2084.
- Blake Development, located at RM 62 and licensed as P-2084.
- Rainbow Falls Development, located at RM 56 and licensed as P-2084.
- Five Falls Development, located at RM 54 and licensed as P-2084.
- South Colton Development, located at RM 52 and licensed as P-2084.

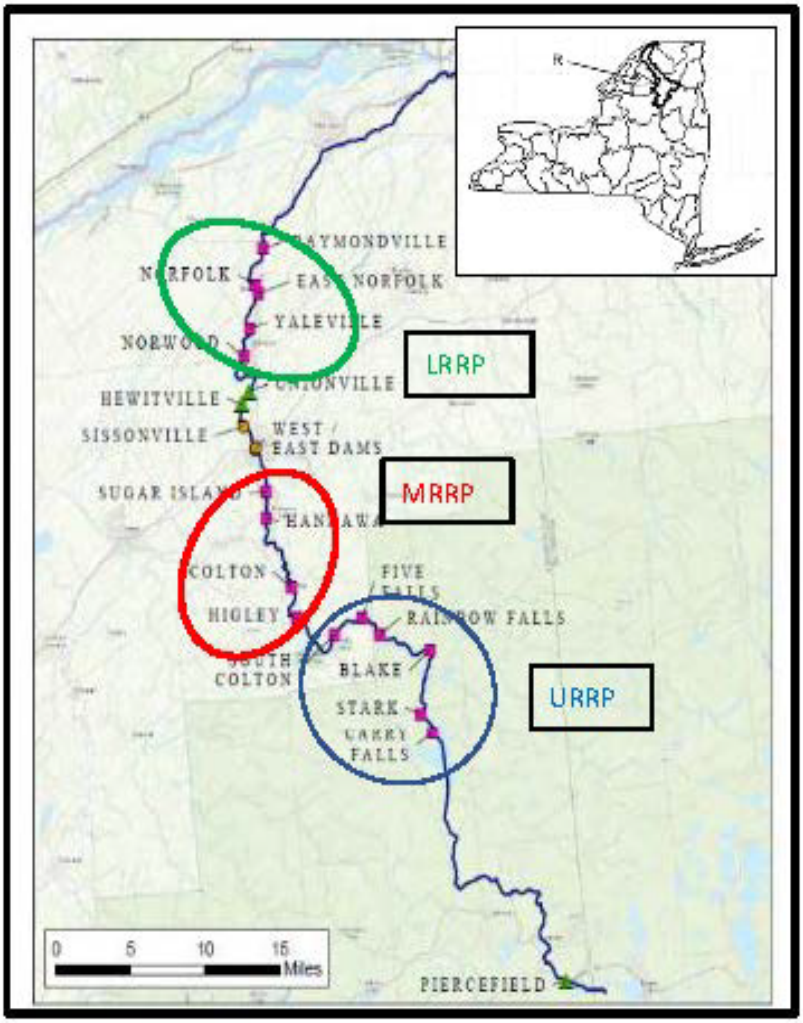

Figure 1 - Location Map

The MRRP developments include:

- Higley Development, located at RM 47 and licensed as P-2320.
- Colton Development, located at RM 45 and licensed as P-2320.
- Hannawa Development, located at RM 39 and licensed as P-2320.
- Sugar Island Development, located at RM 38 and licensed as P-2320.

Flows downstream of Sugar Island travel through four developments having individual dams and impoundments that operate in a run of river (ROR) mode:

- The Potsdam Project (FERC No. 2869) at RM 35, owned by the Village of Potsdam;
- The Sissonville Limited Partnership's (SLP) Sissonville Project (FERC No. 9260) at RM 33;
- EBH's Hewittville Project (FERC No. 2499) at RM 32. Downstream fish passage at Hewittville was completed in January of 2021;
- EBH's Unionville Project (FERC No. 2498) at RM 31. Downstream fish passage at Unionville was completed in November of 2020.

Seasonal upstream eel passage is provided at all dams downstream of Unionville. Flow below Unionville travel through:

- Norwood Development, part of the LRRP, located at RM 28.0 and licensed as P-2330.
- EBH's Yaleville Project, licensed as FERC No. 9222 (LIHI #157) and located at RM 25.0.
- East Norfolk Development, part of the LRRP, located at RM 23.5 and licensed as P-2330.
- Norfolk Development, part of the LRRP, located at RM 22.5 and licensed as P-2330.
- Raymondville Development, part of the LRRP, located at RM 20.0 and licensed as P-2330.

There are three US Geological Survey (USGS) gages located on the Raquette River:

- USGS gage 04266500 (GAGE1), located below the Piercefield dam. This gage has a contributing drainage area of 721 SQMI with recorded daily streamflow since August of 1908;
- USGS gage 04267500 (GAGE2), located below the South Colton dam. This gage has a contributing drainage area of 937 SQMI with recorded daily streamflow from January of 1953 to September of 2002 and from October of 2010 to present day;
- USGS gage 04268000 (GAGE3), located below the Raymondville dam. This gage has a contributing drainage area of 1,125 SQMI with recorded daily streamflow since November of 1943.

The application states that daily flows at GAGE2 was used to estimate available flows at all URRP developments using a linear proration by drainage area ratio (DAR). The DAR is calculated by dividing the drainage area at a development by the drainage area at GAGE2. Each development's flow is estimated by multiplying the GAGE2 flows by the resulting DAR.

Given the drainage areas at Carry Falls (872.2 SQMI) [3], Stark (877 SQMI), Blake (908 SQMI), Rainbow (929 SQMI) and South Colton (937 SQMI), the resulting DARs are 0.9308 at Carry Falls, 0.9360 at Stark, 0.9691 at Blake, 0.9915 at Rainbow, 0.9947 at Five Falls and 1.00 at South Colton.

[3] Adjusted to drainage area at the upstream end of the impoundment.

Table 1 shows a comparison of the monthly and annual daily flows for calendar years 2010 through 2021 at Carry Falls for flows reported in the application versus flows calculated using my HELPUSGS Excel package. The % Diff row shows any discrepancies in the flow estimates.

Table 1 - Estimated Carry Falls Inflows - Calendar 2010 - 2021 Daily Flow Records													
Flow Range	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
Application	2000	1690	2100	2990	3260	2100	1430	1120	1050	1350	1490	1410	1820
HELPUSGS	1,998	1,697	2,105	2,991	3,263	2,104	1,435	1,121	1,047	1,356	1,487	1,410	1,825
% Diff	-0.1%	0.4%	0.2%	0%	0.1%	0.2%	0.3%	0.1%	-0.3%	0.4%	-0.2%	0%	0.3%

From an historical perspective, period of record (POR) inflows can be estimated. The POR starts on January 1, 1953 and ends on August 3, 2022, the date I performed the analysis.

Table 2 shows a comparison of the monthly and annual daily flows at Carry Falls for calendar years 2010 through 2021 versus POR flows. The % Diff row shows differences in flow for the two periods.

Table 2 - Estimated Carry Falls Inflows – POR Daily Flow Records													
Flow Range	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC	ANNUAL
2010-2021	1,998	1,697	2,105	2,991	3,263	2,104	1,435	1,121	1,047	1,356	1,487	1,410	1,825
POR	1,644	1,578	1,968	3,013	2,993	1,713	1,243	1,065	1,032	1,297	1,493	1,583	1,721
% Diff	-17.7%	-1.1%	-6.5%	0.7%	-8.3%	-18.6%	-13.4%	-5.0%	-1.4%	-4.4%	0.4%	12.3%	-5.7%

The results indicate that on an annual basis, flows since 2010 have averaged about 5.7% higher than POR flows at Carry Falls. Flow duration analysis results indicate the minimum daily flow of 4 cubic feet per second (CFS) occurred on June 2, 1954. The maximum daily flow of 11,542 CFS occurred on April 29, 2011. The Project's POR average annual inflow is 1,721 CFS, about 1.97 CFS per SQMI.

Historically, a daily flow of 561 CFS is exceeded about 90% of the time annually. A daily flow of 1,441 CFS is exceeded about 50% of the time annually. A daily flow of 3,230 CFS is exceeded about 10% of the time annually. The 1% exceeded annual daily flow is 5,908 CFS.

Historically, the 10-year daily flow is about 7,688 CFS and the 100-year daily flow is 10,615 CFS. The 7Q10[4] flow is estimated to be 7 CFS. If only flows since November of 2010 are used, the 7Q10 increases to 21 CFS.

III. PROJECT SITE CHARACTERISTICS

The URRP is located on the Raquette River from RM 68 to RM 52 and consists of six developments, Carry Falls, Stark, Blake, Rainbow, Five Falls and South Colton as shown in Table 3. Each development has a dam and reservoir, and all but Carry Falls have powerhouses. The URRP operates as described in the Raquette

[4] 7Q10 flow is the daily seven-day rolling average flow that is exceeded 90% of the time annually. There is only a 10% chance that a seven-day rolling average flow less than this value will occur in a given year.

River Project Settlement Offer (RRPSO), submitted to FERC on April 22, 1998[5] and incorporated into the 2002 FERC licenses.

Table 3 – URRP – Location Coordinates			
Development	**River** Mile	**Latitude of Dam**	**Longitude of Dam**
Carry Falls	68	44.53053	-74.93198
Stark	66	44.45112	-74.76587
Blake	62	44.50200	-74.74610
Rainbow	56	44.51667	-74.82045
Five Falls	54	44.52994	-74.84340
South Colton	52	44.51744	-74.88137

The total installed capacity is 102.389 MW as shown in Table 4. The LIHI application states that from October 1, 2016 through September 30, 2021, the Project produced an AAG of 453,433 MWh, which corresponds to an annual plant factor of 50.6%.

Table 4 – Hydro Parameters			
Development	**Installed Capacity (MW)**	**Average Annual Generation (AAG)**	**Plant Factor (%)**
Carry Falls	0	0	0
Stark	23.872	99,639	47.6
Blake	13.913	62,200	51.0
Rainbow	22.828	104,052	52.0
Five Falls	22.828	101,607	50.8
South Colton	18.948	85,935	51.8
TOTAL	102.389	453,433	50.6

The only changes during the current LIHI certification have been that EBH installed 1-inch clear spaced trashracks at Rainbow in 2016, Five Falls in 2017, Stark in 2019 and Blake in 2020, in accordance with the recertification condition. At Stark, additional piezometers were installed in 2017 and in 2018 embankment repairs were made.

[5] RRPSO - https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0009E5DA-66E2-5005-8110-C31FAFC91712

A. Carry Falls

The Carry Falls development consists of a 76-foot-high, 826-foot-long dam with:

- A 568-foot-long concrete gravity spillway with a crest elevation of 1,386.0 feet mean sea level (FTMSL) that creates a reservoir with a 3,000-acre surface area which creates 114,780 acre-feet (ACFT) of storage capacity at normal maximum pool elevation of 1,385.0 FTMSL. At an elevation of 1,390 FTMSL, the spillway can pass 31,000 CFS;
- Five earthen dikes totaling approximately 2,500 feet in length, with lengths varying from 320 to 1,015 feet and maximum heights varying from 12 to 31 feet, each with a crest width of 12 feet at elevation 1,392.0 FTMSL;
- A 258-foot-long by 63-foot-high concrete gated non-overflow spillway with two 14.5-foot by 27-foot Tainter gates, two 10-foot-high by 10-foot-wide low level sluice gates, and an intake structure with two 15-foot square openings for future power installation.

There are no plans for any facility upgrades at the development.

Figure 2 - Carry Falls Spillway

EBH operates the Carry Falls Reservoir according to the guide curve shown in Figure 4. Although the Carry Falls Reservoir was not designed for flood control purposes, there is incidental flood control derived from the reservoir operation under the current guide curve. The guide curve reduces the late fall, winter and spring drawdowns when compared to the guide curve prior to the 2002 relicense. A large percentage of the reservoir substrate is no longer seasonally exposed, with the number of acres of reservoir substrate wetted continuously having increased from 700 acres to over 2,500 acres.

The reduced drawdown improves wetlands and aquatic habitats, leading to greater benthic invertebrate production, improved fish spawning and nursery areas, improved habitats for reptiles and amphibians, and greater abundance and diversity of fish and wildlife resources.

Figure 3 - Carry Falls Non-Overflow Structure

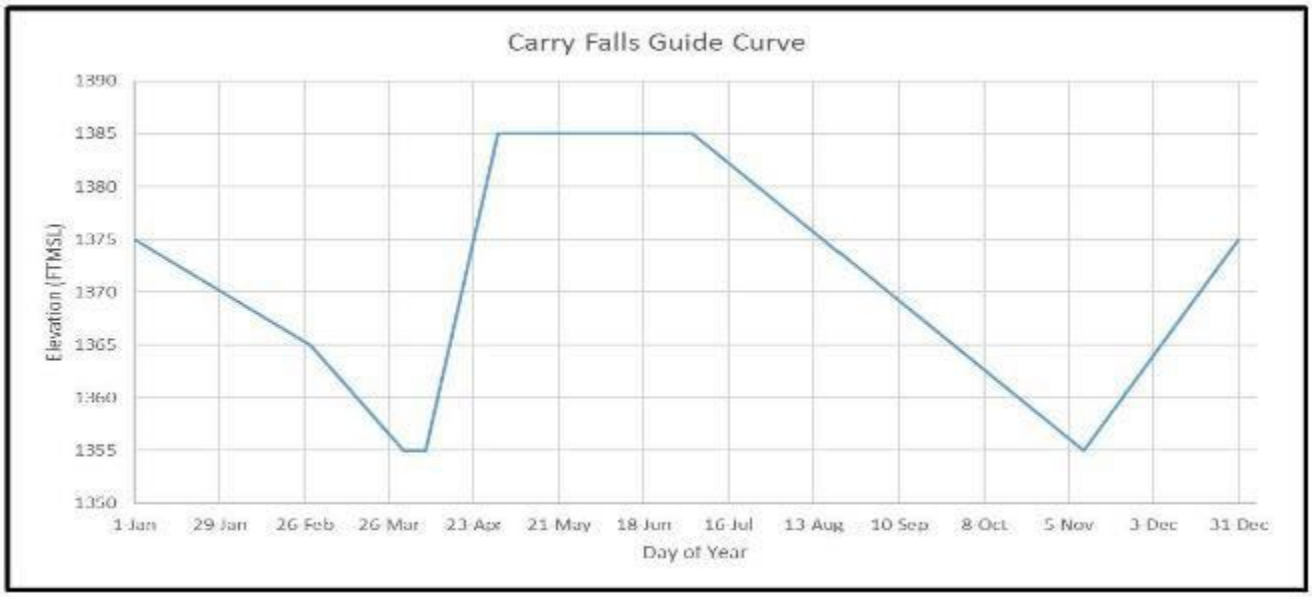

Figure 4 - Carry Falls Guide Curve

B. Stark

An aerial view of the Stake Development is shown in Figure 5. The Stark development consists of a 35-foot-high concrete gravity dam with:

- A reservoir with a 704-acre surface area and 16,861 ACFT of usable storage capacity at normal maximum pool elevation of 1,355.0 FTMSL and a minimum allowable elevation of 1353.7 FTMSL;
- A 294-foot-long concrete overflow section with a crest elevation of 1,355.0 FTMSL. At an elevation of 1,360.5 FTMSL, the overflow can pass 21,300 CFS;
- A 94-foot-long control gate section consisting of two 27-foot-long and 15-foot-high radial Tainter gates with a crest elevation of 1,340.8 FTMSL;
- A low-level sluice gate section consisting of one motor controlled 12-foot square slide gate;
- A 6-foot-wide stop log section;
- Seven earthen saddle dikes with a crest elevation of 1,362.0 FTMSL, totaling approximately 3,700 feet in length, each 16 feet wide with upstream and downstream slopes of 3 to 1 and 2.5 to 1, respectively;
- A pipeline intake containing 1-inch clear spacing trashracks with a maximum velocity of 2.7 feet per second (FPS);
- A 651-foot-long, 18-foot-diameter welded steel pipeline;
- A powerhouse containing one vertical Francis turbine with a design capacity of 32,000 horsepower (HP) at a design head of 104.2 feet and a speed of 120 revolutions per minute (RPM). The output is 21.5 MW at a turbine flow of 2,700 CFS and 23.87 MW at a turbine flow of 3,010 CFS.

There are no plans for any facility upgrades at the development.

Figure 5 - Aerial View of Stark Development

Figure 6 - Stark Dam

Figure 7 - Stark Pipeline

Figure 8 - Stark Powerhouse

C. Blake

An aerial view of the Blake Development is shown in Figure 9. The Blake development consists of a 75-foot-high concrete gravity dam with:

- A reservoir with a 703-acre surface area and 32,900 ACFT of usable storage capacity at normal maximum pool elevation of 1,250.2 FTMSL and a minimum allowable elevation of 1249.2 FTMSL;
- A 592-foot-long concrete overflow section with a crest elevation of 1,250.5 FTMSL. At an elevation of 1,259.5 FTMSL, the overflow can pass 50,000 CFS;
- A 140-foot-long non-overflow section with a crest elevation of 1,266.0 FTMSL;
- Three earthen saddle dikes with a crest elevation of 1,259.5 FTMSL, totaling approximately 1,840 feet in length, each 16 feet wide with upstream and downstream slopes of 3 to 1 and 2.5 to 1, respectively;
- A pipeline intake containing 1-inch clear spacing trashracks with a maximum velocity of 2.6 FPS;
- A 731-foot-long, 18-foot-diameter welded steel pipeline;
- A powerhouse containing one vertical Francis turbine with a design capacity of 18,650 HP at a design head of 67.1 feet and a speed of 112.5 RPM. The output is 13.5 MW at a turbine flow of 2,700 CFS and 13.9 MW at a turbine flow of 2,980 CFS.

There are no plans for any facility upgrades at the development.

Figure 9 - Aerial View of Blake Development

Figure 10 - Blake Dam

Figure 11 - Blake Pipeline/Penstock

D. Rainbow

An aerial view of the Rainbow Development is shown in Figure 12. The Rainbow development consists of a 75-foot-high 2,677-foot-long concrete gravity dam with:

- A reservoir with a 717-acre surface area and 10,462 ACFT of usable storage capacity at normal maximum pool elevation of 1,181.2 FTMSL and a minimum allowable elevation of 1,180.2 FTMSL;
- A 751-foot-long concrete overflow section with a crest elevation of 1,181.5 FTMSL. At an elevation of 1,190.5 FTMSL, the overflow can pass 62,800 CFS;
- A 120-foot long and a 176-foot-long non-overflow section with a crest elevation of 1,181.5 FTMSL;
- Two earthen saddle dikes with a crest elevation of 1,190.0 FTMSL, totaling approximately 2,570 feet in length, each 16 feet wide with upstream and downstream slopes of 3 to 1 and 2.5 to 1, respectively;
- A pipeline intake containing 1-inch clear spacing trashracks with a maximum velocity of 2.6 FPS;
- A 645 foot long, 18-foot-diameter welded steel pipeline;
- A powerhouse containing one vertical Francis turbine with a design capacity of 30,600 HP at a design head of 100.7 feet and a speed of 120 RPM. The output is 20.5 MW at a turbine flow of 2,700 CFS and 22.83 MW at a turbine flow of 3,200 CFS.

There are no plans for any facility upgrades at the development.

Figure 12 - Aerial View of Rainbow Development

Figure 13 - Rainbow Dam

Figure 14 - Rainbow Powerhouse

E. Five Falls

An aerial view of the Five Falls Development is shown in Figure 15. The Five Falls development consists of a 50-foot-high, 1,750-foot-long concrete gravity dam with:

- A reservoir with a 145-acre surface area and 3,090 ACFT of storage capacity at normal maximum pool elevation of 1,076.7 FTMSL and a minimum allowable elevation of 1,074.7 FTMSL;
- A 500-foot-long concrete overflow section with a crest elevation of 1,077.0 FTMSL. At an elevation of 1,087.0 FTMSL, the overflow can pass 45,400 CFS;
- A 6-foot-wide stop log section with a sill elevation of 1,072.0 FTMSL;
- Two earthen saddle dikes with a crest elevation of 1,077 FTMSL, totaling approximately 1,190 feet in length, each 16 feet wide with upstream and downstream slopes of 3 to 1 and 2.5 to 1, respectively;
- A pipeline intake containing 1-inch clear spacing trashracks with a maximum velocity of 2.9 FPS;
- A 1,399-foot-long, 18-foot-diameter welded steel pipeline with a restricted orifice surge tank;
- A powerhouse containing one vertical Francis turbine with a design capacity of 30,600 HP at a design head of 100.8 feet and a speed of 120 RPM. The output is 21.5 MW at a turbine flow of 2,700 CFS and 22.83 MW at a turbine flow of 3,260 CFS.

There are no plans for any facility upgrades at the development.

Figure 15 Aerial View of Five Falls Development

Figure 16 - Five Falls Dam

Figure 17 - Five Falls Pipeline and Surge Tank

F. South Colton

An aerial view of the South Colton Development is shown in Figure 18. The South Colton development consists of a 45-foot-high, 970-foot-long concrete gravity dam with:

- A reservoir with a 230-acre surface area and 3,600 ACFT of storage capacity at normal maximum pool elevation of 973.2 FTMSL and a minimum allowable elevation of 971.2 FTMSL;
- A 592-foot-long concrete spillway section with a crest elevation of 973.5 FTMSL. At an elevation of 983.8 FTMSL, the overflow can pass 50,300 CFS;
- A 6-foot-wide stop log section with a sill elevation of 968.0 FTMSL;
- A pipeline intake containing 1-inch clear spacing trashracks with a maximum velocity of 3.1 FPS;
- A 1,220-foot-long, 18-foot-diameter welded steel pipeline with a restricted orifice surge tank;
- A powerhouse containing one vertical Francis turbine with a design capacity of 25,400 HP at a design head of 82.7 feet and a speed of 120 RPM. The output is 15 MW at a turbine flow of 2,700 CFS and 18.95 MW at a turbine flow of 3,500 CFS.

There are no plans for any facility upgrades at the development.

Figure 18 - Aerial View of South Colton Development

Figure 19 - South Colton Dam

Figure 21 - South Colton Powerhouse

Figure 20 - South Colton Pipeline

IV. ZONES OF EFFECT (ZOEs)

The Project has sixteen ZOEs:

- ZOE 1, which extends from the head of the Carry Falls impoundment to the Carry Falls dam;
- ZOE 2, which extends from the head of Stark Reservoir, downstream to the Stark intake;
- ZOE 3, which extends from the Stark dam, downstream to the Blake impoundment;
- ZOE 4, which extends from the tailrace of the Stark powerhouse, downstream to the Blake Impoundment;
- ZOE 5, which extends from the head of the Blake impoundment at the Stark tailrace and bypassed reach, downstream to the Blake intake;
- ZOE 6, which extends from the Blake dam, downstream to the tailrace and the Rainbow impoundment;
- ZOE 7, which extends from the tailrace of the Blake powerhouse, downstream to the Rainbow impoundment;
- ZOE 8, which extends from the head of the Rainbow impoundment at the Blake tailrace and bypassed reach, downstream to the Rainbow intake and spillway;
- ZOE 9, which extends from the Rainbow dam, downstream to the tailrace and the Five Falls impoundment;
- ZOE 10, which extends from the tailrace of the Rainbow powerhouse, downstream to the Five Falls impoundment;
- ZOE 11, which extends from the head of the Five Falls impoundment at the Rainbow tailrace and bypassed reach, to the Five Falls intake and spillway;
- ZOE 12, which extends from the Five Falls dam, downstream to the tailrace and the South Colton impoundment;
- ZOE 13, which extends from the tailrace of the Five Falls powerhouse, downstream to the South Colton impoundment and the bypassed reach;
- ZOE 14, which extends from the head of the South Colton impoundment at the Five Falls bypassed reach and tailrace, to the South Colton intake and spillway;
- ZOE 15, which extends from the South Colton dam, downstream to the tailrace and the Higley Reservoir impoundment;
- ZOE 16, which extends from the tailrace of the South Colton powerhouse, downstream to the bypassed reach and the Higley Reservoir impoundment.

A. Carry Falls

The Carry Falls development has one ZOE (ZOE1 – Impoundment) from RM 68 downstream to RM 66.

B. Stark

The Stark development has three ZOEs, from RM 66 downstream to RM 62; ZOE2 – Impoundment; ZOE3 – Bypass Reach; ZOE4 - Tailrace.

C. Blake

The Blake development has three ZOEs, from RM 62 downstream to RM 56; ZOE5 – Impoundment; ZOE6 – Bypass Reach; ZOE7 – Tailrace.

D. Rainbow

The Rainbow development has three ZOEs, from RM 56 downstream to RM 54; ZOE8– Impoundment; ZOE9 – Bypass Reach; ZOE10 – Tailrace.

E. Five Falls

The Five Falls development has three ZOEs, from RM 54 downstream to RM 52; ZOE11– Impoundment; ZOE12 – Bypass Reach; ZOE13 – Tailrace.

F. South Colton

The South Colton development has three ZOEs, from RM 52 downstream to RM 47; ZOE14– Impoundment; ZOE15 – Bypass Reach; ZOE16 – Tailrace.

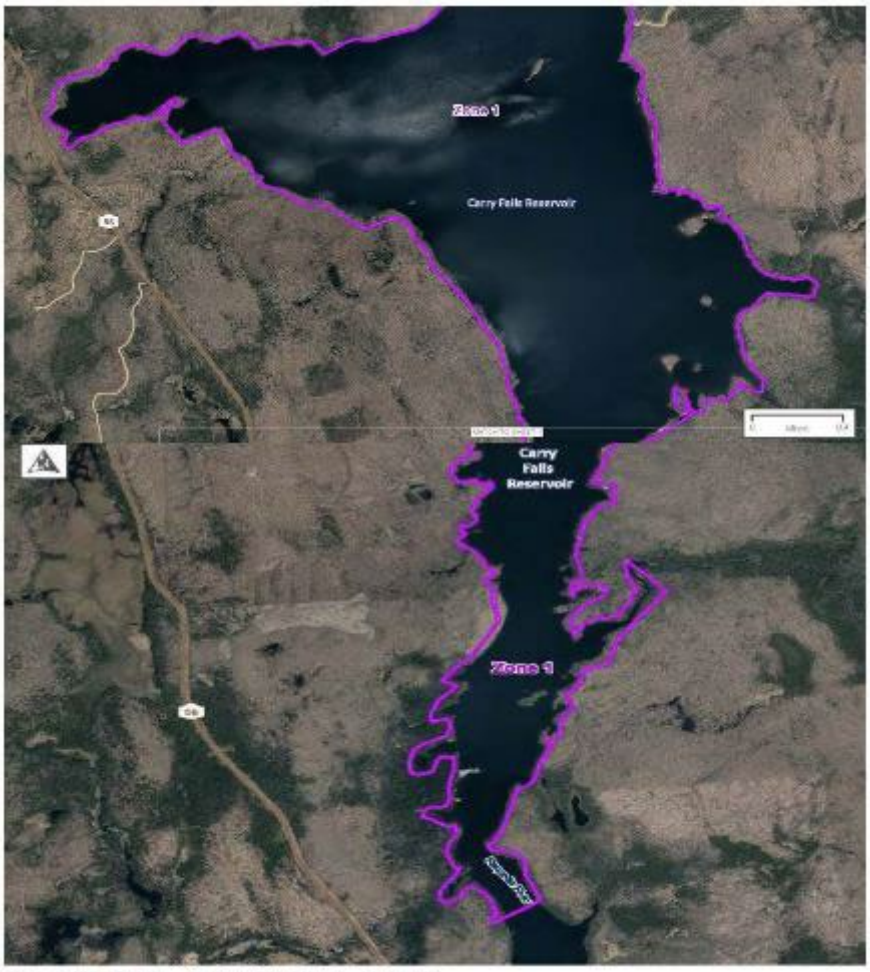

Figure 22 - ZOE 1 - Carry Falls Impoundment

Figure 23 - Stark ZOEs 2, 3 & 4

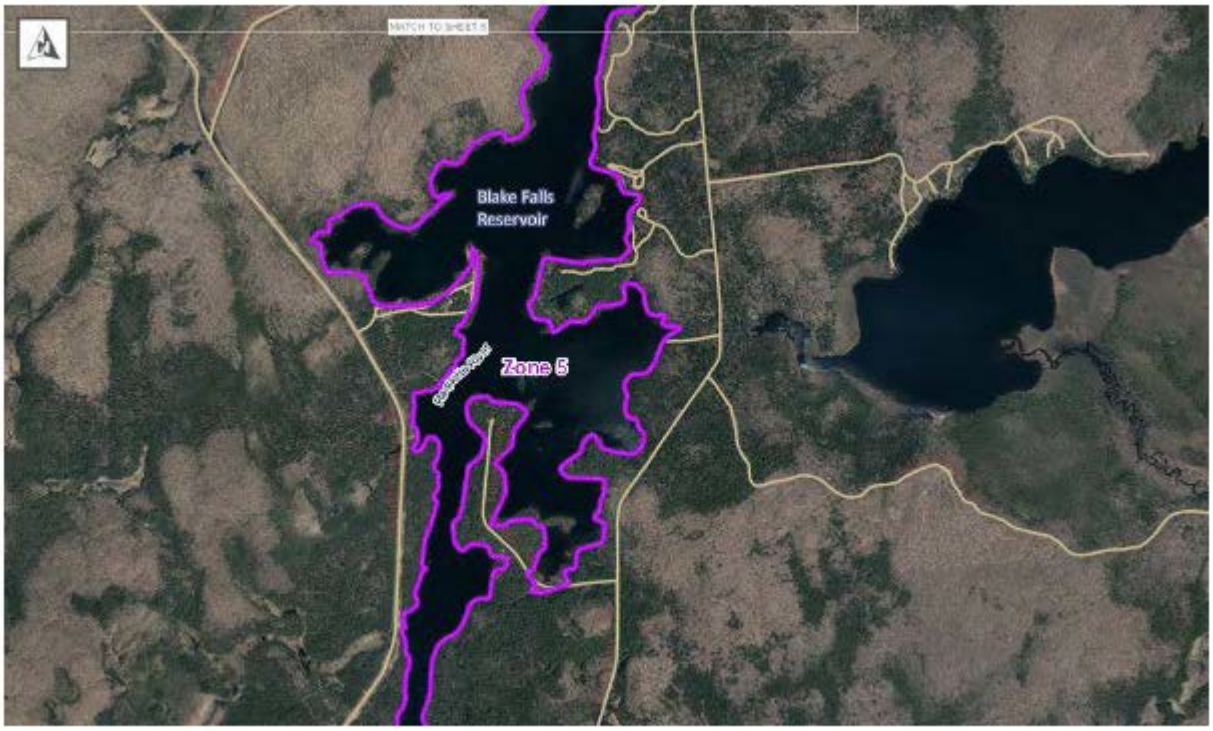

Figure 24 - Blake ZOE 5

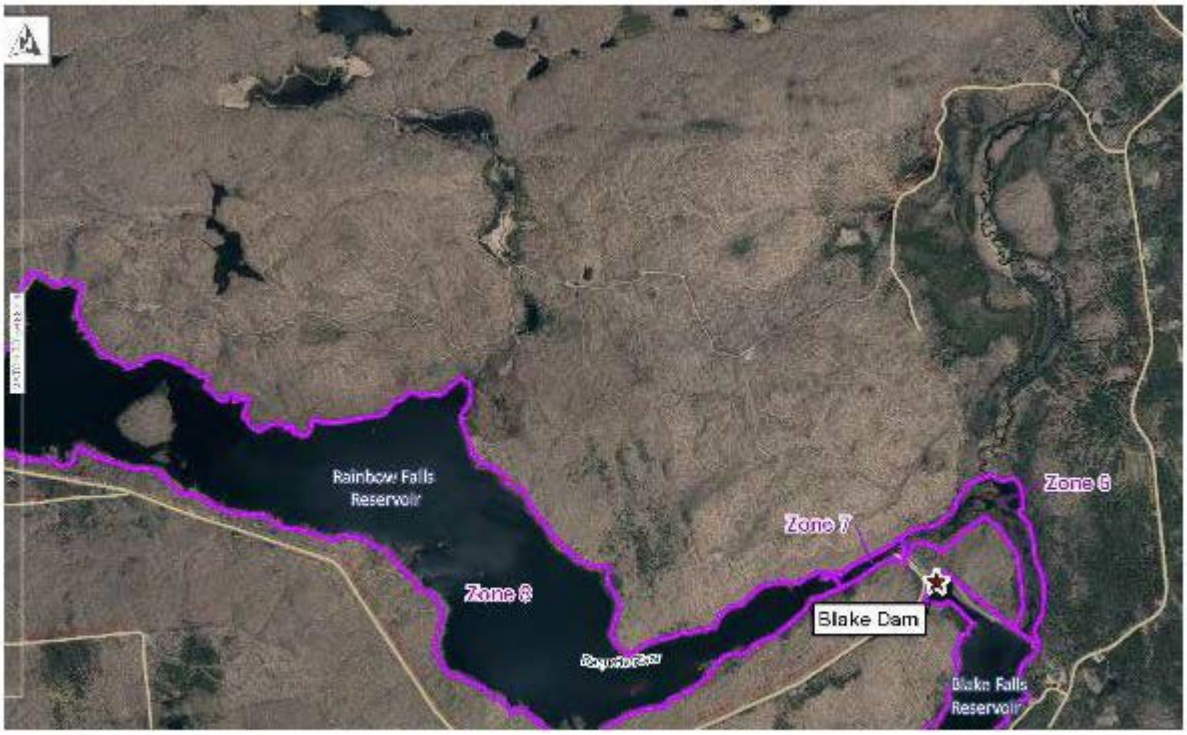

Figure 25 - Blake ZOEs 6 & 7 & Rainbow ZOE 8

Figure 26 - Rainbow ZOEs 9 & 10, Five Falls ZOEs 11, 12, 14, & South Colton ZOE 15

Figure 27 - South Colton ZOE 16

The alternative standards selected to satisfy the LIHI certification criteria in each of these ZOEs are identified in Table 5. As part of my review process, I checked and agreed with their selection.

Table 5: Zones of Effect

	CRITERION and STANDARD SELECTED							
Zone Number and Zone Name	***A***	***B***	***C***	***D***	***E***	***F***	***G***	***H***
	Ecological Flows	**Water Quality**	**Upstream Fish Passage**	**Downstream Fish Passage**	**Shoreline and Watershed Protection**	**Threatened and Endangered Species**	**Cultural and Historic Resources**	**Recreational Resources**
1. Carry Falls Impoundment	2	2	1	1	2	3	2	2
2. Stark Impoundment	2	2	1	2	2	3	2	2
3. Stark Bypass Reach	2	2	1	2	2	3	2	2
4. Stark Tailrace	2	2	1	1	2	3	2	2
5. Blake Impoundment	2	2	1	2	2	3	2	2
6. Blake Bypass Reach	2	2	1	2	2	3	2	2
7. Blake Tailrace	2	2	1	1	2	3	2	2
8. Rainbow Impoundment	2	2	1	2	2	3	2	2

CRITERION and STANDARD SELECTED								
Zone Number and Zone Name	A	B	C	D	E	F	G	H
	Ecological Flows	Water Quality	Upstream Fish Passage	Downstream Fish Passage	Shoreline and Watershed Protection	Threatened and Endangered Species	Cultural and Historic Resources	Recreational Resources
9. Rainbow Bypass Reach	2	2	1	2	2	3	2	2
10. Rainbow Tailrace	2	2	1	1	2	3	2	2
11. Five Falls Impoundment	2	2	1	2	2	3	2	2
12 Five Falls Bypass Reach	2	2	1	2	2	3	2	2
13. Five Falls Tailrace	2	2	1	1	2	3	2	2
14. South Colton Impoundment	2	2	1	2	2	3	2	2
15. South Colton Bypass Reach	2	2	1	2	2	3	2	2
16. South Colton Tailrace	2	2	1	1	2	3	2	2

V. REGULATORY AND COMPLIANCE STATUS

The initial major 50-year FERC license for Carry Falls, P-2060, was issued by the Federal Power Commission (FPC) the predecessor to the FERC, in 1951 and expired on January 31, 2001. Similarly, the initial major 50-year license for the Stark, Blake, Rainbow, Five Falls and South Colton developments, P-2084, was issued by the FPC on February 5, 1952 and expired on January 31, 2002. In 1995, parties to the FERC relicensing proceedings for the LRRP and the MRRP, operating on annual licenses since January 1, 1994, requested that all proceedings be combined with the FERC relicensing for the URRP. On December 13, 1995, the FERC approved the request and the then owner, Niagara Mohawk Power Corp. (NMPC) agreed to accelerate the FERC relicensing for P-2060 and P-2084.

On April 22, 1998, NMPC filed the Settlement Offer (RRPSO).[6] The RRPSO signatories included NMPC, the NYSDEC, the U.S. Fish and Wildlife Service (USFWS), the Adirondack Mountain Club (AMC), the New York State Adirondack Park Agency (NYSPA), New York Rivers United (NYRU), the National Park Service (NPS), the New York State Conservation Council (NYSCC), North Country Raquette River Advocates (NCRRA), St. Lawrence County, the Adirondack Council (AC), the Association for the Protection of the Adirondacks (APA), and the Jordan Club. The New York Power Authority (NYPA) and the New York Council of Trout

[6] RRPSO - https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0009E5DA-66E2-5005-8110-C31FAFC91712

Unlimited (TUNY) participated in the proceeding and had no objections but chose not to become signatories.

The RRPSO provides for minimum flows releases, limitations on impoundment fluctuations, and fish passage and protection measures to protect and enhance the water quality and fishery resources of the Raquette River. It also provides for enhanced recreational opportunities in a manner that is consistent with the undeveloped nature of the surroundings.

Shortly thereafter, the NYSDEC issued a WQC for the Project on June 11, 1998.[7] On April 14, 1999, NMPC submitted an amended joint application for approval of transfer of licenses to EBH.[8] On July 15, 1999, FERC approved the application for new major licenses submitted on January 28, 1999. On April 16, 2001, FERC filed its Final Multiple Project Environmental Assessment (FEA) for the URRP developments.[9] Lastly, on February 13, 2002, the FERC issued new licenses for P-2060 and P-2084 that incorporated both the WQC and RRPSO. Both licenses were for a term of 31 years and 11 months, ending on December 31, 2033.[10]

A. Carry Falls Requirements

The current FERC license for the Carry Falls development authorizes EBH to continue to use the reservoir to supply flows for power at its downstream developments that will not result in any major, long-term adverse environmental impacts. In addition, the license includes conditions to enhance aquatic and terrestrial environments and recreation.

B. Hydro Developments Requirements

The current FERC license was issued with the same eight articles as for Carry Falls with the exception that they pertain to the Stark, Blake, Rainbow, Five Falls and South Colton developments.

FERC License articles include:

- Article 401 – EBH must submit an annual report for FERC approval on or before April 15 of each year. The report should provide a summary of the status of license measures implemented, including any plans developed pursuant to the requirements of the license, and assess resource benefits gained in the previous calendar year (FERC eliminated the reporting requirement in 2014);
- Article 402 – EBH must file for FERC approval, a Stream Flow Monitoring Plan (SFMP) to ensure compliance with the reservoir fluctuation limitations;
- Article 403 – The FERC reserves the right to authorize construction, operation and maintenance of fishways as prescribed by the USDOI;
- Article 404 – EBH must develop and provide a Recreation Plan (RP) in consultation with the Raquette River Advisory Committee (RRAC) for FERC approval;

[7] WQC - https://lowimpacthydro.org/wp-content/uploads/2022/10/Upper-Raquette-WQC-1998.pdf
[8] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0007DF84-66E2-5005-8110-C31FAFC91712
[9] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0011B011-66E2-5005-8110-C31FAFC91712
[10] FERC License 2060 - https://elibrary.ferc.gov/eLibrary/filedownload?fileid=00105941-66E2-5005-8110-C31FAFC91712
FERC License 2084 - https://elibrary.ferc.gov/eLibrary/filedownload?fileid=00105942-66E2-5005-8110-C31FAFC91712

- Article 405 – EBH must implement a Programmatic Agreement (PA) with the FERC, the Advisory Council on Historic Preservation (ACHP), and the New York State Historic Preservation Officer (SHPO) including a Historic Properties Management Plan (HPMP) for the project;
- Article 406 – Impoundment fluctuations and/or minimum flow deviations must be reported to FERC no later than 10 days after each such incident;
- Article 407 – Requires developing and filing of a Bald Eagle Protection and Management Plan (BEPMP);
- Article 408 - Gives GLHA authority to grant permission for certain types of use and occupancy of the project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior FERC approval.

C. Carry Falls Compliance Issues

A review of the FERC docket indicates that throughout the current LIHI certification period, EBH remains in compliance with the established flow conditions and impoundment levels and maintains records of these conditions at the Project. No deviations have occurred through this period of time.

D. Hydro Developments Compliance Issues

A review of the FERC docket indicates that throughout the current LIHI certification period, three license deviations have occurred. All deviations were reported to the agencies.

One deviation was for an extended period of time. On April 21, 2014, through agency consultation, EBH requested that minimum flows be suspended in June for a sufficient amount of time to allow for spillway toe inspection at the Stark and Blake developments. After the inspections were performed on June 4, 2014, minimum flows were inadvertently not reestablished until June 11, 2014. The FERC was notified on July 2, 2014, more than 10 days after the event, in violation of license article 406. On October, 31, 2014, FERC stated the minimum flow deviation would be considered a violation of the license and going forward, EBH must field verify future inspections requiring suspension of flow requirements.[11]

On May 15, 2017, the Stark development's minimum flow was unintentionally violated. During a personnel shift change, the new shift operator recognized the deviation from the requirement when Tainter gates are open for more than 24 hours and increased the minimum flow release from 45 to 90 CFS. FERC was informed on May 26, 2017. On August 21, 2017, FERC stated the deviation would be considered a violation of the license and noted that EPH would review the procedure to ensure the requirements are clearly stated and update them if needed, and the system operators would receive refresher training on the Stark gate closing protocols.[12]

On April 8, 2021, the Stark development's minimum flow was again unintentionally violated under similar conditions as in 2017. FERC was informed on April 15, 2021. On May 6, 2021, FERC stated the violation would be considered a violation of the license and noted that EBH reported having reviewed the procedure with operators once again.[13]

[11] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01C810EB-66E2-5005-8110-C31FAFC91712
[12] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01EDAA49-66E2-5005-8110-C31FAFC91712
[13] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=020D26FD-66E2-5005-8110-C31FAFC91712

VI. LIHI PUBLIC COMMENTS

On January 13, 2022, EBH was informed by LIHI that the current URRP certification would expire on July 9, 2022. On July 8, 2022, LIHI sent notice to EBH that the current certification was extended until December 31, 2022 to allow time for the recertification process. EBH submitted a recertification application on July 9, 2022. On July 21, 2022, LIHI notified EBH that the Stage I review for the Project was complete. The review found the current application required only minor additional information, corrections and supporting documentation to perform a full Stage II recertification review. LIHI posted the application for public comment on August 30, 2022. The 60-day public comment period ended on October 29, 2022.

A. Comment Letters

On August 30, 2022, LIHI filed notice on their email list that the public comment period for the application has been opened. The notice states, *"LIHI is seeking comment on this application. Comments that are directly tied to specific LIHI criteria (flows, water quality, fish passage, etc.) will be most helpful, but all comments will be considered. Comments may be submitted to the Institute by e-mail at comments@lowimpacthydro.org with "Upper Raquette River Project Comments" in the subject line, or by mail addressed to the Low Impact Hydropower Institute, 1167 Massachusetts Avenue, Office 407, Arlington, MA 02476. Comments must be received at the Institute on or before 5 pm Eastern time on October 29, 2022 to be considered. All comments will be posted to the web site and the applicant will have an opportunity to respond. Any response will also be posted. The project description and complete application can be found HERE[14]."*

No responses were received.

B. Agency Correspondence

On August 30, 2022, LIHI[15] emailed contacts[16] listed in the Project application as knowledgeable about the Project stating, *"You may have already received this notice if you are on the Low Impact Hydropower Institute (LIHI) email list. However, you were also identified as an agency contact on the LIHI recertification application recently submitted by Erie Boulevard Hydropower LP, a subsidiary of Brookfield Renewable Energy Group, for the Upper Raquette River Hydroelectric Project located on the Raquette River in New York. The application reviewer, Gary Franc (copied here), may be in contact with you if he has questions about the project or wishes to clarify any aspects of the LIHI applications. You may also provide comments directly to LIHI as indicated below. More information about the project and its application can be found in the link below. If you would like to receive additional notices about this project or other hydroelectric projects in your region applying for LIHI certification, please sign up for our mailing list[17] ."*

No responses were received. Throughout my review, I found no reason to contact any agencies or individuals.

[14] https://lowimpacthydro.org/lihi-certificate-14a-upper-raquette-river-project-new-york/
[15] Maryalice Fischer – LIHI Certification Program Director - mfischer@lowimpacthydro.org - 603-664-5097 office - 603-931-9119 cell
[16] Christopher.Balk@dec.ny.gov; Heidi.Krahling@dec.ny.gov; Robyn_Niver@fws.gov; Michael.Lynch@parks.ny.gov; John_Wiley@fws.gov
[17] https://form.jotform.com/202176096857060

VII. DETAILED CRITERIA REVIEW

This section contains my review of the Project with regard to the LIHI Certification criteria. As part of my review, I conducted a FERC e-library search to verify compliance claims in the recertification application. My review concentrated on the period since EBH was issued its latest LIHI certification on July 9, 2014.

A. Ecological Flows

The goal of this criterion is to support habitat and other conditions that are suitable for healthy fish and wildlife resources in riverine reaches that are affected by the facility's operation. The Applicant states the Project satisfies the LIHI flows criterion in all ZOEs by meeting alternative standard A-2.

In the summers of 1995 and 1996 impoundment fluctuation studies for the Upper Raquette River and Carry Falls reservoir were conducted to delineate the areas and types of habitats within the normal operational fluctuation zone of each impoundment. These efforts involved habitat mapping of the near shore zone using field reconnaissance observations of habitat characteristics with photo and video documentation.

1. Carry Falls

The Carry Falls development operates according to a guide curve as described in the RRPSO. The guide curve provides protection and enhancement of aquatic resources, water quality, fisheries, aesthetic resources, and recreation resources in the Raquette River basin. The RRPSO also requires tiered base flow to the Raymondville development, the most downstream hydroelectric facility on the Raquette River (part of the LRRP), and an instream flow schedule while maintaining target water surface level elevations in the Carry Falls reservoir and the Upper Raquette River impoundments.

According to the license, the new guide curve for Carry Falls continues to provide a series of target elevations over the course of a given year but raises the lower elevation limit from 1,332.0 FTMSL to 1,355,0 FTMSL. Use of this guide curve allows for the downstream hydro developments within the URRP to operate in a daily and seasonal peaking mode. This operation is allowed as long as the Carry Falls reservoir reasonably adheres to the guide which allows for late winter/spring drawdowns from elevation 1,385.0 FTMSL to elevation 1,355.0 FTMSL and fall drawdowns to elevation 1,355.0 FTMSL. The reduced impoundment fluctuation range results in a large percentage of the reservoir substrate being wetted 100% of the time, improving wetlands and aquatic habitats.

The Carry Falls Project does not have a bypassed reach; therefore, it has no instream flow requirements. However, it provides base flows downstream to all remaining impoundments. Minimum base flows to the LRRP's Raymondville development, the last reservoir before the Raquette River empties into the St. Lawrence River, must provide flows that ensure that most of the riffle habitat is adequately watered at all times.

The base flow is measured at the Kent Mill "cemetery riffle" located approximately 4 miles downstream of the Raymondville dam. Total daily average outflow from the MRRP's Colton development, in conjunction with the Carry Falls impoundment elevation and Piercefield USGS gage flow data are used in determining the type of flow condition and corresponding base flow at Raymondville:

- Wet Condition - The total daily average outflow from Colton is greater than or equal to 1,600 CFS and the elevation within Carry Falls Reservoir is greater than or equal to 1,357 FTMSL. During a wet condition, EBH maintains a base flow downstream of Raymondville of at least 560 CFS. A timer system[18] for the LRRP is not utilized under the wet condition;
- Normal Condition - The total daily average outflow from Colton is between 650 and 1,600 CFS, and the elevation within Carry Falls Reservoir is greater than or equal to 1,357 FTMSL. During a normal condition, EBH maintains a base flow downstream of Raymondville of at least 560 CFS. A timer system for the LRRP may be utilized to ensure provision of the 560 CFS;
- Dry Condition - The total daily average outflow from Colton is less than 650 CFS, and the elevation within Carry Falls Reservoir is greater than or equal to 1,357 FTMSL. During a dry condition, occurring less than 5% of the time annually, EBH maintains a base flow downstream of Raymondville of at least 290 CFS. A timer system for the LRRP is utilized to ensure provision of the 290 CFS.
- Drought Condition - Carry Falls elevation is below 1,357 FTMSL and daily average flow at Piercefield is less than 250 CFS. During a drought condition, occurring less than 1% of the time annually, EBH maintains a base flow below Raymondville that equals the average daily flow at the Piercefield gage.

Since issuance of the current LIHI certification, Carry Falls has operated in compliance with resource agency conditions regarding flow conditions with no deviations.

2. URRP Impoundments

Normal impoundment fluctuations of the five hydro developments of the URRP are shown in Table 6. The guide curve for Carry Falls introduced in the 2002 FERC license reduces Stark development drawdowns from 23 feet to 1 foot or less. The reduced impoundment fluctuations result in a large percentage of the reservoir substrate being wetted 100% of the time, ultimately improving wetlands and aquatic habitats. The crest of Stark Dam is at elevation 1,355 FTMSL which results in a backwater up to Carry Falls Dam. To allow for drawdowns of Carry Falls Reservoir below elevation 1,355 FTMSL, the Stark impoundment has to be drawn down in conjunction with Carry Falls Reservoir. In these circumstances, the impoundment fluctuation within Stark impoundment may be greater than 1.0 foot.

Article 402 of the license required a Stream Flow Monitoring Plan (SFMP) to be developed. EBH filed a final SFMP on August 30, 2002, which was modified and approved by the FERC on April 3, 2003.[19] The SFMP required EBH to install staff gages and implement reservoir fluctuation limits and provide minimum flows. Stark, Blake, Rainbow, Five Falls, and South Colton impoundments are managed by Automatic Generation Control (AGC) software. Data regarding headpond elevation and applicable gate opening information is recorded on a daily basis by EBH. Gate opening versus flow relationships have been developed, reviewed periodically, and updated upon any change in the instream flow release structure.

[18] The timer system was developed based on historical records of releases below the Raymondville development to estimate the time it takes for different Raymondville releases to reach the "cemetery riffle" located downstream.
[19] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=002DFA34-66E2-5005-8110-C31FAFC91712

Table 6 - License 2084 Impoundment Fluctuation			
Development	Permanent Crest of Dam (FTMSL)	Normal Impoundment Fluctuation Magnitude (Feet)	Elevation Range (FTMSL) [20]
Stark	1355.0	1.0	1354.7 to 1353.7[21]
Blake	1250.5	1.0	1250.2 to 1249.2
Rainbow	1181.5	1.0	1181.2 to 1180.2
Five Falls	1077.0	2.0	1076.7 to 1074.7
South Colton	973.5	2.0	973.2 to 971.2

Each development is allowed to operate in a pulsing mode that limits the maximum daily reservoir fluctuation under normal flow conditions to 1.0 foot at Stark Falls, Blake Falls and Rainbow Falls and to 2.0 feet at Five Falls and South Colton.

Each development is allowed to start generating when total inflow is available to pass the minimum bypass flow plus run one turbine at its minimum turbine limit. Once a development's net inflow (inflow available after passing minimum flow) exceeds the powerhouse's hydraulic capacity, the powerhouse is run at full hydraulic capacity and all excess water is passed downstream once the upper impoundment elevation limit is attained.

No base flow requirements are defined for the URRP. However, EBH's required minimum flow releases[22] were based on Delphi instream flow studies during relicensing, and are:

- From Stark, 45 CFS year-round is released through the stop log section of the dam. If any flow is passed through the Tainter gates for a period of 24 hours or more, the minimum flow through the stop log section is raised to 90 CFS. This 90 CFS release is maintained for an additional 24 hours following closure of the Tainter gates and then reverts back to 45 CFS [23];
- From Blake, 55 CFS is released from the stop log section of the dam, with an increase to 120 CFS during the start of the walleye spawning season through the end of June. The 55 CFS flow resumes on July 1 of the year[24];
- From Rainbow, 20 CFS year-round is released from the stop log section of the dam[25];
- From Five Falls, 50 CFS is released from the stop log section of the dam, with an increase to 145 CFS during walleye spawning season[26] ; and
- From South Colton, 20 CFS year-round is released over the visible portion of the falls[27].

[20] Normal impoundment fluctuations of the developments of the URRP are measured from 0.3 feet below permanent crest of dam.
[21] Creates a backwater on the upstream Carry Falls development.
[22] All minimum flow actual releases at any given time may be slightly above or below the required value. The degree of variation is a function of head pond impoundment fluctuation. EBH must determine the appropriate gate settings for the provision of minimum flows at each development based upon the midpoint of the normal impoundment fluctuation of each development. For example, if the normal impoundment fluctuation is 1.0 foot, and the instream flow is 45 cfs, the gate setting to provide 45 cfs shall be based upon a drawdown of 0.5 feet.
[23] The 45 CFS varies from 42 CFS to 48 CFS. The 90 CFS varies from 84 CFS to 96 CFS.
[24] The 55 CFS varies from 52 CFS to 58 CFS. The 120 CFS varies from 112 CFS to 128 CFS.
[25] The 20 CFS varies from 19 CFS to 21 CFS.
[26] The 50 CFS varies from 43 CFS to 57 CFS.
[27] The 20 CFS varies from 17 CFS to 23 CFS.

For construction and maintenance activities that require lowering the level of an impoundment below the normal operating limits, EBH's operating procedure (HOP 202) requires notification to NYSDEC and compliance with drawdown rates specified in the WQC. The impoundment fluctuation limitations may also be curtailed or suspended if required by operating emergencies beyond the control of EBH, including security, and for short periods upon mutual agreement between EBH and NYSDEC. If the limitations are modified, EBH notifies the FERC as soon as possible, but no later than ten business days after each such incident.

As previously documented in Section V, three flow deviations have occurred since issuance of the latest LIHI certification. In all cases the FERC found the incident to be a violation of the license. The violations on May15, 2017 and April 8, 2021 both involved deviations of the minimum flow release at the Stark development which occurred due to the same oversight. During shift change of personnel, the new operator recognized the minimum flow deviation that should have been 90 CFS but was only 45 CFS and increased the minimum flow release to 90 CFS.

My review finds that EBH has generally complied with flow conditions and impoundment level requirements with the few exceptions noted above, maintains records of these conditions, and operates in a manner that protects aquatic habitat, and therefore, continues to satisfy the Ecological Flows criterion.

B. Water Quality

The goal of this criterion is to ensure water quality is protected in water bodies directly affected by facility operations, including downstream reaches, bypassed reaches, and impoundments above dams and diversions. The Applicant states the Project satisfies the LIHI water quality criterion in all ZOEs by meeting alternative standard B-2.

The Carry Falls Reservoir and URRP are not listed as impaired in the most current final Section 303(d) List of Impaired Waters from 2018 requiring a total maximum daily load (TMDL).[28] The NYSDEC classifies the waters of the Carry Falls impoundment as Class B designated best usages for primary and secondary contact recreation and fishing and also suitable for fish propagation and survival. The NYSDEC classifies the Raquette River from Piercefield to Massena as a transition from a cold water to a cool water aquatic community/ fishery.

NYSDEC assessed the water quality during relicensing and found dissolved oxygen levels to be above state standards at all times, except for temporary excursions at depth at Carry Falls reservoir. At that time, FERC noted "good to excellent" quality of the inflow from the Adirondack Highlands and NYSDEC reported no summertime impairments and little stratification in the impoundments.[29] The NYSDEC also monitors water quality at two stations on the Raquette River as part of the state's Rotating Intensive Basin Studies.[30] NYSDEC last conducted biological monitoring in 2019 upstream of the Project at Piercefield which showed the river in that vicinity not impacted upstream, and downstream of the Project between the Colton and Hannawa dams (part of the MRRP) which showed the river "slightly impacted".[31]

[28] https://www.dec.ny.gov/docs/water_pdf/section303d2018.pdf
[29] FERC FEA at p. 97, https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0011B011-66E2-5005-8110-C31FAFC91712
[30] Study reports were not found on the NYSDEC website
[31] https://gisservices.dec.ny.gov/gis/dil/

The Carry Falls guide curve provides protection and enhancement of aquatic resources, water quality, fisheries, aesthetic resources, and recreation resources in the Raquette River basin. According to the FEA, EBH performed river-wide water quality monitoring at a series of eight stations from Piercefield downstream to Massena from March through November of 1996.

These studies indicated the impoundments become weakly thermally stratified in summer, have relatively low pH, low buffering capacity, moderately low nutrients, and no substantial Project-related water quality deficiencies. The water quality is generally well above minimum standards for New York State Class B waters, and capable of supporting a diverse and healthy cool water aquatic community. Bypassed reaches were found to be somewhat warmer, with slight increases in pH from upstream to downstream, and having unchanged specific conductance. Dissolved oxygen levels decreased in outflow water as a result of warmer temperatures and equilibration of super saturated water. A noticeable water quality gradient exists in large bypass pools at low flow conditions in which temperature, dissolved oxygen, and pH decline with depth with specific conductance increases.

The URRP's WQC was issued on June 11, 1998, which stipulates adherence to the RRPSO. Generally, changes to the WQC are necessitated by significant changes in a Project's environment or operation culminating in a WQC amendment. This situation has not occurred for the URRP. On March 18, 2022, EBH contacted the NYSDEC, regarding the current WQC status for the Project. The NYSDEC responded on June 8, 2022 stating that the existing WQC is valid for the duration of the FERC license (See page 134 of the LIHI recertification application).

My review indicates that EBH has operated the Project in accordance with its current license requirements, does not appear to adversely impact water quality, and continues to satisfy LIHI's water quality criterion.

C. Upstream Fish Passage

The goal of this criterion is to ensure safe, timely and effective upstream passage of migratory fish so that migratory species can successfully complete their life cycles and maintain healthy populations in areas affected by the Project's facilities. The Applicant states the Project satisfies the LIHI upstream fish passage criterion in all ZOEs by meeting alternative standard C-1.

No migratory fish management issues have arisen for any of the URRP developments since no anadromous or catadromous fish species are present, and the developments are well above the historic upstream extent of anadromous fish migrations.

However, the USDOI did request reservation of its authority to prescribe upstream fish passage facilities in the future in Article 403 of the 2002 licenses. No anadromous fish restoration efforts are currently anticipated.

My review indicates no issues pertaining to upstream fish passage have arisen during the current LIHI certification. It is my recommendation that the Project continues to satisfy the upstream fish passage criterion.

D. Downstream Fish Passage

The goal of this criterion is to ensure safe, timely and effective downstream passage of migratory fish and for riverine fish such that the facility minimizes loss of fish from reservoirs and upstream river reaches affected by facility operations. Migratory species can successfully complete their life cycles and maintain healthy populations in areas affected by the facility. The Applicant states the Project satisfies the LIHI downstream fish passage criterion in the Carry Falls Impoundment (ZOE 1) and all tailrace reaches (ZOE 4, 7, 10, 13 and 16) by meeting alternative standard D-1. All remaining ZOEs within the remaining impoundments and bypass reaches (ZOE 2, 3, 5, 6, 8, 9, 11, 12, 14 and 15) are met by meeting alternative standard D-2.

The Carry Falls impoundment has no downstream fish passage barriers or migratory fish management issues. Since the development has no generating facilities, downstream passage of resident fish species can occur whenever the reservoir is releasing water, without concern for turbine mortality.

Furthermore, there are no migratory fish management issues within the Carry Falls impoundment since no anadromous or catadromous fish species are present and the development is well above the historic upstream extent of anadromous fish migrations. The Carry Falls impoundment was sampled intensively from 1991 to 1995. The most abundant species in the surveys were yellow perch, smallmouth bass, walleye, rock bass, northern pike, and brook trout.

There are no mandatory prescriptions for downstream fish passage, however, the USDOI did request reservation of its authority to prescribe downstream fish passage facilities in the future in Article 403 of the licenses. No efforts to provide additional downstream passage of resident fish species are anticipated.

EBH conducted a fish sampling program within the URRP impoundments and bypassed reaches in 1996. NYSDEC sampled the Stark and Blake developments between 1992 and 1993, and the Rainbow, Five Falls, and South Colton developments between 1994 and 1995. All the URRP developments have comparable fish species, dominated by smallmouth bass, yellow perch, and rock bass. Other species present include walleye, white sucker, northern pike, brown bullhead, fallfish, pumpkinseed, cisco, banded killifish, and black nose dace.

The FEA states the URRP developments exhibit low risk for fish entrainment and an entrained fish at any given development may encounter low to medium risk or mortality. Downstream fish movement is facilitated at all these developments by the release of minimum flows. The minimum flow release structures serve to enable downstream fish movement and are modified to ensure safe downstream movement. These modifications include reducing the roughness of the spillway, reducing dispersion of the release across the spillway face, and creating adequate plunge pools.

Additionally, EBH installed 1-inch clear spaced trashracks at each development to further reduce potential mortality of fish passed through the turbines: South Colton in 2013, Rainbow in 2016, Five Falls in 2017, stark in 2019 and Blake in 2020. EBH is not required to monitor or measure the movement of fish through these release structures.

My review of the FERC docket indicates no issues pertaining to downstream fish passage have arisen during the current LIHI certification. It is my recommendation that the Project continues to satisfy the downstream fish passage criterion.

E. Shoreline and Watershed Protection

The shoreline and watershed protection criterion is designed to ensure that sufficient action has been taken to protect, mitigate or enhance environmental conditions of soils, vegetation, and ecosystem functions on shoreline and watershed lands associated with the facility. The Applicant states the shoreline and watershed protection criterion in all ZOEs is satisfied by meeting alternative standard E-2.

The URRP developments are located in Adirondack Park (AP). The AP is a part of New York's Forest Preserve, established in 1892 for *"the free use of all the people for their health and pleasure"* and for watershed protection. The AP's 6.1 million acres include more than 10,000 lakes, 30,000 miles of rivers and streams, and a wide variety of habitats including wetlands and an estimated 200,000 acres of old growth forests. State lands within the AP are known as Forest Preserve and designated a National Historic Landmark in 1963.

Unlike most state parks, about 52 percent of the land is privately owned. Public and private lands in the AP contain 102 towns and villages, as well as numerous farms, businesses, including EBH lands, regulated by the Adirondack Park Authority which has land management categories including rural use, resource management, wild forest and pending land classifications.

The entire Carry Falls development is within the AP. EBH owns the majority of land bordering the reservoir. The land is characterized by low rural development consisting of hunting and summer cabins, camping facilities, and water recreation facilities. Land immediately adjacent to the impoundment is predominantly undeveloped forestland, with recreational facilities and access points located along its shoreline. Land uses located farther away from the shoreline area range from a recreational campground and private recreational facility to areas of sparse development and undeveloped lands.

There is no Shoreline Management Plan (SMP) for Carry Falls or the URRP. However, the RRPSO reduces Carry Falls impoundment fluctuations to improve habitat, recreational values and protect shoreline. The revised guide curve reduces Stark drawdowns from 23 feet to about 1 foot. The reduced impoundment fluctuations led to a large percentage of the reservoir substrate being wetted 100% of the time, ultimately improving wetlands and aquatic habitats.

The remaining URRP developments are characterized by low rural development consisting of hunting and summer cabins, camping facilities, and water recreation facilities. The Stark, Blake, and Rainbow developments and the southern portion of the Five Falls development are within the AP. The Park Authority has a number of shoreline restrictions, including building setbacks, minimum lot width restrictions, and vegetative cutting requirements. EBH's land use practices comply with park regulations.

Shoreline development in the South Colton and northern portion of Five Falls developments are under jurisdiction of the NYSDEC. The NYSDEC has several building restrictions and community regulations. Shoreline development must be permitted by the NYSDEC and in accordance with park land use regulations.

EBH owns all land immediately adjacent to the developments and much of the upland areas surrounding the developments. In 1996, NMPC developed a plan for divestiture of over 12,000 acres of land outside the Project boundary as part of the RRPSO to lower its operating costs. This land conveyance process between

NMPC and the State was outside the jurisdiction of the FERC relicensing process. However, this land conveyance process was included as part of the RRPSO because certain aspects of the land transfer affected the outcome of certain aspects of the RRPSO. Lands conveyed to the state generally abut the shorelines around the Project developments.

Highlights of this land transfer to the State were:

- At Carry Falls, a fee conveyance of a 760-acre tract of land on the east side of the reservoir and a conservation and development rights easement to a 1,000-acre tract on the west side of the reservoir.
- Near Blake, a fee conveyance of a 400-acre tract of land on the east side of the impoundment and a conservation and development rights easement to a 1,672-acre tract on the west side of the impoundment;
- Near Rainbow, a conservation and development rights easement to a 2,095-acre tract north of the Rainbow impoundment;
- Near Five Falls and South Colton, a conservation and development rights easement to an 1,812-acre tract surrounding these impoundments.
- A fee conveyance of ten miscellaneous parcels composing 449 acres.
- A conservation and development rights easement to three additional parcels to the State of New York. These parcels include lands associated with the following recreational facilities provided as part of RRPSO: the Jordan River canoe portage route, the Blake bypass reach's Dead Creek Access, and the Clear Pond Wild Forest trail.

EBH lands that were committed for inclusion within the FERC boundary during the prior relicensing and were associated with recreation facilities within applicable FERC boundaries, but no longer within the FERC boundary are:

- Portions of the canoe portage routes at Stark, South Colton, Hannawa, Norwood, and Norfolk;
- The intermediate access point to the east bank of the Colton bypass reach off Lenny Road;
- Any portions of the Stone Valley Trail system at Colton that were not currently within the FERC Boundary;
- All lands associated with the development of the Red Sandstone Trail system.

On their own initiative, exempt from any FERC license requirement, EBH collaborated with the NYSDEC to develop land use practices consistent with adjoining State properties. In consultation with the NYSDEC, EBH developed a Land Use Policy (LUP) for project lands that manages shorelines previously developed and protects undeveloped properties. In addition, EBH agreed to establish the Raquette River Advisory Council Fund (RRACF) as part of the RRPSO financed by EBH which helps to support the state lands. As part of the current recertification review, EBH confirmed they are still following the LUP and providing $5,000 annually to maintaining the RRACF.

My review of the FERC docket indicates no issues pertaining to shoreline and watershed protection have arisen during the current LIHI certification. The Project continues to satisfy the LIHI shoreline and watershed protection criterion. Based on EBH confirmation of maintaining the LUP and RRACF, an additional 3 years of certification under the PLUS standard should be credited to the LIHI certification for the URRP.

F. Threatened and Endangered Species Protection

The threatened and endangered species protection criterion is designed to ensure that the facility does not negatively impact state or federally listed threatened or endangered species. The Applicant states the LIHI threatened and endangered species criterion is satisfied in all ZOEs by meeting alternative standard F-3.

Based on information received from the USFWS's New York Field Office on March 21, 2022[32] regarding a request for information on rare, threatened or endangered (RTE) species, no critical habitats were identified. However, the Monarch Butterfly, a candidate for listing may potentially be present within the URRP area. The USFWS has not adopted a formal recovery plan for the Monarch Butterfly. On November 18, 2020, the USFWS published a petition for rulemaking for a section 4(d) rule to list the species as threatened under the Endangered Species Act.

During preparation of this application, EBH consulted with NYSDEC's Natural Heritage Program for an updated list of threatened and endangered species that may occur in the vicinity of the URRP. By letter dated May 16, 2022[33], the NYSDEC indicated that bald eagle, state-listed as threatened, spruce grouse, state-listed endangered, common loon, state-listed as a species of special concern, and Northern clustered sedge, state-list as endangered, have been documented in the vicinity of the Project.

The bald eagle is protected by Environmental Conservation Law Section 11-0535, New York Code of Rules and Regulations, and the Migratory Bird Treaty Act. Bald eagles have been documented in the vicinity of the Stark reservoir and spruce grouse has been documented within one mile of Blake Reservoir.

The NYSDEC developed and manages a Conservation Plan for Bald Eagles (BECP) in New York State[34]. The goal of the plan is to ensure the perpetuation of a healthy bald eagle population, including its essential habitat and the ecosystems upon which it depends, in a cost-effective manner. The BECP strategies include limiting construction, foresting, and recreation activities in the vicinity of nest trees and deep winter roost sites.

EBH developed and implemented a Bald Eagle Protection and Management Plan (BEPMP), which was approved by FERC on July 17, 2003[35]. The plan satisfied article 407 of both licenses. To comply with the BEPMP, EBH filed, and FERC approved the 2008 Bald Eagle Monitoring Report (BEMR) filing on May 26, 2009[36].

The BEMR requires EBH to request the results of the NYSDEC field observations on bald eagles, and file them with the FERC by January 31 of each year. EBH has successfully complied with this requirement.

On December 13, 2013, the NYSDEC recommended, *"Based on human activities documented in the vicinity of nest 14C during the 2011 summer site visit, Department has changed its recommendation regarding signage. On July 13, 2011, staff observed a raft of boats anchored within a short distance of the nest. Since four out the last five nesting years attempts failed to produce chicks, staff is concerned that boat activity in the*

[32] See page 137 of LIHI recertification application
[33] See page 151 of the LIHI recertification application.
[34] https://www.dec.ny.gov/docs/wildlife_pdf/nybaldeagleplan.pdf
[35] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=0037439E-66E2-5005-8110-C31FAFC91712
[36] http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=12030097

vicinity of nest 14C could be contributing to nesting failures at this site. As an effort to keep boats out of the nest buffer, staff recommends that floating signage is installed at the water approach to the nest. No additional signage along the upland is required at this time. The signage shall be installed as soon as practical, but no later than May 1, 2014." EBH completed the signage within the required due date.[37]

EBH has been successfully filing annual monitoring reports throughout the current LIHI certification period. The latest report was filed on December 8, 2021[38]. The report states:

- On March 30, 2021, the NYSDEC completed aerial nest monitoring of the Region 6 bald eagle nests, including the nest on Blake Falls Reservoir, nest 14C, located in the Town of Parishville, St Lawrence County. The NYSDEC confirmed this nest to have a pair of incubating bald eagles;
- The NYSDEC will no longer be conducting aerial nest monitoring annually. The next aerial survey is planned for 2024;
- EBH will continue to install buoys restricting access to the Blake impoundment nesting area on or before May 1st on an annual basis.

The RRPSO stated URRP facilities and operations have no adverse effect on federal or state listed threatened or endangered species. Concurrently, The FEA concluded that the operation of the URRP with signage would not likely adversely affect the bald eagle.

My review of the FERC docket indicates no issues pertaining to threatened and endangered species protection have arisen during the current LIHI certification. It is my recommendation that the Project continues to satisfy the LIHI threatened and endangered species protection criterion.

G. Cultural and Historical Resource Protection

The cultural and historic resource protection criterion is designed to ensure that the facility does not unnecessarily impact cultural and historic resources associated with the facility's lands and waters, including resources important to local indigenous populations. The Applicant states the LIHI cultural and historic resources criterion in ZOE 1 is satisfied by meeting alternative standard G-1 and in all remaining ZOEs is satisfied by meeting alternative standard G-2.

Article 405 of both licenses required implementation of a Programmatic Agreement (PA) among the FERC, the ACHP and the SHPO[39], executed on February 6, 2002.

According to the FEA, cultural resource studies in the area of potential effect (APE) identified that there are no historic properties listed on or eligible for listing in the National register within the Project's APE. The SHPO's archaeological sensitivity maps identify no known archaeological sites in the vicinity of the Project that could be near or within the Project's APE.

EBH consulted with the SHPO pursuant to Section 106 of the National Historic Preservation Act (NHPA). In a letter dated July 18, 1996, included in the license application for Carry Falls, the SHPO stated it had no concerns regarding historic buildings, structures, or districts within the Carry Falls development area. In a

[37] http://elibrary.ferc.gov/idmws/common/OpenNat.asp?fileID=13431034
[38] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=BD614DFD-96F5-C473-A146-7D9BFC800000
[39] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=00105AB0-66E2-5005-8110-C31FAFC91712

letter dated July 15, 1998, included in both license applications, the SHPO indicated it had reviewed the RRPSO and had no additional comments. The RRPSO states continued operation of the URRP will not affect historic preservation issues. The Bureau of Indian Affairs (BIA) filed comments dated December 3, 1998 [40] concluding that the URRP, if as operated as proposed in the RRPSO, is adequate to protect the tribal trust resources of the St. Regis Mohawk Tribe (SRMT). EBH filed a Historic Properties Management Plan (HPMP) on April 14, 2003. The FERC approved the HPMP by order dated 9/28/2004[41]. EBH files annual monitoring reports on activities undertaken that may be subject to the HPMP. The latest annual monitoring report for 2021 was filed on January 31, 2022[42]. The cover letter stated there have been no ground disturbing activities that would be subject to the HPMP since the filing of the last report on February 1, 2021.

My review of the FERC docket indicates no issues pertaining to Cultural and Historical Resource Protection have arisen during the current LIHI certification. It is my recommendation that the Project continues to satisfy the LIHI cultural and historic protection criterion.

H. Recreational Resources

The goal of this criterion is to ensure that recreation activities on lands and waters controlled by the facility are accommodated, and that the facility provides recreational access to its associated land and waters without fee or charge. The Applicant states that the recreation criterion in all ZOEs is satisfied by meeting alternative standard H-2.

Article 404 of the licenses required EBH to file a Recreation Plan (RP). The RP includes:

- Provisions for continued maintenance of the existing recreational facilities;
- Site plans for the new recreational facilities;
- Erosion and sediment control measures for construction activities, if appropriate;
- Locations for directional signage, determined in consultation with the NYSDEC, and
- An implementation schedule.

On November 17, 2004[43], FERC issued an Order Modifying and Approving the RP, which was submitted to FERC on April 11, 2003. Recreation enhancements near Carry Falls included canoe portage around the dam and canoe portage between the Carry Falls Reservoir and the Jordan River. Recreation enhancements at the other downstream developments include:

- Canoe portage at the Stark development[44];
- Canoe portage and Dead Creek access at the Blake development[45];
- Canoe portage and White Hill Wild Forest Trail at the Rainbow development[46];
- Canoe portage at the Five Falls development[47], and
- Canoe portage at the South Colton development[48].

[40] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=19981207-0488&optimized=false
[41] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01CE07B7-66E2-5005-8110-C31FAFC91712
[42] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=8767F9BD-802E-C5F7-9313-7EB156600000
[43] https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20041117-3026&optimized=false
[44] 3/31/2015 Stark - https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20150331-5706&optimized=false
[45] 3/31/2015 Blake - https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20150331-5653&optimized=false
[46] 3/31/2015 Rainbow - https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20150331-5673&optimized=false
[47] 3/31/2015 Five Falls - https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20150331-5655&optimized=false
[48] 3/31/2015 South Colton - https://elibrary.ferc.gov/eLibrary/filelist?accession_number=20150331-5690&optimized=false

EBH only limits public access to facilities specifically related to hydroelectric generation including, but not limited to, dams, dikes, intake structures, water conveyance structures, powerhouses, substations, transmission lines, and certain access roads leading to such facilities.

The most recent FERC environmental inspection at Carry Falls was conducted in 2017.[49] It included three minor findings that EBH corrected shortly thereafter.[50] Recreational facilities owned and operated by the Carry Falls Project include the Parmenter Campground, open seasonally from Memorial Day weekend through Labor Day weekend (fee-based) but remains open free-of-charge through to Thanksgiving Day (though without any water service). Other facilities include a trailer-accessible boat launch and day use area, and two canoe portages. These facilities are owned and maintained by EBH. The Catamount Conference Center and Recreation Area is in the vicinity of the Project and is a private facility owned and operated by St. Lawrence University.

Figure 28 - Parmenter Campground

[49] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01EDCB96-66E2-5005-8110-C31FAFC91712
[50] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01EE8B79-66E2-5005-8110-C31FAFC91712

Figure 29 - Carry Falls Boat Launch & Day Use Area

Recreational facilities associated with the five URRP developments are listed below. The most recent FERC environmental inspection was conducted in 2017.[51] It included four minor findings that EBH corrected shortly thereafter.[52] All facilities are maintained by EBH. Existing development recreational at Stark facilities include:

- Multi-use area on the impoundment with:
  - Picnic facilities
  - Trailer accessible boat launch
- Picnic area on bypass reach
- Canoe portage

Figure 30 - Stark Boat Launch & Day Use Area

[51] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01EDC8CA-66E2-5005-8110-C31FAFC91712
[52] https://elibrary.ferc.gov/eLibrary/filedownload?fileid=01EE8B79-66E2-5005-8110-C31FAFC91712

Existing development recreational at Blake facilities include:

- McNeil Campground
- 58 campsites (two ADA accessible)
- Boat launches
- Supervised swimming beach
- Playground
- Restrooms
- Trailer accessible boat launch
- Canoe portage
- Dead Creek access

Figure 31 - McNeil Campground

Existing development recreational facilities at Rainbow include:

- Trailer accessible boat launch
- Canoe portage
- White Hill Wild Forest Trail

Figure 32 - Rainbow Boat Launch

Existing development recreational facilities at Five Falls include:

- Trailer accessible boat launch
- Canoe portage

Figure 33 - Five Falls Canoe Portage

Existing development recreational facilities at South Colton include:

- Trailer accessible boat launch
- ADA fishing platform downstream of powerhouse
- Canoe portage

Figure 34 - South Colton Fishing Platform

My review of the FERC docket indicates no issues pertaining to recreational resources have arisen during the current LIHI certification. It is my recommendation that the Project continues to satisfy the LIHI recreational resources criterion.

VIII. RECOMMENDATION

My review comprised a thorough assessment of the recertification application and its supporting documentation, a search of the FERC docket, and other publicly available information.

Based on EBH's confirmation of continued voluntary use of the Land Use Policy, perpetual conservation easements on significant land parcels, and providing a $5,000 annual donation to the Raquette River Advisory Council Fund, an additional 3 years of certification should be credited to the LIHI recertification. It is my recommendation that the Project be certified for a thirteen (13) year term with no conditions.

Gary M. Franc

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