ENVIRONMENTAL ASSESSMENT
FOR
HYDROPOWER LICENSE

Great Falls Hydroelectric Project
FERC Project No. 2814-025
New Jersey

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
888 First Street, NE
Washington, D.C. 20426

February 2021

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ACRONYMS AND ABBREVIATIONS

Advisory Council	Advisory Council on Historic Preservation
APE	area of potential effects
BCE	Before Common Era
°C	degrees Celcius
CFR	Code of Federal Regulations
cfs	cubic feet per second
Commission	Federal Energy Regulatory Commission
certification	water quality certification
CZMA	Coastal Zone Management Act
DO	dissolved oxygen
EA	Environmental Assessment
EPRI	Electric Power Research Institute
ESA	Endangered Species Act
ft/s	feet per second
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
FWS	U.S. Fish and Wildlife Service
HPMP	Historic Properties Management Plan
Interior	Department of the Interior
IPaC	Information for Planning and Consultation
kV	kilovolt
kVA	kilovolt-amperes
kW	kilowatts
mg/L	milligrams per liter
mm	millimeters
MGD	million gallons per day
MW	megawatt
MWh	megawatt-hour
National Register	National Register of Historic Places
NEPA	National Environmental Policy Act
NERC	North American Electric Reliability Corporation
New Jersey DEP	New Jersey Department of Environmental Protection
NHPA	National Historic Preservation Act of 1966
PA	Programmatic Agreement
Park Service	National Park Service
PJM	PJM Interconnection LLC
REA	Ready for Environmental Analysis
SD1	Initial Scoping Document
SHPO	State Historic Preservation Office
S.U.M.	Society for Establishing Useful Manufactures
TDS	total dissolved solids

U.S.C	United States Code
USGS	United States Geological Survey
WNS	white-nose syndrome

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Great Falls Hydroelectric Project
FERC Project No. 2814-025 – New Jersey

1.0 INTRODUCTION

1.1 APPLICATION

On February 28, 2019, Great Falls Hydroelectric Company and the City of Paterson, New Jersey (Great Falls Hydro-Paterson or co-licensees), filed an application for a new license with the Federal Energy Regulatory Commission (Commission or FERC) to continue operating the 10.95-megawatt (MW) Great Falls Hydroelectric Project No. 2814 (Great Falls Project or project).[1] The project is located on the Passaic River, near the City of Paterson, Passaic County, New Jersey (figure 1). The project occupies 2.4 acres of federal land administered by the National Park Service (Park Service). The estimated average annual generation of the project (2014 to 2018) is 17,199 megawatt-hours (MWh). The co-licensees propose no changes to the project's generating facilities.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Great Falls Project is to provide a source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a new license to Great Falls Hydro-Paterson for the project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project would be best adapted to a comprehensive plan for improving or developing a waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, or water supply), the Commission must give equal

[1] A license for the project was issued on March 11, 1981, for a term of 40 years, with an effective date of March 1, 1981, and an expiration date of February 28, 2021. *See City of Paterson, New Jersey*, 14 FERC ¶ 61,226 (1981).

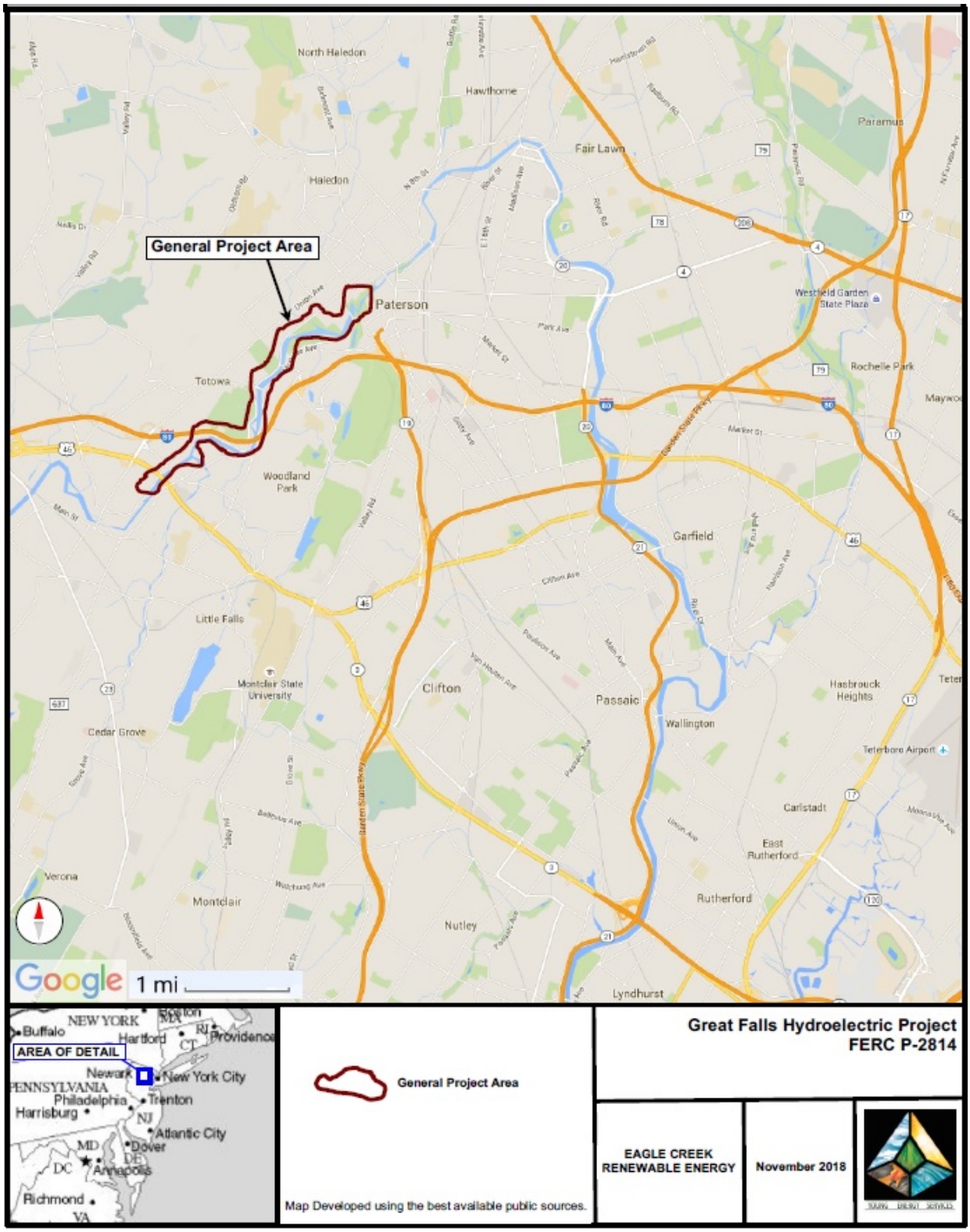

Figure 1. Location of the Great Falls Project (Source: license application, as modified by staff).

consideration to the purposes of: (1) energy conservation; (2) the protection of, mitigation of damage to, and enhancement of fish and wildlife resources; (3) the protection of recreational opportunities; and (4) the preservation of other aspects of environmental quality.

Issuing a new license for the Great Falls Project would allow Great Falls Hydro-Paterson to continue to generate electricity at the project for the term of the new license, making electric power from a renewable resource available to its customers.

This environmental assessment (EA) has been prepared in compliance with the National Environmental Policy Act (NEPA)[2] of 1969 to assess the environmental and economic effects associated with the operation of the project, alternatives to the project, and makes recommendations to the Commission on whether to issue a new license, and if so, recommends terms and conditions to become a part of any license issued.

In this EA, we assess the environmental and economic effects of: (1) continued project operation and maintenance as proposed by Great Falls Hydro-Paterson (proposed action); (2) the proposed action with additional or modified measures (staff alternative); and (3) no action. The primary issues associated with relicensing the project are the effects of continued operation and maintenance on aquatic species and their habitat, terrestrial resources, threatened and endangered species, and cultural resources.

1.2.2 Need for Power

The existing Great Falls Project has an installed capacity of 10.95 MW and generates an average of approximately 17,199 MWh per year.

The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The project is located in the PJM Interconnection LLC (PJM) assessment area of NERC. According to NERC, the peak demand in the region is expected to increase at an average rate of 0.4 percent per year over the 10-year forecast period from 2020–2029 (NERC 2019).

The power from the Great Falls Project would continue to meet a need for power in the PJM region in both the short- and long-term. Further, in displacing generation of

[2] On July 16, 2020, the Council on Environmental Quality (CEQ) issued a final rule, *Update to the Regulations Implementing the Procedural Provisions of the National Environmental Policy Act* (Final Rule, 85 Fed. Reg. 43,304), which was effective as of September 14, 2020; however, the NEPA review of this project was in process at that time and therefore this EA was prepared pursuant to CEQ's 1978 NEPA regulations.

non-renewable resources, the project would help avoid some power plant emissions, thus creating an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

Any license for the Great Falls Project would be subject to numerous requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described in Appendix A.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 Code of Federal Regulations [CFR], § 4.38) require that an applicant consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act, Endangered Species Act (ESA), National Historic Preservation Act (NHPA), and other federal statutes. Pre-filing consultation must be complete and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, we conducted scoping for the Great Falls Project to determine what issues and alternatives should be addressed. We issued an initial scoping document (SD1) on September 23, 2019. It was noticed in the *Federal Register* on December 19, 2019.[3] Written comments were submitted on December 23, 2019, by Mr. Francis Blesso. However, Mr. Blesso's comments did not affect the content of SD1; therefore, Commission staff did not prepare a second scoping document.

1.4.2 Interventions

On February 25, 2020, the Commission issued a notice accepting the license application. This notice set April 25, 2020,[4] as the deadline for filing protests and motions to intervene. The following entity filed a notice of intervention:

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[3] 84 Fed. Reg. 51,536.

[4] 81 Fed. Reg. 79,468. The Commission's Rules of Practice and Procedure provide that if a filing deadline falls on a Saturday, Sunday, holiday, or other day when the Commission is closed for business, the filing deadline does not end until the close of business on the next business day. 18 CFR 385.2007(a)(2) (2020). Because the 60-day

Entity	Date Filed
Department of the Interior (Interior)[5]	April 23, 2020

1.4.3 Comments on the Application

On June 16, 2020, the Commission issued a Ready for Environmental Analysis (REA) notice for the Great Falls Project, and solicited comments, recommendations, terms and conditions, and prescriptions. The following entity filed comments, recommendations, terms and conditions, or prescriptions:

Entity	Date Filed
Interior	August 12, 2020
Frank Blesso	July 24, 2020

Great Falls Hydro-Paterson did not file a response to Interior's comment.

filing deadline fell on a Saturday (i.e., April 25, 2020), the filing deadline was extended until the close of business on Monday, April 27, 2020.

[5] Interior filed the notice of intervention on behalf of its component bureau, the National Park Service.

2.0 PROPOSED ACTION AND ALTERNATIVES

2.1 NO-ACTION ALTERNATIVE

Under the no-action alternative, the project would continue to operate under the terms and conditions of the current license, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative to establish baseline environmental conditions for comparison with other alternatives.

2.1.1 Existing Project Facilities

The project is located on the Passaic River about 350 feet upstream of the Great Falls of the Passaic (Great Falls), a natural waterfall, and uses the head associated with the project dam plus the approximately 65-foot-high drop of Great Falls to generate power (figure 2).

The project dam, also known as the Society for Establishing Useful Manufactures (S.U.M.) dam, is an overflow granite stone gravity structure about 315 feet long, with a maximum height of 15 feet and having a crest elevation of 113.9 feet.[6] The impoundment has a normal storage capacity of approximately 1,415 acre-feet and a normal maximum surface area of approximately 100 acres at an elevation of 116.15 feet.[7] There are no spillway or crest control gates at the project.

Flows from the Passaic River are diverted into a reinforced concrete intake forebay located at the right abutment (looking downstream). The forebay is approximately 68 feet wide at the trash rack and contains trash racks with 2-inch-clear bar spacing and automatic cleaners. Downstream of the trash racks there are three separate intake bays, each fitted with a hydraulically operated 8-foot by 8-foot steel gate. Water entering each intake bay passes through an 8.5-foot-diameter, 55-foot-long penstock leading to a turbine-generator unit at the powerhouse.

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[6] Unless otherwise noted, all elevations reported herein are referenced to the North American Vertical Datum of 1988.

[7] The project operated with 27-inch-high flashboards, resulting in an impoundment elevation of 116.15 feet, until a January 28, 2013 letter from the Commission's Regional Engineer ordered their removal. In a June 19, 2019 letter, Great Falls Hydro-Paterson withdrew its September 21, 2018 request to the Commission to allow reinstallation of the flashboards. In a May 26, 2020 response to staff's February 25, 2020 letter requesting additional information, Great Falls Hydro-Paterson confirmed that flashboards or a spillway control system were not a part of its current proposal.

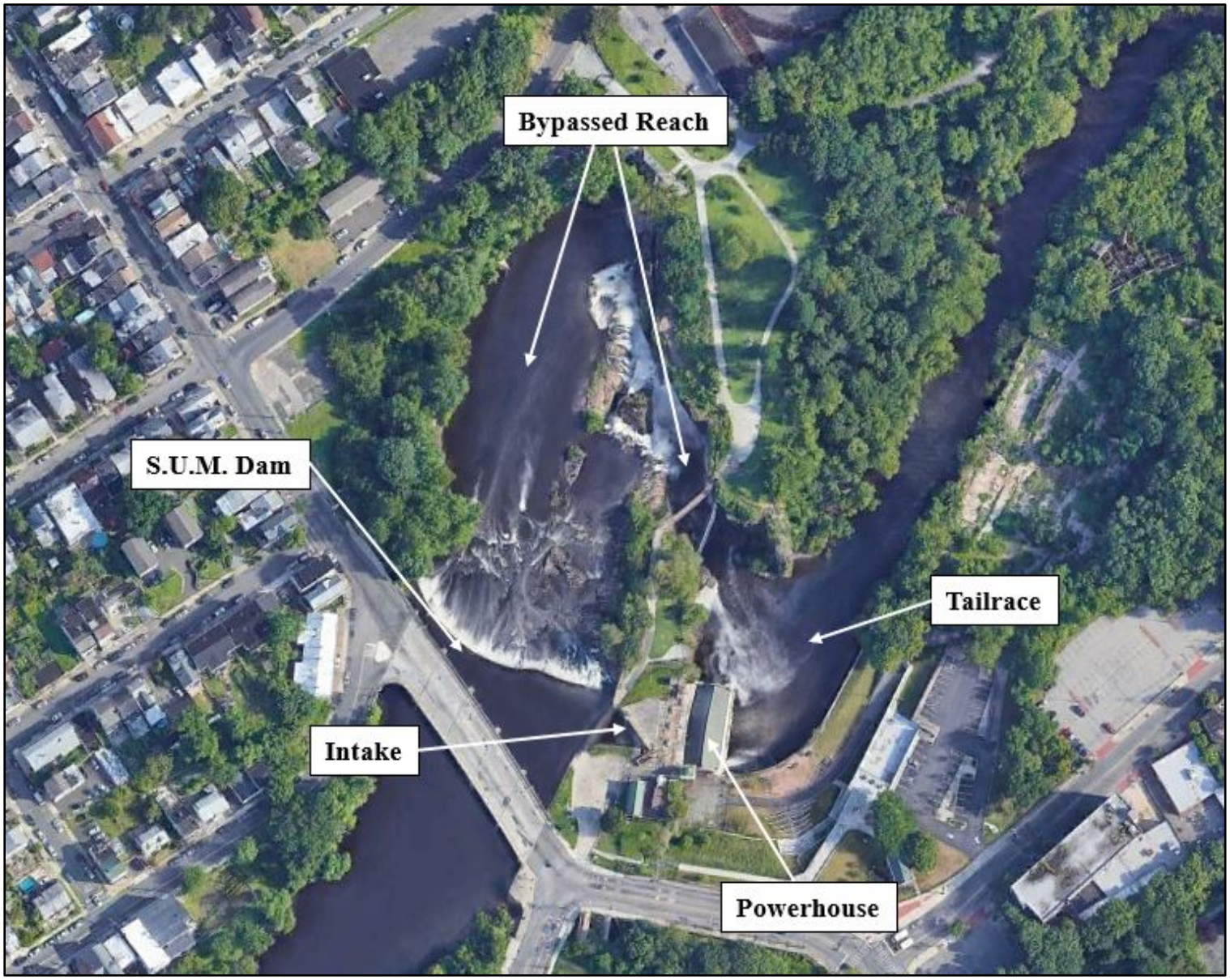

Figure 2. Location of the Great Falls Project facilities (Source: Google Earth, as modified by staff).

The 110-foot-long by 45-foot-wide brick and concrete powerhouse is located at the base of a cliff immediately downstream of Great Falls. The powerhouse contains three vertical Kaplan turbines each with a rated capacity of 3,650 kilowatts (kW), and three generators each with a rated output of 4,055 kilovolt-amperes (kVA) and a power factor of 90 percent. Flows from the penstocks pass through the turbines to the draft tubes and then return to the Passaic River at the powerhouse, immediately downstream of Great Falls, creating a 925-foot-long bypassed reach.

A 37-foot-long, 4.16-kilovolt (kV) underground generator lead connects the powerhouse to a 4.16/26.4-kV step-up transformer at a switchyard where power is stepped up and transmitted to a 26.4-kV utility distribution network owned by Public Service Electric and Gas Company.

2.1.2 Current Project Boundary

The Great Falls Project boundary comprises 114.69 acres and encloses the dam, impoundment (to an elevation of 116.15 feet), powerhouse, transmission line, and appurtenant facilities. Recreation facilities at Overlook Park are enclosed in the project boundary and include an observation platform along the east wall of the powerhouse and a small park area along the existing tailrace wall with park benches and walkways. Great Falls Hydro-Paterson holds title or rights to all lands within the project boundary.

2.1.3 Project Safety

The Great Falls Project has been operating for more than 39 years under the existing 1981 license. During this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency, and safety of operations, compliance with the terms of the license, and proper maintenance.

As part of the relicensing process, Commission staff will evaluate the continued adequacy of the proposed project facilities under a new license. Special articles will be included in any license issued, as appropriate. Commission staff would continue to inspect the project during the new license term to assure continued adherence to Commission-approved plans and specifications, special license articles relating to construction (if any), operation and maintenance, and accepted engineering practices and procedures.

2.1.4 Current Project Operation and Environmental Measures

The Great Falls Project is operated in a run-of-river mode, with a minimum hydraulic capacity of 50 cubic feet per second (cfs) and a maximum of 2,130 cfs (each turbine unit has a minimum and maximum hydraulic capacity of 50 cfs and 710 cfs, respectively). The current license allows the project to operate with or without the use of

27-inch-high flashboards,[8] equating to impoundment levels that fluctuate between 116.15 and 117.45 feet or 113.9 and 115.2 feet, respectively. Under the current license, Great Falls Hydro-Paterson provides a 200-cfs continuous minimum flow or inflow to the project reservoir, whichever is less, to maintain the aesthetic value of Great Falls and to maintain water quality (i.e., dissolved oxygen [DO]) to be consistent with state standards. The current license also requires a continuous minimum flow of 50 cfs, or the inflow to the project reservoir, whichever is less, for the protection of fish resources in the Passaic River between the project dam and tailrace discharge. River flows in excess of 200 cfs and meeting the minimum hydraulic capacity of the project (i.e., 50 cfs) to 2,130 cfs are diverted through the powerhouse for generation. During flood conditions, the facility is shut down, secured, and the gates at the powerhouse are closed, with all flows passing over the dam and Great Falls.

Great Falls Hydro-Paterson monitors DO in the project tailrace from June through October to ensure that DO concentrations of the project discharge are consistent with state water quality standards (i.e., the 24-hour average DO concentration is greater than 5.0 milligrams per liter [mg/L] and not less than 4.0 mg/L at any time). If DO levels are insufficient to meet the standards, the following operational changes may be implemented: (1) pass additional flows over Great Falls in excess of the above stated minimum flows; (2) aerate flows passing through the project powerhouse; and/or (3) shut down project generation.

The project is staffed by fulltime operators and can be operated in both manual and automatic mode. A project control system is located in a gate house at the site where flow and headwater and tailwater levels are displayed and a programmable logic controller is used for automated operation of the turbines and generators. The project is operated in automated mode during non-business hours and can be monitored remotely.

2.2 GREAT FALLS HYDRO-PATERSON'S PROPOSAL

2.2.1 Proposed Project Boundary

Great Falls Hydro-Paterson proposes to amend the project boundary by removing the bypassed reach, Great Falls, and areas immediately downstream of the project dam (figure 3). The modification would remove 7.09 acres, resulting in a modified project boundary that would comprise 107.6 acres.

[8] *Id*.

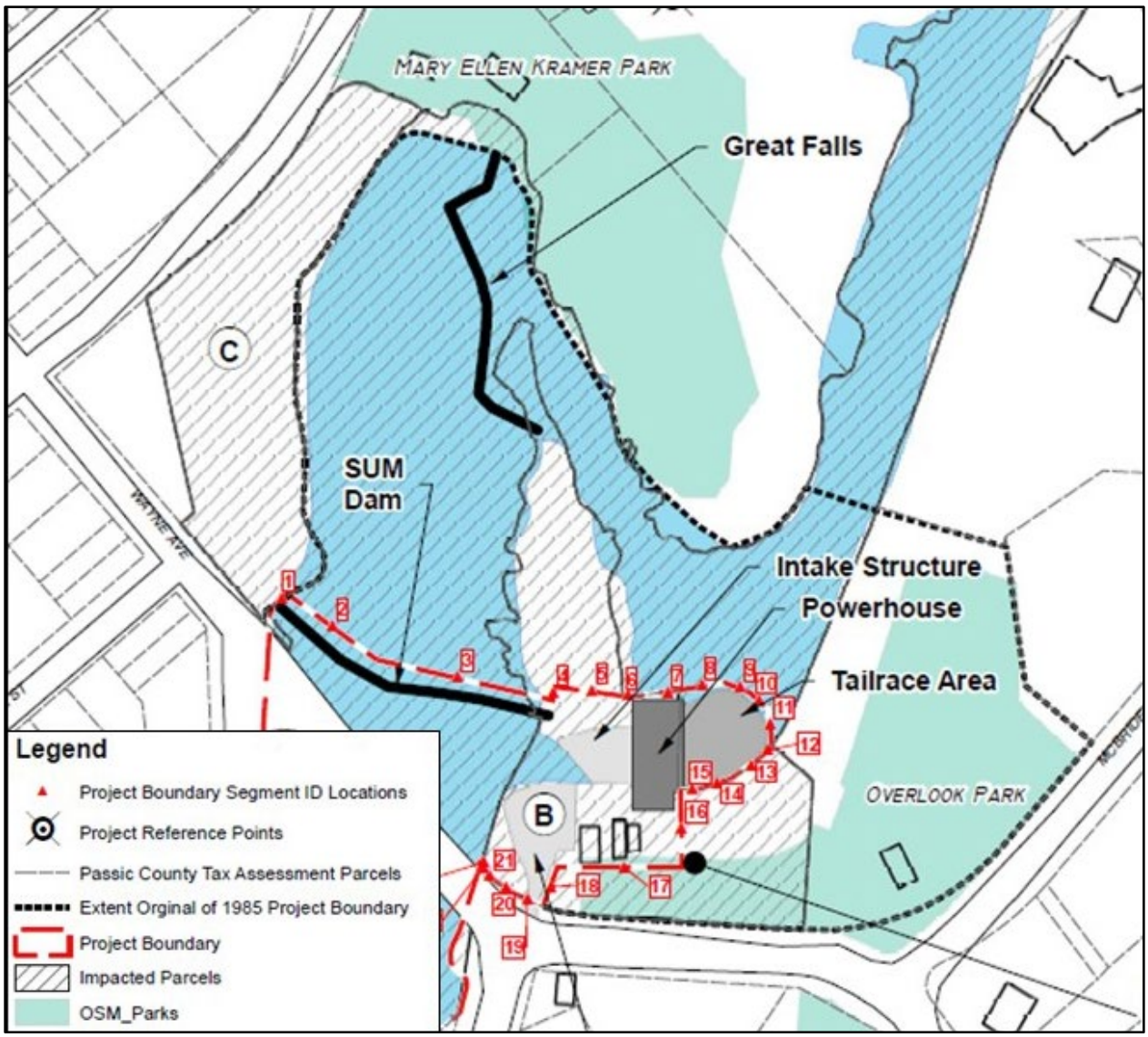

Figure 3. Proposed modifications to the project boundary of the Great Falls Project (Source: license application, as modified by staff).

2.2.2 Proposed Project Facilities and Operation

As described in the license application, Great Falls Hydro-Paterson does not propose any new project facilities; however, Great Falls Hydro-Paterson proposes the following operational measure:

- Continue to operate the project in a run-of-river mode.

2.2.3 Proposed Environmental Measures

In addition to the operational measure described above, Great Falls Hydro-Paterson proposes the following environmental measures:

- Conduct daily water quality monitoring in the project discharge to ensure consistency with the state DO standard of 5.0 mg/L or higher from the 9:00 p.m. to 7:00 a.m. nighttime period when aesthetic flows are reduced from 200 cfs to 50 cfs (see below).

- Provide a minimum aesthetic flow of 200 cfs over the falls from 7:00 a.m. until 9:00 p.m., and 50 cfs from 9:00 p.m. until 7:00 a.m., whenever Passaic River flows at the S.U.M. dam are less than 2,000 cfs.

- As flows permit, provide 400 cfs aesthetic flows to Great Falls during daylight hours on weekends from May through October, plus approximately 100 hours during annual special events.

2.3 STAFF ALTERNATIVE

Under the staff alternative, the project would include Great Falls Hydro-Paterson's proposed operational and environmental measures. The staff alternative would also include the following staff-recommended additions or modifications:

- Develop an operation compliance monitoring plan to document how the co-licensees will monitor, record compliance with, and report any deviations from project operation conditions required by any license issued for the project.

- Develop a water quality monitoring plan to document procedures, ensure compliance, and define reporting requirements for the proposed water quality monitoring.

- Consult with the U.S. Fish and Wildlife Service (FWS) and the New Jersey Department of Environmental Protection (New Jersey DEP) if bald eagles establish a nest within the project boundary.

- Retain the access road through Overlook Park to the powerhouse inside the project boundary.

- Develop an historic properties management plan (HPMP) that includes provisions to: (1) continue to maintain and preserve the original penstock and turbine-generator unit that has been restored and provide public tours of the powerhouse; and (2) maintain the powerhouse in such a way to protect its historic integrity.

2.4 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Certain alternatives to Great Falls Hydro-Paterson's proposal were considered but eliminated from further analysis because they are not reasonable in this case. These alternatives are presented in Appendix B.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project's vicinity; (2) an explanation of the scope of our cumulative effects analysis; and (3) our analysis of the proposed action and other recommended environmental measures. Sections are organized by resource area, with historical and current conditions described first. The existing condition is the baseline against which the environmental effects of the proposed action and alternatives are compared, including an assessment of the effects of proposed mitigation, protection, and enhancement measures, and any potential cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[9]

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The Great Falls Project is located on the Passaic River, adjacent to the City of Paterson, New Jersey. Originating near the Town of Morristown in southeastern Morris County (northeastern New Jersey), the Passaic River flows about 90 miles through Somerset, Union, Essex, Hudson, Sussex, and Bergen counties before emptying to Newark Bay. The Passaic River Basin is the third largest in New Jersey (935 square miles) and includes the Whippany, Rockaway, Pequannock, Wanaque, and Ramapo rivers as its major tributaries (United States Geological Survey [USGS], 2007). Historically, the river was tidally influenced to the base of Great Falls, but Dundee Dam (located about 8 miles downstream of the project) now represents the upstream extent of the tidal effect (USGS, 2007).

The Passaic River Basin is one of the most densely populated and urbanized basins in New Jersey (Chang et al., 2000). It lies in the Piedmont and Highlands physiographic provinces of northeastern New Jersey and southeastern New York (Dalton, 2003; Woods et al., 2007) and comprises complex and diverse land uses. Upstream of Dundee Dam, the basin is about 40 percent urban, with lesser amounts of forest

[9] Unless noted otherwise, the sources of our information are the final license application filed February 28, 2019, and additional information filed by Great Falls Hydro-Paterson on August 13, 2019, November 12, 2019, February 26, 2020 and May 26, 2020.

(27 percent) and wetlands (25 percent) that occur primarily in the headwaters. The lower basin is almost exclusively urbanized with industrial pollution and sediment contamination prevalent in the river.

Climate is humid continental, characterized by warm summers and longer, colder winters. Mean annual precipitation is 48.7 inches, with an additional 25 inches of snowfall. Mean monthly temperature ranges from 29.5 degrees Fahrenheit (°F) in January to 74.6 °F in July.

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the CEQ's regulations for implementing the National Environmental Policy Act (40 C.F.R., § 1508.7),[10] a cumulative effect is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative effects can result from individually minor but collectively significant actions taking place over time, including hydropower and other land and water development activities.

Through scoping, agency consultation, and our independent analysis, we have not identified any resources that would be cumulatively affected by the continued operation of the Great Falls Project.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

In this section, we discuss the effects of the project alternatives on environmental resources. For each resource, we first describe the affected environment, which is the existing condition and baseline against which we measure effects. We then discuss and analyze the site-specific environmental issues.

Only the resources that have the potential to be affected are addressed in this EA. Based on this, we have determined that aquatic resources (including water quantity, water quality, and fisheries), terrestrial resources, threatened and endangered species, recreation and aesthetics, and cultural resources may be affected by the proposed action and action alternatives. We have not identified any substantive issues related to geology and soils or land use associated with the proposed action, and therefore, these resources are not

[10] As noted earlier in this EA, although the CEQ updated its NEPA regulations on July 16, 2020 (effective September 14, 2020), the NEPA process for this project was ongoing at the time of the update, and therefore, this EA was prepared pursuant to CEQ's 1978 NEPA regulations.

addressed in this EA. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Aquatic Resources

3.3.1.1 Affected Environment

Water Quantity and Use

From 2010 through 2018, mean annual flow at the Passaic River in the vicinity of the project is 1,115 cfs (table 1). Flows are seasonally variable, typically reaching their highest values during March and April and the lowest in July. Maximum hydraulic capacity of the project is exceeded about 14 percent of the time (figure 4).

Several entities withdraw water from the Passaic River. Article 34 of the current license requires Great Falls Hydro-Paterson to release "continuous flow" into the Great Falls Raceway and Power System (raceway system);[11] however, as described below in section 3.3.5.1, *Cultural Resources, Affected Environment*, the raceway system was dewatered after it was damaged by Hurricane Irene in July 2010 and has remained inoperable. United Water and the North Jersey District Water Supply Commission have a joint authorization to withdraw 250 million gallons per day (MGD) from the Passaic River and its tributaries (at the Two Bridges Diversion) about 5 miles upstream of the project. The Passaic Valley Sewerage Commission also withdraws water (up to 55 MGD) for use at the Little Falls Water Treatment Plant.

Water Quality

The New Jersey DEP is responsible for administering the state's Surface Water Quality Standards for the protection of surface water quality. The Passaic River, from the outlet of Osborn Pond in the project vicinity to Dundee Dam is classified as FW2-NT. The FW classification is given to all freshwaters of the state, with those located wholly within the state or federal land or special holdings classified as FW1 and receiving the highest protections possible. All other surface freshwaters (excluding the Delaware River and Pinelands waters) are classified as FW2. The NT designation is applied to

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[11] The raceway system, which is discussed in more detail in section 3.3.5, *Cultural Resources,* consists of three canals, known as the upper, middle, and lower raceways, that were built between 1792 and 1846, to channel water to manufacturing facilities along its path. It ceased providing water to manufacturing facilities in 1982 but was rehabilitated in 2004–2005 and provided aesthetic flows of 10 cfs until it was damaged in 2011. It is owned by the City of Paterson and is an important component of the Paterson Great Falls National Historic Park.

Table 1. Monthly and annual mean flows (cfs) at the Great Falls Project, 2010–2018.

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
2010	1,793	1,212	5,912	2,849	1119	310	237	258	98	550	313	1,290	1,328
2011	584	1,359	5,734	3,514	2,805	1,351	434	3,138	5,668	1,822	2,250	2,871	2,627
2012	1,636	877	561	477	644	655	191	281	223	488	457	1,468	663
2013	1,215	1,583	1,972	795	1,322	2,615	858	582	285	119	252	670	1,022
2014	1,160	847	1,762	2,328	2,987	846	728	209	106	163	271	1,098	1,042
2015	805	272	1,754	1,335	332	751	331	135	128	308	314	644	595
2016	1,148	2,403	1,129	437	563	148	320	508	79	93	178	459	622
2017	665	642	996	2,223	1,325	533	660	368	171	243	378	143	695
2018	780	1,543	2,372	2,501	1,537	565	617	2,095	975	1,550	3,674	3,444	1,804
Monthly	1,087	1,193	2,466	1,829	1,404	864	486	842	859	593	899	1,343	1,155

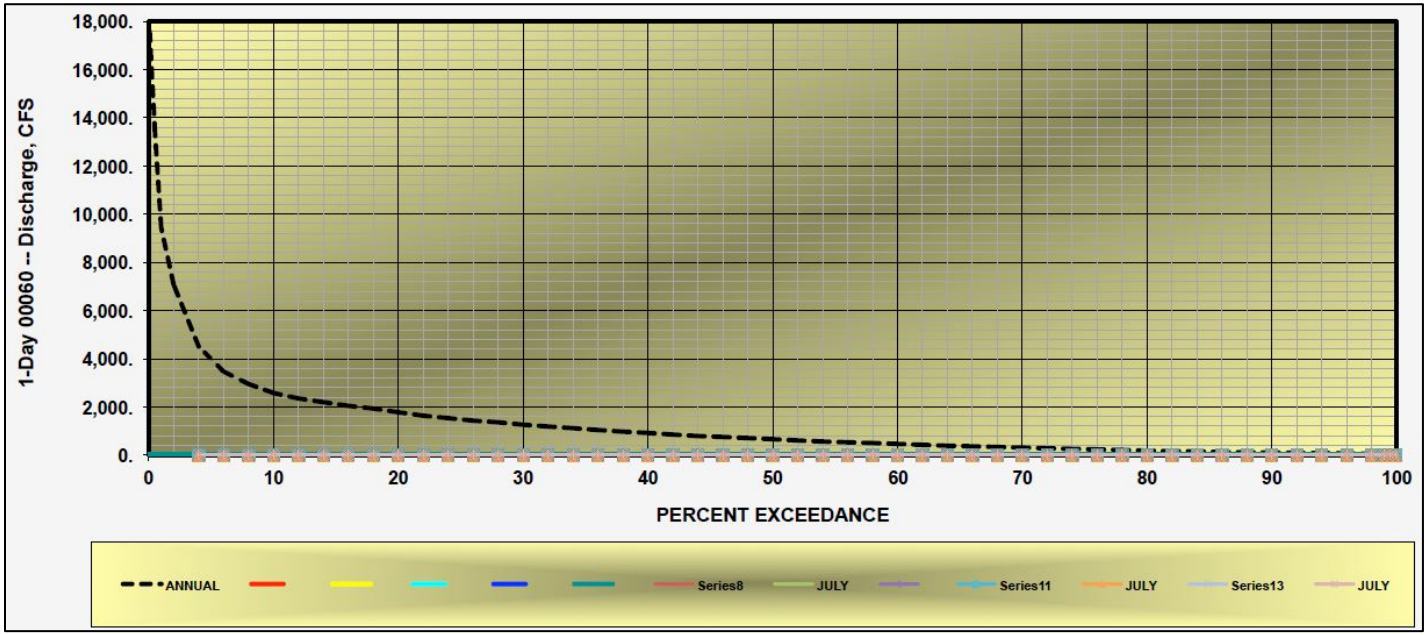

Figure 4. Flow duration curve at the Great Falls Project, 2010–2018.

freshwaters that have not been designated as having the quality and standards necessary to support trout production or trout maintenance but are suitable for other fishes.

The Passaic River, from the Pompton River downstream to Goffle Brook (about 2 miles downstream of the project), is listed as an impaired segment under section 303(d) of the Clean Water Act due to several contaminants exceeding limits established by the U.S. Environmental Protection Agency. This includes elevated arsenic in public water supplies, and several fish tissue contaminants, such as mercury, polychlorinated biphenyls (PCBs), chlordane, and dichlorodiphenyltrichloroethane (DDT) that have resulted in fish consumption advisories.

The Passaic Valley Sewerage Commission conducts long-term ambient water quality monitoring on the Passaic River, including at two sites in the vicinity of the project and one site farther downstream. Station 1 is 1.2 miles upstream of the project, Station 2 is 100 feet downstream of the powerhouse, and Station 3 is about 3 miles downstream. Data from the most recent sampling period (2010 to 2012) is summarized below.

- Station 1: water temperature ranged from 0.56 degrees Celsius (°C) on February 1, 2010 to 27.75 °C on July 25, 2011; DO concentrations ranged from 3.87 mg/L (July 25, 2011) to 18.73 mg/L (January 4, 2010); and pH ranged from 6.4, recorded on April 11, 2011, to 8.04 on March 8, 2010 and July 18, 2011.

- Station 2: water temperature ranged from 0.39 °C on February 1, 2010 to 27.81 °C on July 9, 2012; DO concentrations ranged from 6.49 mg/L (July 25, 2011) to 21.61 mg/L (November 15, 2010); and pH ranged from 6.34, recorded on February 7, 2011, to 8.58, on July 18, 2011.

- Station 3: water temperature ranged from 0.38 °C on February 1, 2010 to 27.76 °C on July 25, 2011; DO concentrations ranged from 3.84 mg/L (August 9, 2010) to 21.42 mg/L (February 7, 2012); and pH ranged from 5.48, recorded on January 3, 2011, to 8.72, on June 7, 2010.

Commission staff evaluated 10 years of hourly DO data from the Passaic River, about 7.5 miles upstream of the project.[12] Mean monthly DO concentrations peak at over 12 mg/L during January through March and decrease to about 6.5 mg/L from June through August (table 2). Observations of less than 4 mg/L have been documented

[12] U.S. Geological Survey (USGS) gage on the Passaic River below the Pompton River at Two Bridges, New Jersey (USGS Gage No. 04234000). Dissolved oxygen data from October 1, 2008 to September 30, 2018, https://waterdata.usgs.gov/usa/nwis/uv?01389005.

during June through September, occurring about 4.6 percent of the time, but are generally of short duration. As a result, minimum mean daily DO concentrations never fall below 6.2 mg/L and are consistent with the state standard of maintaining a 5.0 mg/L average over a 24-hour period.

Table 2. Mean monthly DO concentrations (mg/L) and mean daily DO ranges in the Passaic River at Two Bridges, New Jersey, 2008–2018.

Month	Mean Monthly DO Concentration	Range of Mean Daily DO Concentration
January	12.3	12.0–12.6
February	12.6	11.7–12.9
March	12.2	11.7–12.8
April	10.3	8.8–11.6
May	7.5	6.4–8.9
June	6.5	6.2–7.0
July	6.6	6.2–6.9
August	6.5	6.2–6.8
September	7.1	6.3–8.0
October	8.0	7.6–8.6
November	9.1	7.6–10.5
December	11.3	10.4–12.0

Resident Fish Community

A total of 27 fish species have been documented in the Passaic River from the project vicinity to its confluence with Newark Bay, with species of the family Cyprinidae (minnows and carps) representing 7 species and Centrarchidae (bass and sunfishes) and Alosidae (herrings) each comprising 5 species (table 3). The Passaic River upstream of Great Falls supports a warm-water fishery dominated by Centrarchids, such as largemouth bass (*Micropterus salmoides*) and bluegill (*Lepomis macrochirus*). In addition to naturally sustained largemouth bass, recreational angling occurs for Northern pike (*Esox lucius*) and channel catfish (*Ictalurus punctatus*), which are supplemented by New Jersey DEP's annual stocking upstream of the project. Farther upstream, headwater tributaries including the Ramapo, Wanaque, Pequannock, and Rockaway rivers receive annual allotments of brown trout (*Salmo trutta*).

Downstream of Dundee Dam, the Passaic River transitions from tidal freshwater to tidal brackish water as it approaches Newark Bay and supports more euryhaline species. Temperate basses (e.g., striped bass [*Morone saxatilus*] and white perch [*Morone americana*]), along with Atlantic menhaden (*Brevoortia tyrannus*), tidewater silversides (*Menidia peninsulae*), and mummichog (*Fundulus heteroclitus*) are commonly encountered species.

Table 3. Fish species documented in the mainstem Passaic River, New Jersey.

Family		Survey Year	
Common Name	**Scientific Name**	**2010[a]**	**1981[b]**
Freshwater Eels			
American eel	*Anguilla rostrata*	X	X
Herrings	**Alosidae**		
Alewife	*Alosa pseudoharengus*	X	X
Blueback herring	*Alosa aestivalis*	X	X
American shad	*Alosa sapidissima*		X
Gizzard shad	*Dorosoma cepedianum*	X	X
Atlantic menhaden	*Brevoortia tyrannus*		X
Topminnows	**Fundulidae**		
Banded killifish	*Fundulus diaphanus*	X	X
Mummichog	*Fundulus heteroclitus*		X
Minnows and Shiners	**Cyprinidae**		
Goldfish	*Carassius auratus*	X	X
Common carp	*Cyprinus carpio*	X	X
Eastern silvery minnow	*Hybognathus regius*	X	X
Golden shiner	*Notemigonus crysoleucas*	X	X
Satinfin shiner	*Cyprinella analostana*	X	X
Common shiner	*Luxilus cornutus*		X
Eastern blacknose dace	*Rhinichthys atratulus*		X
Suckers	**Catostomidae**		
White sucker	*Catostomus commersoni*	X	X
Catfishes	**Ictaluridae**		
Brown bullhead	*Ameiurus nebulosus*	X	X
Channel catfish	*Ictalurus punctatus*		X
Trouts	**Salmonidae**		
Brown trout	*Salmo trutta*		X
Silversides	**Atherinopsidae**		
Tidewater silverside	*Menidia peninsulae*		X
Temperate Basses	**Moronidae**		
White perch	*Morone americana*	X	X

Striped bass	*Morone saxatilus*		X
Sunfishes	**Centrarchidae**		
Redbreast sunfish	*Lepomis auritus*	X	
Pumpkinseed	*Lepomis gibbosus*	X	X
Bluegill	*Lepomis macrochirus*	X	X
Largemouth bass	*Micropterus salmoides*	X	X
Black crappie	*Pomoxis nigromaculatus*	X	X

[a] New Jersey DEP (2010)
[b] FWS (1981)

Migratory species, such as American eel (*Anguilla rostrata*) and Alosids, are largely limited to the lower portion of the Passaic River as Dundee Dam (7 miles downstream of the project) and the 65-foot-high Great Falls effectively restrict upstream passage. However, in records dating to 1975, New Jersey DEP has routinely documented American eel (generally less than 10 individuals per site) upstream of the project during fisheries surveys for northern pike[13] and, as recently as 2018, captured three specimens in the Peckman River (about 3 miles upstream of the project) as part of field surveys for the state's Northern Fish Index of Biotic Integrity.[14] These captures suggest that some individuals can navigate past the Passaic River's man-made and natural downstream barriers.

Aquatic Macroinvertebrates

Aquatic macroinvertebrates were collected as part of New Jersey DEP's Ambient Biomonitoring Network in two tributaries of the Passaic River in the vicinity of the project (Molly Ann Brook and the Peckman River) and one mainstem location about 2.5 miles upstream. Taxa richness ranged from 12 to 21 genera, with sensitive taxa comprising the orders Ephemeroptera, Plecoptera, and Trichoptera accounting for only 1 to 8 percent of the total taxa. Categorical ratings of the sites, based on the New Jersey

[13] *See* Great Falls Hydro-Paterson's August 13, 2019, *Response to Deficiency and Additional Information Requests*.

[14] *See* https://www.state.nj.us/dep/wms/bfbm/download/njs11-156a_2018.pdf

DEP's High Gradient Macroinvertebrate Index, classified the biological condition of Molly Ann Brook as "poor," with the remaining sites receiving a "fair" rating.

3.3.1.2 Environmental Effects

Mode of Operation

The project is operated in a run-of-river mode, whereby the sum of all outflows from the project at any given point in time approximates the sum of all inflows to the project impoundment. Compared to other modes of operation (e.g., peaking and storage projects), the shorter water residence time in run-of-river impoundments minimizes water level fluctuations and associated scour, as well as fluctuations in water temperature.

Great Falls Hydro-Paterson proposes to continue to operate the project in a run-of-river mode; however, as described in section 2.1.2, it is no longer proposing to operate the project's 27-inch-high flashboards. Under these conditions, impoundment levels prior to January 28, 2013 varied between 113.9 (spillway crest) and 115.2 feet.

Staff Analysis

The project impoundment is unlikely to experience thermal stratification due to its relatively shallow nature and strong currents. As such, under run-of-river operation, water exiting the turbines should have similar temperature and DO characteristics to the impoundment. Dissolved oxygen monitoring under the current license, has shown conditions to be consistent with the state's water quality criteria. Therefore, continuing to operate the project in a run-of-river mode, in conjunction with DO monitoring, as proposed by Great Falls Hydro-Paterson, would not be expected to result in any project-related changes in water quality conditions (i.e., water temperature and DO), which appear suitable for aquatic biota and consistent with state water quality criteria in the project area. Further, run-of-river operation would limit the range of water level fluctuations and increase habitat stability, thereby providing a benefit to fishes that spawn in near-shore areas (Sammons and Bettoli, 2000). In the event that units trip offline or are manually shutdown, maintaining impoundment levels near or above the spillway crest, as proposed, would allow spill to occur quickly to minimize the magnitude and duration of downstream effects on water quantity and aquatic biota.

Minimum Flow to the Bypassed Reach

The current license, as amended, requires the co-licensees to provide continuous minimum flows of (1) 50 cfs or inflow to the project impoundment, whichever is less, to the bypassed reach for the protection of fish resources (Article 36) and (2) 200 cfs or inflow to the project impoundment, whichever is less, over Great Falls for the purpose of maintaining water quality and scenic values, as well as fish and wildlife resources (Article 38).

To enhance the aesthetic value of Great Falls, Great Falls Hydro-Paterson proposes to modify minimum flows to the bypassed reach by providing 200 cfs or inflow from 7:00 a.m. to 9:00 p.m. and 50 cfs from 9:00 p.m. to 7:00 a.m., whenever flows are less than 2,000 cfs. When available, Great Falls Hydro-Paterson would provide 400 cfs flows during daylight hours on weekends from May 1 to October 3, as well as during special annual events totaling approximately 100 hours.

Staff Analysis

Great Falls Hydro-Paterson's proposed 50-cfs minimum flow to the bypassed reach is unchanged from that of the current license, as is its measure to provide 200 cfs aesthetic flows for Great Falls, albeit from only 7:00 a.m. to 9:00 p.m. The proposed 400 cfs for special annual events is unlikely to have any effects on habitat availability and aquatic biota as the conditions would occur infrequently and would result in only a modest increase in water velocity and depth in the bypassed reach. Further, as substrate in the bypassed reach consists of fractured bedrock and large boulder, suitable cover for fishes exists and could provide refuge from higher water velocities during the 400-cfs releases. Further, habitat in the bypassed reach is unlikely to change under the increased flows due to the stable channel morphology and substrate composition, which is broad, shallow, and bedrock-dominated upstream of the falls, and a confined vertical-walled gorge with a bedrock-boulder mix downstream of the falls.

Operation Compliance Monitoring

As described above, Great Falls Hydro-Paterson proposes to continue to operate the project in a run-of-river mode and would provide aesthetic flows to Great Falls; however, there are no further details describing how impoundment elevations or minimum flows would be monitored for compliance purposes. Although compliance measures do not directly affect environmental resources, they do allow the Commission to ensure that a licensee complies with the environmental requirements of a license. Therefore, operational compliance monitoring and reporting are standard requirements in Commission-issued licenses.

Staff Analysis

An operation compliance monitoring plan describes the methodology, instrumentation, and reporting procedures a licensee intends to use to verify a project is being operated in accordance with the operational requirements of its license. Great Falls Hydro-Paterson has proposed to operate the project in a run-of-river mode and would provide aesthetic flows to Great Falls, but does not propose any provisions for monitoring and reporting to the Commission to ensure compliance with the operating requirements of any license issued for the project. Therefore, developing an operation compliance monitoring plan that includes the monitoring provisions as well as procedures for reporting the data to the Commission and establishing a schedule for reporting any

operational deviations would ensure that all operation requirements for the protection and enhancement of aquatic and aesthetic resources are being met.

Water Quality Monitoring

As required by the current license, Great Falls Hydro-Paterson monitors DO in the project tailrace and bypassed reach (downstream of the falls) during project operation from June 1 through September 30 to ensure consistency with the state water quality standard, defined as a 24-hour average concentration of not less than 5.0 mg/L and not less than 4.0 mg/L at any time. Any occurrences of DO concentrations below 5.0 mg/L would result in modified operation of the project including: (1) providing additional flows over Great Falls in excess of the stated minimum flows, (2) providing aeration of flows passing through the powerhouse, and/or (3) shutting down the project.

Great Falls Hydro-Paterson proposes to conduct daily DO monitoring from 9:00 p.m. to 7:00 a.m., when aesthetic flows are reduced from 200 cfs to 50 cfs, to ensure consistency with state water quality standards. Any occurrences of DO concentrations below 5.0 mg/L would result in modified operation of the project as described above.

Staff Analysis

As described in section 3.3.1.1 (*Affected Environment, Water Quality*), mean monthly DO concentrations in the Passaic River upstream of the project range from 7.5 mg/L to 12.6 mg/L from October through May. During the same period, minimum mean daily concentrations are 6.4 to 12.9 mg/L, or about 30 to 158 percent higher than the 5.0 mg/L state water quality standard, with no observations below 4.0 mg/L. While the range of mean monthly and daily DO concentrations in June through September decrease from those during the winter (down to 6.5 to 7.1 mg/L and 6.2 to 6.3mg/L, respectively), the occurrence of observations below 4.0 mg/L increases to about 4.6 percent of the hourly readings, with most occurring during the evening from July through September.

Despite maintaining suitable daily mean DO concentrations during the summer, the increased incidence of low DO, ranging down to 1.9 mg/L, from June through September could affect aquatic biota. Therefore, to ensure that conditions at the project remain consistent with state water quality standards, conducting DO monitoring during that time and, if necessary, implementing any operational changes to enhance concentrations would be beneficial to aquatic biota and provide safeguards against diel DO fluctuations. The data, however, do not support conducting DO monitoring from October through May as daily mean DO concentrations are generally greater than 8.0 mg/L. Because there is no formal monitoring plan, developing a water quality monitoring plan to document procedures, guide implementation, and ensure compliance would be a useful addition to the proposed monitoring.

Fish Protection

Great Falls Hydro-Paterson does not propose any fish protection measures at the project and the Commission did not receive any comments regarding project-induced mortality of fishes. However, in support of the license application, Great Falls Hydro-Paterson conducted a desktop impingement and entrainment study,[15] which we evaluate below.

Staff Analysis

In consultation with the New Jersey DEP, Great Falls Hydro-Paterson evaluated eight target species documented in the project vicinity to evaluate project-induced mortality. The species include: American eel; white sucker (*Catostomus commersoni*); redbreast sunfish (*Lepomis auratus*); pumpkinseed (*Lepomis gibbosus*); satinfin shiner (*Cyprinella analostana*); golden shiner (*Notemigonus crysoleucas*); and banded killifish (*Fundulus diaphanous*). Using a desktop analysis, the study provides descriptions of the downstream passage facility design and operation, and includes estimates of impingement, entrainment, and turbine survival and total project survival for fish passing downstream at the project.

The study concluded that impingement mortality at the project is negligible due to the low intake approach velocities (2.2 feet per second [ft/s] or less, depending on generation flow) and the ability of fish large enough to be physically excluded by the 2-inch clear bar spacing to escape these velocities. Total annual entrainment of target species, derived from data compiled from comparable hydropower facilities (EPRI, 1997), is also low (418 to 1,258 individuals and 853 to 17,929 individuals for fishes 200 to 500 millimeters [mm] in length and less than 200 mm, respectively); however, entrained fish are likely to experience high turbine mortality (89 percent for individuals 200 to 500 mm) due to the fast rotational speed, number of blades, and small diameter of the project's turbines. Despite these potential losses, the total estimated annual survival[16] of fishes passing downstream of the project is 87 percent. American eel, which, as described above in section 3.3.1.1 *Affected Environment*, have been documented upstream of the project, experience about 89 percent total survival during the downstream migration period (August 15 to December 15). Under the proposed reduction of flows to the bypassed reach (i.e., 200 cfs to 50 cfs during evening hours), American eel total survival is estimated to decrease about 2.5 percent over the migration season.

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[15] Filed November 12, 2019.

[16] Total survival was estimated by determining the proportion of fish using each available downstream passage route (turbines, spillway, and fish bypass) and applying route-specific survival estimates.

Based on negligible impingement, the relatively low entrainment numbers and mortality (i.e., total number of fish killed annually), and the high total project survival rates, any potential impacts of impingement and entrainment on fish populations in the vicinity of the project would be minimal.

3.3.2 Terrestrial Resources

3.3.2.1 Affected Environment

Upland habitat within the project boundary is largely modified by urban development, with some upland forest and open habitats adjacent to the Passaic River and surrounding the project facilities. Forested habitat within the project boundary is mainly limited to a narrow band of sparse, oak-dominated forest with a relatively gentle slope located along the project impoundment.

Wetlands

As noted in its additional information response filed August 13, 2019, Great Falls Hydro-Paterson identified 103.8 acres of National Wetlands Inventory mapped wetlands within the project boundary. Wetland habitat near the project is primarily represented by the impounded Passaic River (riverine; 103 acres), with smaller areas of palustrine forested and scrub-shrub wetlands (0.8 acre).

Wildlife

Upland and wetland habitat within the project supports a variety of wildlife, including those species tolerant of human development and activity (i.e., raccoon, Virginia opossum, eastern cottontail rabbit, eastern gray squirrel, red fox, and numerous passerine and non-passerine bird species), game species such as white-tailed deer, and species associated with wetland habitat (i.e., various reptile, amphibian, waterfowl and marsh bird species, and mammals such as muskrat).

Rare and State-listed Species

<u>Bald eagle</u>

The bald eagle (*Haliaeetus leucocephalus*) is protected under the Migratory Bird Treaty Act and the Bald and Golden Eagle Protection Act, which prohibit the "take" of eagle eggs, nests, and offspring, and which prohibit substantially disturbing normal breeding and feeding activities, except as permitted by regulation. Bald eagles are listed as an endangered species in New Jersey and are protected under New Jersey State law.

Bald eagles typically forage over water and other open habitats. Nesting occurs in mature trees and snags and on cliffs, rocks, and artificial structures, generally within 1 mile of water. In New Jersey, nesting activity occurs between December and June.

The co-licensees note that bald eagles have the potential to occur at the project. Immature and adult bald eagles have been occasionally observed roosting or in transit within the project boundary over the past 10 years, and frequently observed in the Garrett Mountain Reservation area about 1 mile south of the project.[17] A 2019 bald eagle report prepared by the New Jersey DEP indicates that the closest bald eagle nest to the project is about 2.5 miles northwest of the project boundary in the City of Paterson.[18]

3.3.2.2 Environmental Effects

Great Falls Hydro-Paterson proposes no environmental measures associated with terrestrial resources, and the Commission received no substantive comments regarding the effects of project operation or maintenance on terrestrial resources. However, as bald eagles are known to be present within the project boundary, staff analyzed the effects of project operation and maintenance on this species.

Bald eagles

Bald eagles have been observed at or near the project over the past 10 years and one of the few bald eagle nests in urban northern New Jersey is located about 2.5 miles northeast of the project. Project transmission infrastructure is underground and thus does not represent a collision or electrocution hazard to bald eagles. Project maintenance may involve some removal of trees to allow for the safe operation of the project. While such maintenance is not likely to result in substantial disturbance to foraging or roosting bald eagles within the project boundary or in transit through the project, it has the potential to affect nesting bald eagles should any become established in the project boundary. As a bald eagle nest is located close to the project, consulting with the FWS and New Jersey DEP if bald eagles are observed nesting within the project boundary, and determining if any measures are necessary to minimize habitat disturbance surrounding active nests on project lands, would minimize effects to bald eagles.

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[17] According to the Cornell Lab of Ornithology's eBird database (http://ebird.org), numerous sightings of bald eagle adults and immatures were observed within and adjacent to the project boundary over the past 10 years in the December to July period. Most sightings involved individual birds and a few observations of two adults or adult and immature birds together.

[18] *See* page 9 in https://www.state.nj.us/dep/fgw/ensp/pdf/eglrpt19.pdf.

3.3.3 Threatened and Endangered Species

3.3.3.1 Affected Environment

According to FWS's Information for Planning and Conservation (IPaC) system, two federally listed species, the endangered Indiana bat and the threatened northern long-eared bat,[19] have the potential to occur within the project boundary. No critical habitat for any federally listed threatened and endangered species occurs within project-affected lands.

Indiana bat

FWS listed the Indiana bat as threatened on March 11, 1967.[20] This species occurs in the eastern United States, including New Jersey, and hibernates colonially in caves and mines (hibernacula) through the winter (FWS, 2018). The Indiana bat's non-hibernation season includes spring emergence and staging,[21] summer reproduction in maternity roosts, and fall swarming.[22]

Summer habitat requirements for this species include: (1) dead or live trees and snags with peeling or exfoliating bark, split tree trunks or branches, or cavities that may be used as maternity roost areas; (2) live trees such as shagbark hickory and oaks that have exfoliating bark, or other hardwoods that are dead, or have dead branches with loose bark, which provide crawl spaces for the bats between the bark and the trunk or branches of the tree; and (3) stream corridors, riparian areas, and upland woodlots which provide forage sites (FWS, 2018).

Mating occurs in August or early September when Indiana bats swarm at the entrance of caves or mines, and maternity colonies are formed by female bats that roost in groups of up to 100 or more individuals (FWS, 2018). Birth of a single young generally

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[19] *See* January 30, 2020, memorandum.

[20] 32 Fed. Reg. 4001 (March 11, 1967).

[21] Spring staging is the time period between winter hibernation and migration to summer habitat. During this time, bats begin to gradually emerge from hibernation and exit the hibernacula to feed but re-enter the same or alternative hibernacula to resume daily bouts of torpor (i.e., a state of mental or physical inactivity).

[22] Fall swarming occurs after summer and prior to winter hibernation. The purpose of swarming behavior may include: introduction of juveniles to potential hibernacula, copulation, and gathering at stop-over sites on migratory pathways between summer and winter regions.

occurs in late June. Maternity roost trees can be considered as "primary" or "alternate" by the proportion of bats that consistently occupy the roost. Primary roosts serve as the bats' main roosts for the summer; alternate roosts provide safe resting areas and protection from inclement weather, and in the event of damage to a primary roost. Indiana bats forage on a variety of flying insects, typically along forest edges and canopies.

Threats to Indiana bats include mortality related to white-nose syndrome (WNS); human disturbance in hibernacula; environmental toxins, such as herbicides and pesticides; and summer habitat loss and degradation (FWS, 2018).

Northern long-eared bat

FWS listed the northern long-eared bat as threatened on May 4, 2015 (FWS, 2015), and determined on April 27, 2016, that designating critical habitat is not prudent (FWS, 2016a).

The northern long-eared bat is a medium-sized bat species found throughout the central and eastern United States, coinciding with the greatest abundance of forested areas (FWS, 2015). It is found in a variety of forested habitats in the summer season, where bats roost singly or in colonies underneath bark, in cavities, or in crevices of both live and dead trees. In the fall season, northern long-eared bats leave their forested habitat to hibernate in caves, mines, and similar habitat. The bats arrive at hibernacula between August and September, enter hibernation between October and November, and emerge from hibernacula between March and April.

On January 14, 2016, FWS issued a final 4(d) rule that prohibits the following activities in areas of the country impacted by WNS:[23] incidental take within a hibernation site; tree removal within 0.25 mile of a known, occupied hibernaculum; and cutting or destroying known occupied maternity roost trees, or any other trees within 150 feet of that maternity roost tree, during the pup-rearing season (June 1 through July 31) (FWS, 2016b).

The Great Falls Project is in Passaic County, which is within the WNS zone and the Indiana and northern long-eared bats geographical range (FWS, 2019a and 2019b). There are no known summer or winter occurrences of either species within the project

[23] White-nose syndrome is the main threat to the northern long-eared bat and has caused a precipitous decline in bat numbers (in many cases, 90 to 100 percent) where the disease occurs.

boundary. Within Passaic County, there are confirmed northern long-eared bat maternity roosts and hibernacula in several locations and two known Indiana bat hibernacula.[24]

3.3.3.2 Environmental Effects

Federally listed bats

The project is located within the summer migratory ranges of the federally listed Indiana and northern long-eared bats.[25] However, there are no project-related activities that would affect the bats. Moreover, FWS stated that it did not anticipate any adverse effects to the federally listed Indiana and northern long-eared bat associated with the relicensing of the Great Falls Project.[26] FWS also stated that it had no objection to relicensing the project, no need to participate in the relicensing proceeding, and determined that no further consultation pursuant to section 7(a)(2) of the ESA is required regarding the Indiana and northern long-eared bats. For these reasons, we conclude that the proposed project would have no effect on the federally listed Indiana and northern long-eared bats.

3.3.4 Recreation and Aesthetics

3.3.4.1 Affected Environment

Recreation

Local Recreation

The City of Paterson, New Jersey State Parks, and the Park Service operate and maintain several recreation areas in the vicinity of the project as shown in figure 5. The City of Paterson maintains Great Falls Gateway Park, Valley of the Rocks, Mary Ellen Kramer Park, Allied Textile Printers Quarry Lawn Park, Allied Textile Printers Waterpower Ruins Park, the S.U.M. Middle and Lower Raceway Park, the S.U.M. Upper Raceway and Reservoir Park, and the Paterson Museum. New Jersey State Parks maintains the Maple Street Triangle and the Paterson Vista State Park. The Park Service maintains Overlook Park and the Visitor Center. These areas provide walkways,

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[24] https://www.fws.gov/northeast/njfieldoffice/pdf/battowns.pdf (Revised April 8, 2020).

[25] *See* FWS' March 30, 2016, letter filed with Great Falls Hydro-Paterson's August 13, 2019, additional information response.

[26] *Id*.

Figure 5. Recreation facilities (delineated by the solid red line) in the vicinity of the Great Falls Project (Source: Great Falls Hydro-Paterson's August 13, 2019, response to Commission staff's request for additional information).

benches, observation decks, and picnic tables throughout the project area and its surrounding environs.

Mary Ellen Kramer Park, Overlook Park, and the Paterson Museum are open for public use and include trails, benches, and viewing areas. Enhancements at the remaining recreation sites shown in figure 5 near the project, are scheduled to be completed over the next 10 years and would further enhance the recreation experience.[27]

Project Recreation

Overlook Park is the only recreation facility located within the current project boundary. It is operated and maintained by the Park Service and until 2020 was located on land owned by Great Falls Hydro-Paterson (discussed below in section 3.3.4.2). The park occupies 3 acres and is a destination for visitors who want to view Great Falls. The park includes an observation platform along the east wall of the powerhouse, a visitor center, an outdoor amphitheater and open space along the tailrace wall, benches, parking, a statue of Alexander Hamilton, and a walkway around the powerhouse leading to an observation area close to Great Falls and the chasm bridge. The chasm bridge spans the falls and allows access to Mary Ellen Kramer Park located on the side of the river opposite the project. Both Overlook Park and Great Falls are within the Great Falls/S.U.M. Historic District, which was elevated to the Great Falls/S.U.M. National Historic Landmark District (National Historic Landmark District) in 1976. Due to its historical and national significance, the Park Service designated the National Historic Landmark District as the Paterson Great Falls National Historical Park in 2011.

Aesthetics

In the immediate vicinity of the project, several locations in Overlook Park and Mary Ellen Kramer Park provide panoramic views of industrial and natural landscapes. The aesthetic features viewable near the project include the S.U.M. dam and Great Falls.

The S.U.M. dam is a run-of-river gravity overflow dam and measures approximately 315 feet in length with a maximum height of 15 feet. The falls are approximately 77 feet high and 280 feet wide. Great Falls is the second largest waterfall (behind Niagara Falls) by volume east of the Mississippi. The project boundary encompasses the falls, the outflow of the falls, and land below the falls (as shown in figure 3). Great Falls is a major tourist attraction and has been designated a National Natural Landmark by the Park Service.

[27] As described in Great Falls Hydro-Paterson's August 13, 2019, response to Commission staff's request for additional information.

3.3.4.2 Environmental Effects

Recreation

Great Falls Hydro-Paterson proposes to remove 7.09 acres of the project boundary, from the toe of S.U.M. dam to immediately downstream and adjacent to the powerhouse (*see* figure 3), citing that the lands are unnecessary for operation of the project. The proposed modification would include the bypassed reach, Great Falls, and a 2.4-acre parcel of Overlook Park transferred to the Park Service in 2020, as depicted in figure 6 and described below.[28] Overlook Park is the site of the former S.U.M. Steam Generation Plant that was constructed in tandem with the hydroelectric plant in 1914. The steam plant was demolished in 1960 and only the foundation of the building remains. Currently, a parking lot occupies the footprint of the building's foundation; however, the Park Service plans to construct a visitor center for Paterson Great Falls National Historical Park within that footprint.

In its Notice of Intent to Convey an Interest in Project Lands filed on April 29, 2020, Great Falls Hydro-Paterson describes an agreement reached between the City of Paterson and the Park Service in 2011 to transfer ownership of various parcels of land surrounding Great Falls to the Park Service. The agreement specifies that the management of lands within the project boundary, including Great Falls as a National Historic Landmark, would be accomplished cooperatively by the City of Paterson and the Park Service, as would funding and developing Overlook Park and the surrounding historic district.[29]

On May 20, 2020, the Commission acknowledged that the April 29, 2020, notice met the requirements of Article 26(d) of the license and that Great Falls Hydro-Paterson could make the proposed conveyance without prior Commission approval and that no further Commission action was necessary. The Commission stated that the project boundary remained unchanged with the conveyance of Overlook Park and that any changes to the project boundary would be evaluated as part of relicensing. The fee title conveyance was granted so that the Park Service could begin construction of the visitor center by the fall of 2020 on federal property. The visitor center will be constructed over

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[28] Although not proposed in the final license application, Great Falls Hydro-Paterson proposed to remove Overlook Park from the project boundary and to transfer ownership of the park to the Park Service in its additional information response filed with the Commission on August 13, 2019.

[29] In its Notice of Intent, Great Falls Hydro-Paterson describes easements it has retained for vehicular and equipment access through Overlook Park to the powerhouse.

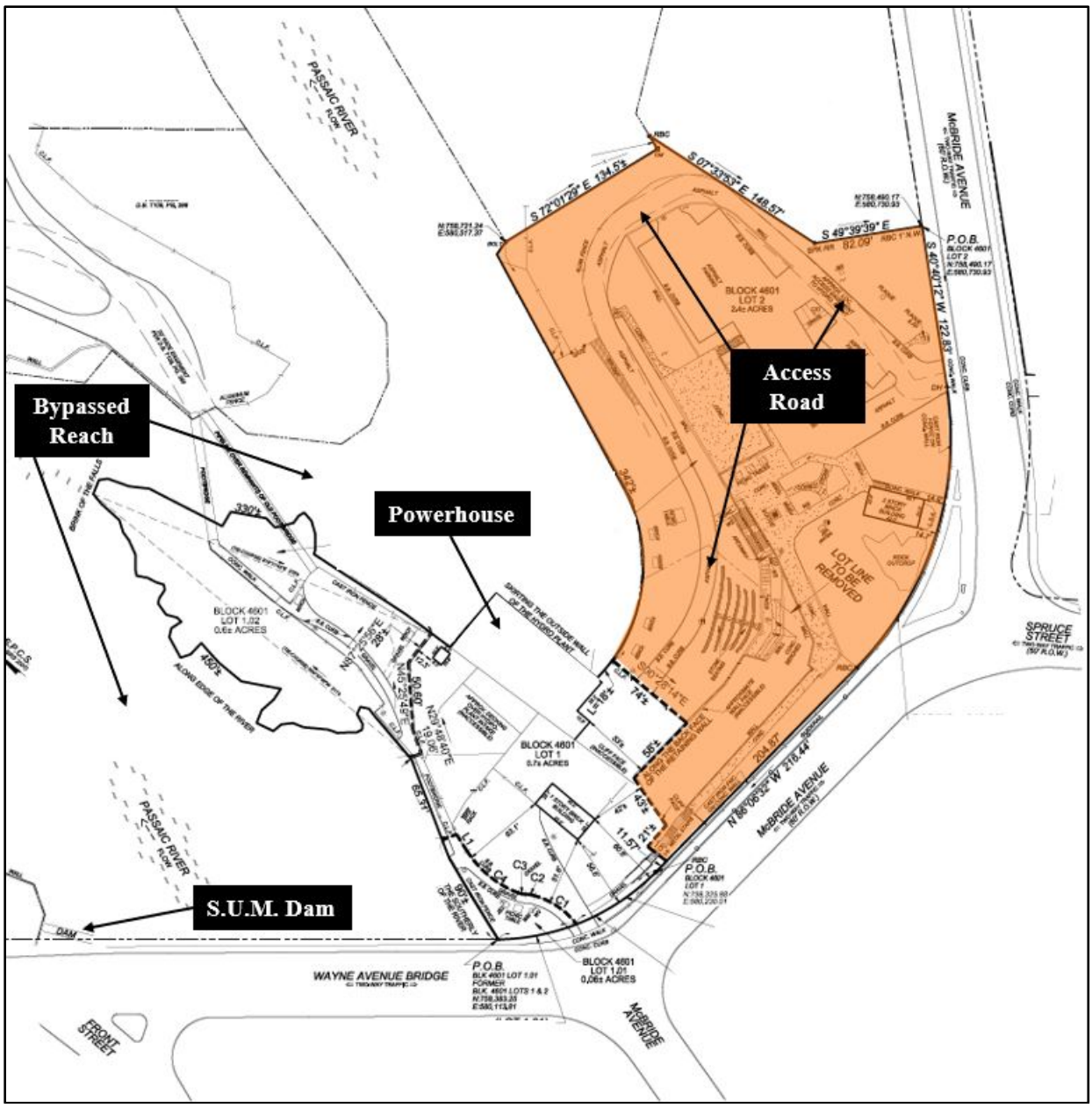

Figure 6 Lands of Overlook Park (highlighted) conveyed to the Park Service (Source: Notice of Intent filed April 29, 2020).

the next two years under Park Service guidance and is scheduled to be completed in the summer of 2022.

The Commission received no comments regarding recreation, the conveyance of Overlook Park to the Park Service, or the proposed modification of the project boundary.

Staff Analysis

The project boundary at Commission-licensed projects encompasses lands that are necessary for project purposes such as project operation or recreation access. At the Great Falls Project, the project boundary encloses the bypassed reach from downstream of the S.U.M. dam to the downstream end of Overlook Park (figure 3). Under the current license, Great Falls Hydro-Paterson is required to pass flows to maintain the aesthetic value of Great Falls. Removing the bypassed reach from the project boundary would not affect the ability of the project to continue providing aesthetic flows to Great Falls.

Overlook Park provides a project purpose of recreation and is currently in the project boundary. However, removal of the park from the project boundary would likely not negatively affect recreation opportunities because the Park Service, who owns and manages the park, would continue to provide recreation facilities and access to the public. Further, multiple recreation opportunities at and near the falls are provided by local, state, and federal entities. These surrounding parks and recreation areas were created to showcase the natural beauty of the falls. Therefore, removing Great Falls and Overlook Park from the project boundary would have no effect on project operation or recreation at the project. Great Falls Hydro-Paterson would, however, need to retain access to the powerhouse, which is only available via the access road through Overlook Park. Great Falls Hydro-Paterson has retained easements from the Park Service for use of the access road. However, to ensure access is always available, the access road should remain in the project boundary.

Aesthetics

Article 27 of the current license requires a continuous minimum flow of 200 cfs, or inflow, whichever is less, over Great Falls to maintain the aesthetic value of this natural resource. The first priority in the allocation of river flows is to preserve the aesthetic value of the falls. The current license requires river flows at 200 cfs or less to go over the falls. Generation can occur at flows of 250 cfs and above as this satisfies the minimum flow at Great Falls and the 50-cfs minimum hydraulic capacity of the project. Generation can occur up to the maximum hydraulic capacity of the project, which is 2,130 cfs; any flows above 2,130 cfs would enter the bypassed reach and Great Falls.

The Park Service requested an aesthetic flow study during pre-filing consultation. The objective of the study was to evaluate the existing aesthetic flows and their respective aesthetic characteristics, and to quantify potential project effects of the aesthetic flows while continuing to produce power at the project.

Great Falls Hydro-Paterson proposes the following aesthetic flows at Great Falls, when available: (1) daily releases of 200 cfs or inflow, whichever is less, from 7:00 a.m. to 9:00 p.m., (2) 50 cfs from 9:00 p.m. to 7:00 a.m., and (3) 400 cfs during daylight hours

on (a) weekends from May 1 to October 31 and (b) annual special events equaling approximately 100 hours.

No resource agencies or other entities filed comments or recommendations regarding aesthetic flows in response to the REA notice.[30]

Staff Analysis

The results of Great Falls Hydro-Paterson's aesthetic flow study, based on six visual and auditory criteria, concluded that higher flows of 800, 400, and 200 cfs (which received the first, second, and third highest overall ratings, respectively) were more aesthetically pleasing than those of 100 cfs and 50 cfs. Generally, as the flow levels increase, more water covers the lip of the falls and cascades down the falls creating an impressive sight. However, the more visually appealing 800-cfs and 400-cfs flows potentially affect generation. Great Falls Hydro-Paterson concluded that 200 cfs would provide suitable flows at Great Falls while also minimizing any impacts to power generation.

Staff compared the flow recommendations to the availability of water and any effects on project generation. At 200 cfs, flows over Great Falls were available almost year-round according to table 1 and would not have an effect on generation as current license requirements prioritize flows for aesthetics. As a result, 200 cfs would provide the best aesthetic value for viewing Great Falls, while also allowing for adequate power generation at the project.

Regarding the proposed 400-cfs flows, or inflow, whichever is less, during weekends from May to October and during special annual events, staff notes that flows would often be unavailable as the proposed timeframe directly coincides with seasonal low flows at the project. As shown in table 1, flows are generally at their lowest levels from June through October, with 51 percent of the mean monthly values falling below 400 cfs. The lowest mean monthly flows occur in July and October; however, the greatest number of mean flows less than 400 cfs over the 9-year period occurs during August (6 times) and September (7 times). May and June have the highest mean flows of the targeted peak visitation period, with only three occurrences of mean monthly flows below 400 cfs.

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[30] In its comments on the draft license application, the Park Service commented that when available, providing flows of 400 cfs over Great Falls on weekends from May through October and during special events, would maximize the volume of the falls and minimize the noise of the turbines to the greatest extent possible, which would benefit park visitors and event attendees.

Great Falls Hydro-Paterson's proposed flow regime would provide visitors with the opportunity to enjoy Great Falls with an adequate amount of water that displays the majesty of this natural feature. Flow data suggest that May and June would offer the greatest opportunity to meet the desired 400-cfs flows and July and October would present the greatest challenges. However, while we recognize that 400-cfs flows may not be available during every weekend from May 1 to October 31, the continuance of 200-cfs flows during daylight hours, or inflow if less, would safeguard its scenic value for visitors to the site. Great Falls Hydro-Paterson's proposal would maintain an adequate viewing experience of Great Falls at 200 cfs and, when available, additional opportunities to provide 400 cfs would enhance the visitor experience.

3.3.5 Cultural Resources

3.3.5.1 Affected Environment

Section 106 of the NHPA requires that the Commission take into account the effects of its actions on historic properties and afford the Advisory Council on Historic Preservation (Advisory Council) a reasonable opportunity to comment on the undertaking.[31] Historic properties are those that are listed or eligible for listing in the National Register of Historic Places (National Register). The regulations implementing section 106 of the NHPA also require that the Commission seek concurrence with the State Historic Preservation Office (SHPO) on any finding involving effects or no effects on historic properties, and consult with interested Indian tribes or Native Hawaiian organizations that attach religious or cultural significance to historic properties that may be affected by an undertaking. In this document, we also use the term "cultural resources" for properties that have not been determined eligible for listing in the National Register. Cultural resources represent things, structures, places, or archaeological sites that can be either prehistoric or historic in origin. In most cases, cultural resources less than 50 years old are not considered historic.

On June 10, 2016, the Commission designated Great Falls Hydro-Paterson as the non-federal representative for carrying out day-to-day consultation regarding the licensing efforts, pursuant to section 106 of the NHPA. However, the Commission

[31] An undertaking means "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license, or approval." 36 C.F.R. § 800.16(y) (2020). Here, the undertaking is the potential issuance of a new license for the Great Falls Project.

remains largely responsible for all findings and determinations regarding the effects of the project on any historic property.

Areas of Potential Effects

Pursuant to section 106 of the NHPA, the Commission must take into account whether any historic property could be affected by the issuance of a license within a project's area of potential effects (APE). The APE is defined as the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist.[32] For the Great Falls Project, the APE is all lands within the project's existing project boundary, and any lands outside the project boundary where cultural resources may be affected by project-related activities that are conducted in accordance with the FERC license.

The area where the Great Falls Project is located has an extensive archaeological and historic record. It is believed that the first inhabitants of the region were present from approximately 10,000 BCE (Before Common Era) until 8,000 BCE. By the time of European contact, the region, known as the Acquakanonk territory, was occupied by the Lenape people (Lenni Lenape or Delaware), a loose affiliation of kinship bands. The first European contact occurred in the 17th century, when Dutch settlers arrived to farm the area (Wallace, 2019). European occupation around Great Falls intensified in the late 17th century and early 18th century, but the history of Paterson really begins in the late 18th century, when Alexander Hamilton, the first Secretary of the Treasury, developed an ambitious plan to harness the power of the falls and establish an industrial town. On July 4, 1792, the charter for the S.U.M. was signed by New Jersey Governor William Paterson (the city's namesake), a passionate supporter of Hamilton's plans (Park Service, 2006).

The S.U.M. was organized to develop waterpower at the falls. In 1792, the S.U.M. purchased 700 acres of land above and below Great Falls to establish the City of Paterson, and pioneered methods there for harnessing the power of water for industrial use. The first raceway plan was designed by Pierre Charles L'Enfant, architect and planner of Washington, D.C., and modified by Peter Colt (Fries, 1976). They envisioned a multi-tiered raceway system that would channel water for powering mills to be constructed and operated by the S.U.M. along its path. The early raceway operated from 1794 to 1799 and drew water from the Passaic River through a wooden dam above the falls (predecessor to the S.U.M. dam). Between 1792 and 1846, the raceway system was modified and expanded to consist of three canals known as the upper, middle, and lower raceways, which exist today in essentially the same form as the last major expansion back in 1846. The S.U.M. dam was built of granite from 1838 to 1840 to replace the earlier

[32] 36 C.F.R. § 800.16(d) (2020).

wooden structure and was intended to raise the level of the river at the upper raceway (Fries, 1974). The raceway system allowed Paterson to develop into an important 18th and 19th century industrial center for cotton, silk, iron, and locomotive production (Rothe, 1986).

Use of the raceway system continued to expand into the 20th century as industries prospered in Paterson; however, by about 1900, it became apparent that the individual water wheel using water from the raceway was generally less efficient than a central station generating hydroelectricity from the river. In order to use the waterpower of the Passaic River more efficiently, the S.U.M. hydroelectric plant (the present-day Great Falls Project) was constructed in 1912. The plant, which was designed and built by the Thomas Edison Electric Company, used water diverted by the S.U.M. dam and was operable by 1914 (Park Service, 2006). Construction of the hydroelectric plant changed milling operations in Paterson as manufacturing facilities began to switch to electricity instead of water-powered wheels. Though initially intended to solely provide power to the local mills, the plant supplied most of the power to the City of Paterson's grid (Park Service, 2016).

The S.U.M continued to operate for 153 years. Although not a terribly successful venture at first, approximately 60 mills and other manufacturing plants were subsequently established in the area, many dating from the 1830s and 1840s. The City of Paterson is recognized as being one of the sites where the American Industrial Revolution began and was the first planned industrial area in the United States (Fries, 1974). While it did not fulfill the vision of its founders as a manufacturing enterprise, it prospered from real estate and waterpower ventures (Park Service, 2006). However, the changing manufacturing landscape through the 1920s, and the Great Depression of the 1930s, took their toll, and in 1945, immediately after the conclusion of World War II, the S.U.M. sold its assets (land and buildings) to the City of Paterson. At that time, the city leased the hydroelectric plant (still extant) to the Public Service Corporation (later Public Service Electric & Gas or PSE&G) to continue providing electric power to the city's remaining industries. The hydroelectric plant closed in 1969 when PSE&G determined it was not economically feasible to repair it after it had been damaged by flood waters (Wallace, 2019).

Although S.U.M. was dismantled and the hydroelectric plant was inactive, strong interest remained, both locally and nationally, in preserving Paterson's important natural and industrial history (Wallace, 2019). In 1967, Great Falls was designated a National Natural Landmark. In 1970, the Great Falls of the Passaic River/S.U.M. Historic District was listed on the National Register. The historic district, of which the Great Falls Project is a contributing resource, encompasses approximately 118 acres and includes various features and deposits related to historic aspects of the City of Paterson's industrial era, in addition to Native American occupation. Several nearby sites utilized by the local Native

Americans are known, including at least 20 pre-contact fords and weirs between Passaic Park and Two Bridges, a rock shelter, and a stone blade cache.

In 1971, the historic district was listed on the New Jersey Register of Historic Places. In 1973, the historic district was recorded in the Historic American Engineering Record. In 1976, the historic district was designated a National Historic Landmark District because it "contains one of the most significant engineering and industrial complexes in the United States" (Rothe, 1986). In 1977, the Great Falls Raceway and Power System was designated a National Historic Mechanical and Civil Engineering Landmark, because "[t]he Great Falls raceway and power system is the basis of the oldest American community integrating waterpower, industrial development, and urban planning" (ASCE/ASME, 1977). On November 7, 2011, the National Historic Landmark District became part of the Paterson Great Falls National Historical Park, which the National Park Service dedicated as the 397th park unit in the National Park System. The park consists of natural, cultural, and historic resources associated with Great Falls, the hydropower system it feeds, and a 220-year period of industrial history that illustrates the growth and evolution in industrial planning, architecture, and engineering in the U.S. from 1792 to 1945. The Great Falls Project is an important contributing element to this park.

Beginning in 1974, local residents developed a plan to rehabilitate the S.U.M. dam and the former S.U.M. hydroelectric project (Park Service, 2016), and in 1981, the City of Paterson received a FERC license to refurbish and operate the Great Falls Project. The S.U.M. dam and powerhouse structures and components have been modified only as required for structural safety, in order to maintain the existing physical facilities and keep the architectural details with respect to historic preservation requirements of the project. In 1986, three new vertical Kaplan turbine generators were installed; however, as required by the original FERC license, the historic headgate, penstock, turbine casing, and generator in bay number 5 of the powerhouse were retained in-place and restored. The historical equipment was cleaned, painted, and fitted with concrete plugs in the draft tube and in front of the headgate to prevent moisture from causing further deterioration. The restored historical turbine/generator provides a comparison of the new and historic equipment and the Park Service has an agreement with the City of Paterson that requires that the Great Falls Project be open to the public for reserved tours (Park Service, 2016 at 110).

According to the Paterson Raceway Rehabilitation and Improvements Concept Design Report (McMullan, 2018), development of the S.U.M. hydroelectric plant in 1914 led to the cessation of the raceway system's power generating function, although it continued to supply water to some mills. Over time, lack of use led to the deterioration of the system. In 1976, the City of Paterson received a grant to rehabilitate the raceways and work was completed from 1977 to 1982, primarily on the upper raceway and the south leg of the middle raceway. In 1982, the last mill using water from the raceways

closed, bringing an end to the raceway system's long history of industrial uses. In 2004 and 2005, additional rehabilitation work was completed on the upper raceway in an effort to stop leaks and increase flows in the raceways. In July 2010, after the raceway system was damaged by Hurricane Irene, it was dewatered.

In 2017, the City of Paterson contracted with McMullan & Associates to conduct a preservation and engineering study to determine the feasibility of rehabilitating the historic raceway system (McMullan, 2018). The 2018 Paterson Raceway Rehabilitation and Improvements Concept Design Report (Raceway Rehabilitation Report) states that, as originally designed, the capacity of the raceway system was 525 cfs and the peak flow rate was 463 cfs, although significant modifications to the system have reduced the capacity. As described in the Raceway Rehabilitation Report, a 10-cfs aesthetic flow had previously been released into the raceway system, as required by the existing FERC license; however, no flows have been released in the system since it was damaged in 2010. The report found that without water, deterioration of the raceways accelerated, and vegetation, silt, and trash have accumulated. The report determined that while 10 cfs is sufficient to provide aesthetic and maintenance flows in the raceway system, it is not enough to power waterwheels for flow demonstrations, which would need approximately 50 to 60 cfs to operate. The report concludes that while it is feasible to rehabilitate the system, the "historic nature of the raceway system, numerous upgrades made at various locations over time, storm damage, varied site conditions (i.e., from developed to disrepair), multitudes of utilities, hydraulic connections (i.e., existing, abandoned, or unknown), as well as the geographic extent of the system, inherently make the rehabilitation of such a complex system challenging" (McMullan, 2018, at 78).

3.3.5.2 Environmental Effects

Great Falls Hydro-Paterson proposes to operate the project in a run-of-river mode and does not propose to conduct any project-related land-clearing or land-disturbing activities within the APE that would impact any archaeological site, historic cemetery, architectural resource, or area that has been identified as having moderate to high potential for containing archaeological sites. Great Falls Hydro-Paterson proposes no measures related to historic properties, but states that maintaining the historic integrity of the area is of critical concern.

In a letter dated January 3, 2019, and filed in Appendix G of the final license application, the New Jersey SHPO recognized that the project is a contributing resource to the National Historic Landmark District. The New Jersey SHPO states that based on the undertaking as currently defined, no adverse effects to historic properties are expected.

The Park Service requests[33] and Mr. Blesso recommends that the license include a condition to allow for public access to the powerhouse for supervised tours. The Park Service states that "the powerhouse and hydroelectric operations are an integral part of the visitor's experience and could be accessible to the public with appropriate time and manner conditions." Mr. Blesso states that Great Falls Hydro-Paterson has always cooperated with the agreement to provide public tours and the project should continue to be available to the public in light of the increase in interest and visitation due to the creation of the National Historic Park.

Mr. Blesso also requests that the three large steel grates covering the windows on the east side of the plant be removed. He states that the grates are not part of the original construction and were installed in 1985 to prevent birds from entering the plant. He recommends that the grates be removed and replaced by installing less visible plastic-covered steel mesh on the inside and outside of each pivot window, which would maintain the appearance of the original historic resource.

While the historic raceway system's canals are outside of the project boundary, the water intake for the raceway system (raceway gate) is located within the project boundary, just upstream of the S.U.M. dam, and both the Park Service and Mr. Blesso discuss the possibility of restoring aesthetic and waterpower demonstration flows into the canals. In its April 26, 2019 letter, the Park Service recommended that the license include a provision similar to Article 34 of the current license that requires "continuous flows to the existing power canal network" to preserve and re-water the raceway system. Mr. Blesso also recommends that the same provision be continued in a new license. In the final license application, however, Great Falls Hydro-Paterson states there is insufficient flow in the Passaic River to operate the raceway without diverting water from generation. Both the Park Service and Mr. Blesso disagree with this statement. The Park Service states "[t]his is not due specifically to a lack of flows, but rather the condition of the raceway gate and associated structures." Mr. Blesso clarifies that "[t]he raceway gate has been shut since 2010. The gate was closed due to the leakage of water resulting from damage to the raceway from several severe storms and the unavailability of funds to make the extensive repairs required. During this time the floating raceway trash screen has essentially been lying flat and significant silt has built up to the extent that even if the raceway gate were opened, unless the river was unusually high, no flow would enter the raceway. The invert at the raceway gate, however, is sufficiently low that if the entrance was dredged to its historic level, there would be flow into the raceway at most times."

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[33] The Park Service filed comments on the final license application on April 26, 2019; however, it did not file any recommendations, terms, or conditions in response to the Commission's June 16, 2020 REA notice.

Both the Park Service and Mr. Blesso reference the Raceway Rehabilitation Report, which determined a flow of 50 to 60 cfs would be sufficient as an aesthetic flow into the system, as well as enough volume for a waterpower demonstration. Mr. Blesso also refers to a previous raceway study that "recommended 10 cfs as the absolute minimum quantity to achieve continuous flow," but states that he agrees with the 50 to 60 cfs recommended in the 2018 study, even though "this amount is nowhere near the amount of flow that typically flowed through the system during its historic operation." The Park Service states that "flows of 50 to 60 cfs would not need to be continuous, although some flow, perhaps as low as 10 to 20 cfs, would have to be maintained in order to prevent the system from drying up" and compromising any liner that is ultimately installed to seal the raceway system when it is rehabilitated. Both the Park Service and Mr. Blesso also recommend that a "proper state-of-the art flow-measuring device" be installed at the raceway entrance to maintain the necessary demonstration and maintenance flows.

While Great Falls Hydro-Paterson does not propose to release raceway flows, the final license application states it is willing to explore the possibility of providing flows to meet future waterpower demonstration flows, including more flow during certain periods such as during special events, and when excess water is available (over and above station capacity plus aesthetic flows at Great Falls).

Staff Analysis

Historic Properties Management Plan

Project-related effects on cultural resources within the APE can result from modifications to project facilities or project operation; project-related ground-disturbing activities; construction, modification, or maintenance of project recreation facilities and use of such facilities by visitors; project-induced shoreline erosion;[34] and vandalism. The Great Falls Project is listed on the National Register as a contributing resource to the Great Falls/S.U.M Historic District National Historic Landmark and is an important component of the Paterson Great Falls National Historic Park. Great Falls Hydro-Paterson is not proposing to modify project operation or conduct any project-related land-clearing or land-disturbing activities within the APE. However, during the term of any license issued, operation and maintenance of the project has the potential to affect National Register-listed historic properties, as well as undiscovered historic and archaeological resources. Development of an HPMP, in accordance with the Guidelines for the Development of Historic Properties Management Plans for FERC Projects

[34] Project-induced shoreline erosion does not include shoreline erosion attributable to flood flows or natural phenomena, such as wind-driven wave action, erodible soils, and loss of vegetation due to natural causes.

(Advisory Council and FERC, 2002), to protect historic properties that are listed or eligible for the National Register would ensure that any future adverse effects are addressed. An HPMP would provide direction and guidance for Great Falls Hydro-Paterson's management of historic properties and would ensure that appropriate consultation occurs prior to any activity that could affect historic properties in the APE. In addition, including a provision in the HPMP requiring the preserved historic equipment in the powerhouse be maintained, and describing the maintenance process and how public tours will be provided throughout the term of any new license issued, would ensure this historic resource continues to be available for public viewing and educational purposes.

Regarding the window grates, the Great Falls Project is a contributing element to the National Historic Landmark District. It does not appear that it is listed on the National Register because it embodies any distinguishing characteristics of an architectural type; therefore, the addition of the grates would not be considered an adverse effect to an historic property. However, the grates were not part of the original construction of the powerhouse and do detract from the building's aesthetics. While Great Falls Hydro-Paterson does not propose to replace the grates at this time, it could consider a less intrusive design the next time the grates need to be painted, repaired, or replaced. Incorporating a provision into an HPMP that requires Great Falls Hydro-Paterson to consult with the Park Service and the New Jersey SHPO at such a time when the grates need to be painted, repaired, or replaced would ensure that any work done on the powerhouse takes into account the historic character of the facility.

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) with the New Jersey SHPO for the protection of historic properties within the project's APE that could be affected by the continued operation and maintenance of the project. The terms of the PA would require Great Falls Hydro-Paterson to develop and implement an HPMP for the term of any new license issued for the project.

Restoring Raceway Flows

The Park Service's Draft General Management Plan for the Paterson Great Falls National Historic Park identifies the raceway system "as the most significant extant historic resource in the park;" however, it goes on to state that "[t]he conditions of the upper, middle, and lower raceways vary; most of the spillway and raceway features are in poor condition, and are in danger of further deterioration. The upper raceway has been rehabilitated and the path along the raceway upgraded. The middle and lower raceways are generally dry and lack adjacent formalized pedestrian paths. When water enters the raceways, such as during flood events, leakage into adjacent buildings is a problem" (Park Service, 2016 at 19). While Great Falls Hydro-Paterson states it is willing to explore the possibility of providing waterpower demonstration flows in the raceway, the

raceway system has deteriorated and currently cannot use the water. The Park Service's Draft General Management Plan proposes that the upper, middle, and lower raceways be preserved and re-watered, but adds that "prior to re-watering, studies would be completed to ensure the raceways can function properly" (Park Service, 2016). As indicated in the Raceway Rehabilitation Report, this restoration is possible, but complicated. If the raceway's system is rehabilitated, restoring flows would be an important aesthetic and education component to the National Historic Park, as well as an important maintenance requirement to ensure the raceway system functions properly and does not become overgrown. Installing a flow measuring device at the raceway entrance, as recommended by both the Park Service and Mr. Blesso, would ensure that appropriate flows were being released into the canals during both demonstration events and for regular maintenance of the canal. The Park Service acknowledges that the suitability of the canal system to safely pass the flow is currently an unknown issue and more work on a canal repair plan and schedule is needed. Although the Park Service and City of Paterson have completed preliminary studies, no definite plans exist to fully rehabilitate the raceways.

3.4 NO-ACTION ALTERNATIVE

Under the no-action alternative, the Great Falls Project would continue to operate in its current manner. None of the co-licensee's proposed measures would be required. Improvements in operational procedures to limit flow fluctuations downstream of the project would not be implemented, and botanical resources, bald eagles, and northern long-eared bats would not be protected.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we examine the Great Falls Project's use of the Passaic River for hydropower purposes to determine what effect various operation and environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[35] the Commission compares the current project cost to an estimate of the cost of obtaining the same amount of energy and capacity using a likely alternative source of power for the region (cost of alternative power). In keeping with Commission policy as described in *Mead*, our economic analysis is based on current electric power cost conditions and does not consider future escalation of fuel prices in valuing the hydropower project's power benefits.

For each of the licensing alternatives, our analysis includes an estimate of: (1) the cost of individual measures considered in the EA for the protection, mitigation and enhancement of environmental resources affected by the project; (2) the cost of alternative power; (3) the total project cost (i.e., for operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost. If the difference between the cost of alternative power and total project cost is positive, the project produces power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, the project produces power for more than the cost of alternative power. This estimate helps to support an informed decision concerning what is in the public interest with respect to a proposed license. However, project economics is only one of many public interest factors the Commission considers in determining whether, and under what conditions, to issue a license.

4.1 POWER AND DEVELOPMENTAL BENEFITS OF THE PROJECT

Table 4 summarizes the assumptions and economic information we use in our analysis. This information, except as noted, was provided by Great Falls Hydro-Paterson in its license application and subsequent submittals. Based on our independent review, the values provided by the applicant are reasonable for the purposes of our analysis. Cost items common to all alternatives, except the no-action alternative, would include: taxes and insurance costs, net investment (the total investment in power plant facilities remaining to be depreciated), normal operation and maintenance costs, and licensing

[35] See *Mead Corporation, Publishing Paper Division*, 72 FERC ¶ 61,027 (July 13, 1995). In most cases, electricity from hydropower would displace some form of fossil-fueled generation, in which fuel cost is the largest component of the cost of electricity production.

costs. Values provided by Great Falls Hydro-Paterson in its license application were indexed to 2020 dollars.

Table 4. Parameters for the economic analysis of the Great Falls Project (Sources: Great Falls Hydro-Paterson and staff).

Parameter	Value
Period of analysis	30 years
Term of financing	20 years
Federal income tax rate[a]	21.00 percent
Net investment[b]	$2,945,000
Application cost	$261,078
Operation and maintenance cost	$528,180/year
Commission fees[c]	$28,000/year
Interest rate[a]	8.00
Discount rate[a]	8.00
Insurance rate[a]	0.25 percent
Cost of alternative power:[d]	
Energy rate	$20.59/MWh
Capacity rate	$159.70/kilowatt-year

[a] Assumed by staff.
[b] Remaining undepreciated net investment.
[c] Estimated by staff.
[d] Source: Energy Information Administration's Annual Energy Outlook 2020 at http://www.eia.gov/outlooks/aeo/index.cfm. The cost of alternative power is a combination of energy and capacity rates.

4.2 COMPARISON OF ALTERNATIVES

Table 5 summarizes the installed capacity, annual generation, cost of alternative power, estimated total project cost, and difference between the cost of alternative power and total project cost for each of the alternatives considered in this EA: the no-action alternative, the co-licensees' proposal, and the staff alternative.

Table 5. Summary of the annual cost of alternative power and annual project cost for alternatives for the Great Falls Project (Source: Staff).

	No-Action Alternative	Great Falls Hydro-Paterson's Proposal	Staff Alternative
Installed capacity (MW)	10.95	10.95	10.95
Annual generation (MWh)	17,199	18,669	18,669
Dependable capacity (MW)[a]	1.87	2.03	2.03
Annual value of project power[b]	$653,218 $37.98/MWh	$709,049 $37.98/MWh	$709,049 $37.98/MWh
Total annual project cost	$803,193 $46.70/MWh	$814,902 $43.65/MWh	$820,503 $43.95/MWh
Difference between the cost of alternative power and project cost[c]	($149,975) ($8.72/MWh)	($105,853) ($5.67/MWh)	($111,454) ($5.97/MWh)

[a] Estimated based on average generation.
[b] The value of project power is based on the cost of alternative power as identified in table 4 above.
[c] A number in parentheses denotes that the difference between the cost of alternative power and project cost is negative, thus the project cost is greater than the cost of alternative power.

4.2.1 No-action Alternative

Under the no-action alternative, the Great Falls Project would continue to operate as it does now. With an installed capacity of 10.95 MW and a dependable capacity of 1.87 MW, the project generates an average of 17,199 MWh of electricity annually. The average annual cost of alternative power would be $653,218, or about $37.98/MWh. The average annual cost of producing this power, including depreciation, operation and maintenance costs, and taxes would be about $803,193, or about $46.70/MWh. Overall, the project would produce power at a cost that is $149,975, or $8.72/MWh, more than the cost of alternative power.

4.2.2 Applicant's Proposal

Appendix C lists all environmental measures, and the estimated cost of each, considered for the Great Falls Project.

Under the applicant's proposal, the project would have an installed capacity of 10.95 MW and a dependable capacity of 2.03 MW and would generate an average of 18,669 MWh of electricity annually. The average annual cost of alternative power would be $709,049, or $37.98/MWh, and the average annual project cost would be $814,902, or $43.65/MWh. Overall, the project would produce power at a cost that is $105,853, or $5.67/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative includes the same development proposal as Great Falls Hydro-Paterson and, therefore, would have the same capacity and energy attributes. Appendix C shows the staff-recommended deletions and modifications to Great Falls Hydro-Paterson's proposed environmental protection and enhancement measures, and the estimated cost of each.

Based on a total capacity of 10.95 MW, a dependable capacity of 2.03 MW, and an average annual generation of 18,669 MWh, the average annual cost of alternative power would be $709,049, or $37.98/MWh. The average annual project cost would be $820,503, or $43.95/MWh. Overall, the project would produce power at a cost that is $111,454, or $5.97/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Appendix C presents the cost of each of the environmental enhancement measures considered in our analysis. All costs are in 2020 dollars. We have converted all costs to equal annual (levelized) values over a 30-year period of analysis to give a uniform basis for comparing the benefits of a measure to its cost.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a)(1) of the FPA require the Commission to give equal consideration to the power development purposes and to the purposes of energy conservation; the protection, mitigation of damage to, and enhancement of fish and wildlife; the protection of recreational opportunities; and the preservation of other aspects of environmental quality. Any license issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing a waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for licensing the Great Falls Project. We weigh the costs and benefits of our recommended alternative against other proposed measures.

Based on an independent review of the agency and public comments filed on this project and our evaluation of the environmental and economic effects of the proposed action and its alternatives, we have selected the staff alternative as the preferred alternative for the Great Falls Project. We recommend this alternative because: (1) issuing a new license for the project would allow Great Falls Hydro-Paterson to operate the project as a beneficial and dependable source of electric energy; (2) generation from the Great Falls Project, with an installed electric capacity of 10.95 MW, comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of this alternative exceed those of the no-action alternative; and (4) the recommended measures would protect and enhance aquatic, terrestrial, aesthetic, and cultural resources at the project.

In the following section, we make recommendations as to which environmental measures proposed by Great Falls Hydro-Paterson, or recommended by agencies or other entities, should be included in any license issued for the project. In addition to Great Falls Hydro-Paterson's proposed environmental measures listed below, we recommend additional staff-recommended environmental measures to be included in any new license issued for the project.

5.1.1 Measures Proposed by Great Falls Hydro-Paterson

Based on our environmental analysis of Great Falls Hydro-Paterson's proposal, as discussed in section 3.0, *Environmental Analysis*, and the costs presented in section 4.0, *Developmental Analysis*, we conclude the following operation and environmental measures proposed by Great Falls Hydro-Paterson would protect and enhance environmental resources and would be worth the cost. Therefore, we recommend including the following measures in any new license issued for the Great Falls Project:

Project Operation

- Continue to operate the project in a run-of-river mode.

Aesthetic Resources

- Pass a minimum flow of 200 cfs over the falls from 7:00 a.m. until 9:00 p.m., and 50 cfs from 9:00 p.m. until 7:00 a.m., whenever the Passaic River flows at the S.U.M. dam are less than 2,000 cfs.

- As flows permit, provide 400 cfs aesthetic flows to Great Falls during daylight hours on weekends from May through October, plus approximately 100 hours during annual special events.

5.1.2 Additional Measures Recommended by Staff

Under the staff alternative, the project would be operated with Great Falls Hydro-Paterson's proposed measures, as identified above, and the following additions or modifications:

- Develop an operation compliance monitoring plan to document how the co-licensees will monitor, record compliance with, and report any deviations from project operation conditions required by any license issued for the project.

- Modify Great Falls Hydro-Paterson's proposed daily water quality monitoring to occur from June through September from 9:00 p.m. to 7:00 a.m. when aesthetic flows are reduced from 200 cfs to 50 cfs.

- Develop a water quality monitoring plan to document procedures, ensure compliance, and define reporting requirements for the proposed water quality monitoring.

- Consult with FWS and New Jersey DEP if bald eagles nest within the project boundary.

- Retain the access road through Overlook Park to the powerhouse inside the project boundary.

- Develop an HPMP that includes provisions to: (1) continue to maintain and preserve the original penstock and turbine-generator unit that have been restored and provide public tours of the powerhouse; and (2) maintain the powerhouse in such a way as to protect its historic integrity.

Below, we discuss the basis for our staff-recommended measures and the rationale for modifying Great Falls Hydro-Paterson's proposal.

Project Operation

Continuing run-of-river operation and maintaining water levels near the spillway crest as proposed by Great Falls Hydro-Paterson would protect aquatic habitat and aquatic species within and downstream of the project impoundment. Specifically, if the units trip offline, spill would occur quickly, minimizing any effects on flow and aquatic species downstream of the project. In the impoundment, continued maintenance of water levels near the dam crest would protect fish species such as sunfish that build nests and spawn in shallow near-shore habitat. As such, we recommend Great Falls Hydro-Paterson operate the project in run-of-river mode as proposed. There is no incremental cost associated with this measure since Great Falls Hydro-Paterson currently operates the project in a run-of-river mode.

Operation Compliance Monitoring Plan

Commission staff recommends that any license issued for the project include the development of an operation compliance monitoring plan that describes the monitoring methods and devices (including calibration procedures) that would be used to ensure compliance with environmental measures (e.g., minimum flows and impoundment fluctuation allowances) required by any new license issued for the project, and reporting procedures. The development of such a plan would facilitate the Commission's administration of the license and verify that operational measures for the protection and enhancement of aquatic and aesthetic resources are working as intended. We estimate the levelized annual costs to develop a plan with these compliance monitoring procedures would be $354 and conclude the benefits to aquatic and aesthetic resources would be worth the cost.

Water Quality Monitoring

Great Falls Hydro-Paterson proposes to conduct daily DO monitoring from 9:00 p.m. to 7:00 a.m., when aesthetic flows are reduced from 200 cfs to 50 cfs, to ensure consistency with the state water quality standards.

As discussed in section 3.3.1.2, *Aquatic Resources, Environmental Effects, Water Quality Monitoring*, minimum mean daily DO concentrations in the Passaic River from October through May range from 6.4 to 12.9 mg/L, or about 30 to 158 percent higher than the 5.0 mg/L state water quality standard, and have no observations below 4.0 mg/L. Concentrations decrease during June through September, with mean daily values from 6.2 to 8.0 mg/L; however, observations below 4.0 mg/L occur more frequently and generally during the evening, accounting for about 4.6 percent of all hourly readings. Therefore, as DO levels are adequate to support aquatic biota from October through May,

Commission staff recommends that DO monitoring only be conducted from June through September, coinciding with reduced aesthetic flows (200 to 50 cfs) from 9:00 p.m. to 7:00 a.m. To help document monitoring procedures, guide implementation, and ensure compliance with the recommended water quality monitoring, we also recommend the development of a water quality monitoring plan.

There are no incremental costs associated with the recommended water quality monitoring because it is similar in scope to Great Falls Hydro-Paterson's current DO monitoring. However, we estimate the levelized annual cost of Commission staff's recommended water quality monitoring plan to be $177 and conclude that the benefits of the plan outweigh the relatively low cost.

Bald Eagle Consultation

Bald eagles have been observed at or near the project over the past 10 years, and one of few bald eagle nests in urban northern New Jersey is located about 2.5 miles northeast of the project. Project transmission infrastructure is underground, and thus does not represent a collision or electrocution hazard to bald eagles. Project maintenance may involve some removal of trees to allow for the safe operation of the project. While such maintenance is not likely to result in substantial disturbance to foraging or roosting bald eagles within the project boundary or in transit through the project, it has the potential to affect nesting bald eagles should any become established in the project boundary. Therefore, consulting with FWS and New Jersey DEP if bald eagles are observed nesting within the project boundary and determining if any measures are necessary to minimize habitat disturbance surrounding active nests on project lands, would minimize project effects to bald eagles. There would be no costs associated with this agency consultation.

Changes to the Project Boundary

Great Falls Hydro-Paterson proposes to remove 7.09 acres from the project boundary, including the bypassed reach from the toe of the S.U.M. dam to the downstream end of Overlook Park, including a 2.4-acre parcel of Overlook Park that was conveyed to the Park Service in 2020. The lands containing the bypassed reach are not used for project operation or maintenance purposes and removing the bypassed reach from the project boundary would not prevent the project from continuing to release minimum or aesthetic flows over the falls.

Overlook Park provides project-related recreation opportunities. However, removing the park from the project boundary should not negatively affect recreation due to the Park Service's recent acquisition of the park. The Park Service has developed plans to improve the park including building a new visitor center for the Paterson Great Falls National Historical Park in Overlook Park.

Great Falls Hydro-Paterson should, however, retain the necessary rights for access to the powerhouse. The access road that crosses Overlook Park provides the only direct entrance to the powerhouse for vehicles and utility trucks. Therefore, the access road should remain in the project boundary.

Aesthetic Flows

Great Falls Hydro-Paterson proposes to provide continuous minimum daily aesthetic flows of 200 cfs from 7:00 a.m. to 9:00 p.m. and flows of 50 cfs from 9:00 p.m. to 7:00 a.m. On weekends during peak visitation, from May 1 to October 31, and during special events, if flows are available, Great Falls Hydro-Paterson would provide 400 cfs during daylight hours. The current license requirement as well as the proposal for year-round flows of 200 cfs, or inflow if less, to the falls ensures that visitors to the park are able to experience and view the falls with a steady flow at all times. Increased flows of 400 cfs, if available, during peak visitation to the park would provide an enhanced visual experience since more of the falls would be covered with water and an enhanced auditory experience as more water crashes over the falls. The provision of 200 cfs and 400 cfs, if available and depending on the time of the year, ensures that the public will be able to enjoy viewing the falls whenever they visit the area. Implementing the proposed minimum aesthetic flows would result in a generation gain of 1,880 MWh, due to the reduced nighttime flows, and a loss of 410 MWh, due to the special event flows, respectively. We therefore estimate that the levelized annual gain to implement the proposed aesthetic flows would be $23,911 ($30,580 in benefits and $6,669 in costs) and conclude that the measure would provide benefits both to generation and aesthetics at the project.

Historic Properties Management Plan

The Great Falls Project is listed on the National Register as a contributing resource to the Great Falls/S.U.M Historic District National Historic Landmark and is an important component of the Paterson Great Falls National Historic Park. While Great Falls Hydro-Paterson is not proposing to modify project operation or conduct any project-related land-clearing or land-disturbing activities within the APE, continued operation and maintenance of the project has the potential to affect National Register-listed historic properties, as well as undiscovered historic and archaeological resources. Developing an HPMP, in accordance with the *Guidelines for the Development of Historic Properties Management Plans for FERC Projects*, to protect historic properties that are listed or eligible for the National Register would ensure that any future adverse effects are addressed. The HPMP should include a provision that requires Great Falls Hydro-Paterson to consult with the Park Service and the New Jersey SHPO at such a time when the powerhouse window grates need to be painted, repaired, or replaced, or when other maintenance work or improvements are undertaken at the powerhouse, to ensure that any work done on the powerhouse takes into account the historic character of the facility. The HPMP should also include steps that Great Falls Hydro-Paterson will take in the

event that previously unidentified cultural resources are discovered during project-related activities that require ground-disturbance. These steps would include discontinuing all ground-disturbing activities, notifying the Commission, the Park Service, and the New Jersey SHPO, and consulting on the proper treatment of the newly discovered resource. Finally, the HPMP should include a provision requiring the preserved historic equipment in the powerhouse to be maintained and available for public tours throughout the term of any new license issued, in order for this historic resource to be available for public educational purposes.

An HPMP that includes the above measures would serve as a guide for Great Falls Hydro-Paterson and provide a framework for consultation with the Park Service and New Jersey SHPO to ensure that the required approvals are received, and appropriate measures are implemented. It would also provide a framework for operating personnel when performing necessary activities to address any ongoing and future effects to historic properties. To ensure that adverse effects on known and potential historic properties, and to any as yet unidentified cultural resources, are satisfactorily resolved over the term of any new license, we intend to execute a PA with the New Jersey SHPO for the Great Falls Project. The PA would require Great Falls Hydro-Paterson to develop and implement an HPMP in consultation with the New Jersey SHPO. We estimate that the levelized annual cost to develop an HPMP would be $5,011 and conclude that the benefits of the plan would outweigh the costs.

5.1.3 Measures Not Recommended by Staff

Restoring Raceway Flows

As discussed above in section 3.3.5, *Cultural Resources*, the raceway system consists of three canals, known as the upper, middle, and lower raceways, that were built by the S.U.M. between 1792 and 1846, to channel water to manufacturing facilities along its path. The Park Service considers the raceway system "the most significant extant historic resource in the park;" however, it goes on to state that "[t]he conditions of the upper, middle, and lower raceways vary; most of the spillway and raceway features are in poor condition, and are in danger of further deterioration (Park Service, 2016)." The City of Paterson owns the historic raceway system and while the canals are outside of the project boundary, the water intake for the system (raceway gate) is located within the project boundary, just upstream of the S.U.M. dam and Article 34 of the current license requires Great Falls Hydro-Paterson to release "continuous flows to the power canal network." Until the intake gate was damaged by a storm in 2011, Great Falls Hydro-Paterson released a flow of approximately 10 cfs into the system through the raceway gate. Since 2011, the gate has been inoperable and raceway system has been dewatered.

To preserve and re-water the raceway system and thereby enhance historic and aesthetic resources at the project, Mr. Blesso recommends that Great Falls Hydro-Paterson continue provide regular maintenance and aesthetic flows and waterpower

demonstration flows in the raceway and install a flow monitoring device. The Park Service's Draft General Management Plan for the Paterson Great Falls National Historic Park states that the raceways system's "preservation and re-watering is of great historic interest to both Paterson residents and the broader preservation community" (Park Service, 2016). However, while Great Falls Hydro-Paterson states it is willing to explore the possibility of providing waterpower demonstration flows in the raceway, the raceway system currently is in a state of deterioration and there are no definite plans to fully rehabilitate the raceways and we cannot predict when the system will be repaired. While it may be beneficial to provide demonstration flows to this historic resource in the future, and installing a flow measuring device would ensure appropriate flows are released, these measures are contingent upon an uncertain future event. Predicting when these measures would be implemented, along with the environmental conditions that would exist at that time, and the costs that would occur due to lost generation, would be entirely speculative. Therefore, we have no basis for estimating the cost and recommending these measures at this time.

5.2 UNAVOIDABLE ADVERSE EFFECTS

Continued operation of the Great Falls Project would result in some unavoidable fish impingement and entrainment. However, given the relatively low approach velocities (2.2 fps) and large trash rack spacing at the project (2 inches clear), most fish susceptible to impingement would be large (e.g., adult largemouth bass) and could therefore avoid impingement due to their increased swimming ability. Most fish entrained at the project would be small (e.g., juvenile minnows and shiners) and, therefore, would experience low blade strike mortality. The younger individuals in a population generally have high rates of natural mortality, even in the absence of hydropower operations, and fish populations have generally evolved to withstand losses of these smaller and younger individuals with little or no impact to long-term population sustainability. Therefore, entrainment and turbine mortality of smaller individuals could occur, but is expected to be very low and have minimal consequences on the sustainability of the fish communities and associated fisheries at the projects.

5.3 CONSISTENCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 United States Code (U.S.C.) § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed eighteen comprehensive

plans that are applicable to the Great Falls Project, located in New Jersey.[36] No inconsistencies were found.

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[36] Atlantic States Marine Fisheries Commission (ASFMC). Interstate fishery management plan for Atlantic striped bass. (Report No. 24). 1995. (2) ASFMC. Amendment 1 to the Interstate Fishery Management Plan for Atlantic sturgeo*n (Acipenser oxyrhynchus oxyrhynchus*). (Report No. 31). 1998. (3) ASFMC. Interstate fishery management plan for Atlantic striped bass. (Report No. 34). 1998. (4) ASFMC. Amendment 1 to the Interstate Fishery Management Plan for shad and river herring. (Report No. 35). 1999. (ASFMC). Interstate Fishery Management Plan for American ee*l (Anguilla rostrata*). (Report No. 36). 2000. (5) ASFMC. Technical Addendum 1 to Amendment 1 of the Interstate Fishery Management Plan for shad and river herring. 2000. (6) ASFMC. Amendment 2 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. 2008. (7) ASFMC. Amendment 2 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. 2009. (8) ASFMC. Amendment 3 to the Interstate Fishery Management Plan for shad and river herring, Arlington, Virginia. 2010. (9) ASFMC. Amendment 3 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. 2013. (10) ASFMC. Amendment 4 to the Interstate Fishery Management Plan for American eel. Arlington, Virginia. 2014. (11) ASFMC. Delaware River Basin Compact. Trenton, New Jersey. 1967. (12) National Marine Fisheries Service. Final Recovery Plan for the shortnose sturgeon *(Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team for the National Marine Fisheries Service, 1998. (13) NPS. The Nationwide Rivers Inventory. Department of the Interior. 1993. (14) NPS. General Management Plan for Patterson Great Falls National Historical Park. Department of the Interior. 2016. (15) New Jersey Department of Environmental Protection. New Jersey Statewide Comprehensive Outdoor Recreation Plan (SCORP): 2008–2012. Trenton, New Jersey. (16) U.S. Fish and Wildlife Service. Canadian Wildlife Service. 1986. North American waterfowl management plan. Department of the Interior. Environment Canada. May 1986. FWS. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C. n.d.

6.0 FINDING OF NO SIGNIFICANT IMPACT

If the Great Falls Project is relicensed with our recommended measures, the project would operate while providing enhancements and protective measures for aquatic, terrestrial, threatened and endangered species, aesthetic, and cultural resources in the project area.

Based on our independent analysis, issuance of a new license for the Great Falls Project, with additional staff-recommended measures, would not constitute a major federal action significantly affecting the quality of the human environment.

7.0 LITERATURE CITED

The literature cited in this EA is presented as Appendix D.

8.0 LIST OF PREPARERS

The list of preparers of this EA is presented as Appendix E.

APPENDIX A

STATUTORY AND REGULATORY REQUIREMENTS

Federal Power Act

Section 18 Fishway Prescription

Section 18 of the Federal Power Act (FPA), 16 U.S.C. § 811, states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretary of the U.S. Department of Commerce or the Secretary of the U.S. Department of the Interior (Interior). By letter filed July 6, 2020,[37] Interior requests that a reservation of authority to prescribe fishways under section 18 be included in any license issued for the project.

Section 10(j) Recommendations

Under section 10(j) of the FPA, 16 U.S.C. § 803(j), each hydroelectric license issued by the Commission must include conditions based on recommendations provided by federal and state fish and wildlife agencies for the protection, mitigation, or enhancement of fish and wildlife resources affected by the project. The Commission is required to include these conditions unless it determines that they are inconsistent with the purposes and requirements of the FPA or other applicable law. Before rejecting or modifying an agency recommendation, the Commission is required to attempt to resolve any such inconsistency with the agency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency.

No recommendations were filed under section 10(j).

Clean Water Act

Under section 401(a)(1) of the Clean Water Act (CWA), 33 U.S.C. § 1341(a)(1), a license applicant must obtain either a water quality certification (certification) from the appropriate state pollution control agency verifying that any discharge from a project would comply with applicable provisions of the CWA, or a waiver of the certification by the appropriate state agency. The failure to act on a request for certification within a

[37] Interior initially filed a reservation of authority to prescribe fishways on June 18, 2020, however, the letter erroneously cited to a ready for environmental analysis notice issued on May 6, 2020, for a separate and unrelated project.

reasonable period of time, not to exceed one year, after receipt of the request constitutes a waiver.

On July 2, 2020, via email, Great Falls Hydro-Paterson consulted with the New Jersey Department of Environmental Protection (New Jersey DEP) regarding certification for the Great Falls Project. In an email dated July 8, 2020, New Jersey DEP waived certification.[38]

Endangered Species Act

Section 7 of the Endangered Species Act (ESA), 16 U.S.C. § 1536, requires federal agencies to ensure that their actions are not likely to jeopardize the continued existence of endangered or threatened species, or result in the destruction or adverse modification of the critical habitat of such species. On July 14, 2020, Commission staff requested an official species list for the project through the U.S. Fish and Wildlife Service's (FWS) IPaC system, which indicated that two federally listed species, the endangered Indiana bat (*Myotis sodalis*) and threatened northern long-eared bat (*Myotis septentrionalis*), have the potential to occur within the project boundary.[39] There are no proposed or designated critical habitats in the project area.

Our analysis of project effects on the northern long-eared bat is presented in section 3.3.3, *Threatened and Endangered Species*.

In a letter dated March 30, 2016,[40] FWS stated that the Great Falls Project is located within the summer migratory range of the federally listed Indiana bat and northern long-eared bat. FWS further stated that it did not anticipate any adverse effects to these species associated with the relicensing of the Great Falls Project, and determined that no further consultation pursuant to section 7(a)(2) of the ESA is required regarding the Indiana and northern long-eared bats. Commission staff also concluded in section 3.3.3 that the proposed action would have no effect on the federally listed Indiana and northern long-eared bats. For these reasons, no ESA consultation is necessary.

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[38] Great Falls Hydro-Paterson filed a letter including copies of its email exchanges with New Jersey DEP on July 24, 2020.

[39] *See* July 15, 2020, official species list memorandum.

[40] FWS' March 30, 2016, letter was filed with Great Falls Hydro-Paterson's August 13, 2019, additional information response.

Coastal Zone Management Act

Under section 307(c)(3)(A) of the Coastal Zone Management Act (CZMA), 16 U.S.C. §1456(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state's coastal zone management agency concurs with the license applicant's certification of consistency with the state's CZMA program, or the agency's concurrence is conclusively presumed by its failure to act within 6 months of its receipt of the applicant's certification.

On September 2, 2020, Great Falls Hydro-Paterson filed an August 27, 2020, e-mail from New Jersey DEP in which it concurred with Great Falls Hydro-Paterson's determination that the Great Falls Project is not located in New Jersey's coastal zone.

National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA), 54 U.S.C. § 306108, requires that a federal agency "take into account" how its undertakings could affect historic properties. Historic properties are districts, sites, buildings, structures, traditional cultural properties, and objects significant in American history, architecture, engineering, and culture that are eligible for inclusion in the National Register of Historic Places (National Register).

Commission staff designated Great Falls Hydro-Paterson as its non-federal representative for the purposes of conducting section 106 consultation under the NHPA on June 10, 2016. Pursuant to section 106, and as the Commission's designated non-federal representative, Great Falls Hydro-Paterson initiated consultation with the New Jersey State Historic Preservation Office (New Jersey SHPO), and potentially affected tribes, to identify historic properties and assess potential adverse effects on historic properties within the project's area of potential effects (APE).

The Great Falls Project is located at Great Falls, adjacent to the City of Paterson, New Jersey. The geologic formation created an extraordinary 77-foot fall into a naturally occurring 280-foot chasm that attracted American Indians and later Colonial era tourists and in 1967, the falls was designated a National Natural Landmark. The project is located within the Great Falls/S.U.M. Historic District, which was listed on the National Register in 1970. In 1971, the historic district was listed on the New Jersey Register of Historic Places. In 1976, the historic district was designated a historic landmark because it "contains one of the most significant engineering and industrial complexes in the United States. Alexander Hamilton and other supporters organized the Society for Establishing Useful Manufacturers [sic] to achieve America's independence from British manufactures and demonstrate her own profitability. With the major waterpower to be harnessed from Great Falls, and the original engineering plan of Pierre Charles L'Enfant, the City of Paterson developed into an important 18th and 19th century industrial center for cotton, silk, iron and locomotive production" (Rothe, 1986). In 1977, the Great Falls

Raceway and Power System was designated a National Historic Mechanical and Civil Engineering Landmark, because "[t]he Great Falls raceway and power system is the basis of the oldest American community integrating waterpower, industrial development, and urban planning" (ASCE/ASME, 1977). On November 7, 2011, the historic district became part of the Paterson Great Falls National Historical Park, which the National Park Service dedicated as the 397th park unit in the National Park System. The Paterson Great Falls National Historical Park consists of natural, cultural, and historic resources associated with Great Falls, the hydropower system it feeds, and a 220-year period of industrial history that illustrates the growth and evolution in industrial planning, architecture, and engineering in the U.S. from 1792 to 1945. The Great Falls Project is an important contributing element to this park.

While continued operation of the project is not likely to affect cultural resources in the APE, continued operation and maintenance of the project has the potential to affect National Register-listed historic properties, as well as undiscovered historic and archaeological resources. Further, the project is a contributing resource to the National Historic Landmark District and the Paterson Great Falls National Historic Park. Because of the historic importance of the project and its surroundings, an historic properties management plan (HPMP) would provide proper management of the existing project features and specific guidance if changes to the historic structures are required or archaeological discoveries are located during future project improvement activities.

To meet the requirements of section 106, the Commission intends to execute a Programmatic Agreement (PA) with the New Jersey SHPO for the protection of historic properties within the project's APE from the effects of continued operation and maintenance of the Great Falls Project. The terms of the PA would ensure that Great Falls Hydro-Paterson addresses and treats any adverse effects to historic properties identified within the APE through the development of an HPMP.

APPENDIX B

ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Issuing a Non-power License

A non-power license is a temporary license that the Commission would terminate when it determines that another governmental agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this time, no agency has suggested a willingness or ability to take over the project. No party has sought a non-power license, and we have no basis for concluding that the Great Falls Project should no longer be used to produce power.

Federal Government Takeover

Federal takeover and operation of the Great Falls Project would require congressional approval. While that fact alone would not preclude further consideration of this alternative, there is currently no evidence to indicate that federal takeover should be recommended to Congress. No party has suggested that federal takeover would be appropriate, and no federal agency has expressed interest in operating the project.

Project Decommissioning

As the Commission has previously held, decommissioning is not a reasonable alternative to relicensing in most cases.[41] Decommissioning can be accomplished in different ways depending on the project, its environment, and the particular resource needs.[42] For these reasons, the Commission does not speculate about possible decommissioning measures at the time of relicensing, but rather waits until an applicant actually proposes to decommission a project, or a participant in a relicensing proceeding

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[41] *See, e.g., Eagle Crest Energy Co*., 153 FERC ¶ 61,058, at P 67 (2015); *Public Utility District No. 1 of Pend Oreille County*, 112 FERC ¶ 61,055, at P 82 (2005); *Midwest Hydro, Inc*., 111 FERC ¶ 61,327, at PP 35-38 (2005).

[42] In the unlikely event that the Commission denies relicensing a project or a licensee decides to surrender an existing project, the Commission must approve a surrender "upon such conditions with respect to the disposition of such works as may be determined by the Commission." 18 CFR § 6.2 (2020). This can include simply shutting down the power operations, removing all or parts of the project (including the dam), or restoring the site to its pre-project condition.

demonstrates that there are serious resource concerns that cannot be addressed with appropriate license measures and that make decommissioning a reasonable alternative.[43]

Great Falls Hydro-Paterson does not propose decommissioning, nor does the record to date demonstrate there are serious resource concerns that cannot be mitigated if the project is relicensed; as such, there is no reason, at this time, to include decommissioning as a reasonable alternative to be evaluated and studied as part of staff's NEPA analysis.

[43] *See generally Project Decommissioning at Relicensing*; Policy Statement, FERC Stats. & Regs., Regulations Preambles (1991-1996), ¶ 31,011 (1994); *see also City of Tacoma, Washington,* 110 FERC ¶ 61,140 (2005) (finding that unless and until the Commission has a specific decommissioning proposal, any further environmental analysis of the effects of project decommissioning would be both premature and speculative).

APPENDIX C

COST OF ENVIRONMENTAL MEASURES

Enhancement / Mitigation Measure	Entity	Capital Cost (2020$)	Annual Cost (2020$)	Levelized Annual Cost[a] (2020$)
1. Continue operating the project in a run-of-river mode.	Great Falls Hydro-Paterson, Staff	$0[b]	$0[b]	$0
2. Maintain dissolved oxygen levels downstream of Great Falls at 5 milligrams per liter or higher from the 9:00 p.m. to 7:00 a.m.	Great Falls Hydro-Paterson, Staff	$0[b]	$0[b]	$0
3. Consult with FWS and New Jersey DEP if bald eagles establish a nest within the project boundary.	Staff	-[c]	-[c]	-
4. To maintain the aesthetic quality of Great Falls, pass a minimum flow of 200 cfs over the falls from 7:00 a.m. until 9:00 p.m., and 50 cfs from 9:00 p.m. until 7:00 a.m., whenever Passaic River flows at the S.U.M. dam are less than 2,000 cfs.	Great Falls Hydro-Paterson, NPS, Staff	$0	- $38,709[d]	-$30,580
5. As flows permit, provide 400 cfs aesthetic flows to Great Falls during daylight hours on weekends from May through October plus	Great Falls Hydro-Paterson,	$0	$8,442[e]	$6,669

Enhancement / Mitigation Measure	Entity	Capital Cost (2020$)	Annual Cost (2020$)	Levelized Annual Cost[a] (2020$)
approximately 100 hours during annual special events.	NPS, Staff			
6. Develop an operation compliance monitoring plan.	Staff	$5,000	$0	$354
7. Develop a water quality monitoring plan.	Staff	2,500	$0	$177
8. Develop and implement an HPMP that includes provisions to (1) continue to maintain and preserve the original penstock, turbine, and generator unit that has been restored and provide public tours of the powerhouse, and (2) maintain the powerhouse in such a way to reflect its historic status.	Staff	$15,000	$5,000	$5,011

[a] All capital and annual costs are converted to equal annual costs over a 30-year period to give a uniform basis for comparing all costs.

[b] Staff estimates no additional cost as it is a continuing measure.

[c] No cost estimated for this measure as it would be speculative.

[d] Cost is based on estimated gain in generation of 1,880 MWh.

[e] Cost is based on estimated loss of 410 MWh in generation.

APPENDIX D

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APPENDIX E

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