DRAFT ENVIRONMENTAL ASSESSMENT
FOR
HYDROPOWER LICENSE

Millville Hydroelectric Project
FERC Project No. 2343-086
West Virginia

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

August 2017

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

ACRONYMS AND ABBREVIATIONS

APE	area of potential effects
Certification	water quality certification
cfs	cubic feet per second
CWA	Clean Water Act
DO	dissolved oxygen
EA	environmental assessment
EPA	U.S. Environmental Protection Agency
°F	degrees Fahrenheit
FERC or Commission	Federal Energy Regulatory Commission
FPA	Federal Power Act
Fps	feet per second
FWS	U.S. Fish and Wildlife Service
HPMP	Historic Properties Management Plan
Interior	U.S. Department of the Interior
kV	Kilovolt
kW	kilowatt
msl	Mean Sea Level
MW	megawatt
MWh	megawatt-hour
mg/l	milligrams per liter
National Register	Nation Register of Historic Places
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act
West Virginia SHPO	West Virginia State Historic Preservation Officer
West Virginia DNR	West Virginia Division of Natural Resources
West Virginia DEP	West Virginia Department of Environmental Protection
West Virginia DWWM	West Virginia Division of Water and Waste Management
RM	river mile
SCORP	State Comprehensive Outdoor Recreation Plan
USGS	U.S. Geological Survey

EXECUTIVE SUMMARY

Proposed Action

On December 30, 2015, PE Hydro Generation, LLC (PE Hydro or applicant) filed a license application with the Federal Energy Regulatory Commission (FERC or Commission) for the Millville Hydroelectric Project (Millville Project or project).

The 2,840-kilowatt (kW) project is located on the Shenandoah River, near the town of Harpers Ferry in Jefferson County, West Virginia. The project does not occupy federal land.

Project Description

The project's features include: a 14.0-foot-high concrete and stone dam; a 100-acre reservoir; an upstream trap and pass system for juvenile American eels; a headrace canal; a 125-foot-long, 40-foot-wide brick powerhouse that contains 3 turbine-generating units with a combined capacity of 2.84 megawatts (MW); a 550-foot-long tailrace; a 1,006-foot-long, 2.4-kilovolt (kV) transmission line connected to a 34.5-kV transformer; and a 794-foot-long, 34.5-kV transmission line connected to the power grid. The project diverts water around a 2,100-foot section of the Shenandoah River (bypassed reach). The project includes four recreation sites: the Big Eddy Access Area, Upper Angling Access Trail, Lower Angling Access Trail, and Downstream Access Area.

As currently licensed, PE Hydro operates the project in run-of-river mode, such that outflow from the project approximates inflow. PE Hydro also provides at all times, a 200-cfs minimum flow to the project bypassed reach as a veil flow over the dam. The project shuts down nightly from September 15 to December 15 to facilitate downstream eel passage. The project's average annual energy production is 10,723 megawatt-hours (MWh).

PE Hydro proposes to continue to operate the Millville Project in a run-of-river mode, with the 200-cfs minimum bypassed reach flow at all times and nightly shutdowns from September 15 to December 15 for downstream eel passage. No modifications to project facilities are proposed. PE Hydro also proposes to continue funding U.S. Geological Survey (USGS) Gage No. 01636500 Shenandoah River at Millville located 0.5 miles downstream from the project.

Proposed Environmental Measures

In addition to the operation-related measures described above, PE Hydro proposes to:

- Operate and maintain the upstream trap and pass system for juvenile American eels.

- Design and test a model of downstream migration cues and timing of adult American eels at the project to evaluate the effectiveness of, and if necessary, refine the seasonal project generation shut down schedule.

- Implement a Recreation Management Plan that includes provisions for continued operation and maintenance of the project's four existing recreation sites and construction of a new portage facility.

- Implement the Historic Properties Management Plan (HPMP) filed with the final license application.

Modifications to the Project Boundary

PE Hydro proposes to remove certain lands from the project boundary are unnecessary for project purposes. These lands include upland areas associated with non-project facilities that do not provide direct access to the project and are not needed for public recreation. PE Hydro also proposes to enclose within the project boundary an additional 60.5 acres of land associated with the project's bypass reach.

Public Involvement and Areas of Concern

Before filing the license application, the applicant conducted pre-filing consultation in accordance with the Commission's Integrated Licensing Process. The intent of the Commission's pre-filing process is to initiate public involvement early in the project planning process and to encourage citizens, governmental entities, tribes, and other interested parties to identify and resolve issues prior to an application being formally filed with the Commission.

On September 30, 2015, the Commission issued a public notice accepting the application and soliciting motions to intervene and protests, stating that the application is ready for environmental analysis, and requesting comments, terms and conditions, recommendations, and prescriptions.

The primary issues associated with relicensing the proposed project are the effects of project operation on aquatic and terrestrial resources, and the adequacy of the project's recreation amenities.

Alternatives Considered

This draft environmental assessment (DEA) considers the following alternatives: (1) PE Hydro's proposal, as outlined above; (2) PE Hydro's proposal including additional

staff modifications (staff alternative); (3) the staff alternative with mandatory conditions; and (4) no action, meaning that the project would continue to operate under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented.

Staff Alternative

Under the staff alternative, the project would be operated as proposed by PE Hydro, with 401 Certification Conditions 1, 2, and 4-9, as well as the modifications and additional measures described below.

The staff-recommended modifications and additional environmental measures include, or are based on, PE Hydro's proposed measures, and recommendations or mandatory conditions provided by federal and state resource agencies that have an interest in resources that may be affected by operation of the proposed project.

- Develop an operation compliance monitoring plan to monitor and document compliance with the operational requirements of any license that may be issued.

- Modify the proposed Recreation Management Plan to include accessible, portable restroom facilities as specified in the certification.

- Cease project activities and notify the West Virginia State Historic Preservation Officer (West Virginia SHPO) and potentially affected Indian tribes if any unknown archaeological or historic resources are discovered as a result of operation or other project-related activities.

- Consult with the West Virginia SHPO about effects on historic properties prior to conducting any maintenance activities, land-clearing or land-disturbing activities, or making changes to project operation or modifications to facilities not already authorized by any license issued for the project.

The staff alternative does not include: (1) PE Hydro's proposal to implement an HPMP to protect historic properties at the project, as continued operation and maintenance of the project would be unlikely to adversely affect historic properties; and (2) 401 certification condition #3 which requires the licensee to pay $16,289.28 annually, for fish mortality caused by project operations, as there is no indication that West Virginia DNR plans to spend the compensation funds to further enhance the Shenandoah River fishery in the vicinity of the Millville Project to mitigate for these minor losses.

Staff alternative with Mandatory Conditions

The staff alternative with mandatory conditions includes all the measures included in the staff alternative with the addition of 401 Certification Condition #3, which requires the licensee to pay $16,289.28 annually, for fish mortality caused by project operations.

No-Action Alternative

Under the no-action alternative, the project would continue to operate and generate about 10,723 MWh annually, and the environmental conditions at the project site would remain the same.

Environmental Effects of the Staff Alternative

Below we summarize the environmental effects of the measures included in the staff alternative.

Water Resources

Operating the Millville Project in a run-of-river mode by maintaining the reservoir surface elevation at 324 feet msl would continue to provide stable reservoir elevations. A minimum flow of 200 cfs would continue to spill over the length of the Millville Dam and provide aeration of the river flows to DO levels sufficient to support aquatic life.

Aquatic Resources

Operating and maintaining the upstream juvenile American eel trap and passage system and shutting down the project from 6 pm to 6 am nightly, from September 15 through December 15, to pass downstream migrating adult American eels would maintain the available habitat for eels and migration survivorship. Additionally, requiring PE Hydro to continue to consult the agencies involved in the modeling of the downstream migration of adult American eels with the goal of making adjustments to project operation to improve eel migration could lead to improved eel passage at a lower cost.

Terrestrial Resources

Under the Staff Alternative, continued run-of-river operation of the project would maintain stable conditions along the project shoreline and continue to protect riparian habitat used by wildlife. Downstream of the dam, riparian areas would be unchanged by continued run-of-river operation and minimum flow releases.

Recreation and Land Use

Implementation of the Recreation Management Plan under the Staff Alternative would ensure continued operation and maintenance of the project's recreation facilities

sites and would enhance boating opportunities. Adding accessible, portable toilet facilities to three of the four sites (the Big Eddy Access Area, Lower Angling Access Trail parking area, and Downstream Access Area) would improve the recreation experience at these areas.

Cultural Resources

Two structures eligible for listing on the National Register of Historic Places (historic properties) were identified during cultural resource surveys of the Millville Project's area of potential effects: the Little Falls Canal and associated Hopewell Mill factory ruins. However, continued operation and maintenance of the project, under the Staff Alternative would not adversely affect those properties. Any unknown archeological or historic resources discovered over the term of a license would be protected under the Staff Alternative's recommendation for consultation with the West Virginia SHPO should cultural resources be inadvertently discovered during the term of any license issued for the project.

Draft License Articles

Our recommendations for conditions for any new license for the project are based on the analysis presented in this EA. Draft license articles are attached in Appendix A.

Conclusions

Based on our analysis, we recommend licensing the project under the Staff Alternative.

In section 4.2 of the EA, we estimate the likely cost of alternative power for each of the four alternatives identified above. Our analysis shows that under the no-action alternative, project power would cost $322,011,123 or $30.03 per MWh more than the likely alternative cost of power. Our analysis shows that during the first year of operation under the proposed action, project power would cost $325,228 or $30.33 per MWh more than the likely alternative cost of power. Under the staff alternative, project power would cost $335,737 or $31.31 per MWh more than the likely alternative cost of power. Under the staff alternative with mandatory conditions, project power would cost $346,567 or $32.32 per MWh more than the likely alternative cost of power.

We chose the staff alternative as the preferred alternative because: (1) the project would provide a dependable source of electrical energy for the region (10,723 MWh annually); (2) the 2,840 kW of electric capacity would come from a renewable resource that does not contribute to atmospheric pollution, including greenhouse gases; and (3) the recommended environmental measures proposed by PE Hydro, as modified by staff, would adequately protect and enhance environmental resources affected by the project.

The overall benefits of the staff alternative would be worth the cost of the proposed and recommended environmental measures.

We conclude that issuing a new license for the project, with the environmental measures we recommend, would not be a major federal action significantly affecting the quality of the human environment.

DRAFT ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, D.C.

Millville Hydroelectric Project
FERC Project No. 2343-086 – West Virginia

1.0 INTRODUCTION

1.1 APPLICATION

On December 30, 2015, PE Hydro Generation, LLC (PE Hydro or applicant) filed a license application with the Federal Energy Regulatory Commission (FERC or Commission) for the Millville Hydroelectric Project (Millville Project or project).[1] The 2,840- kilowatt (kW) project is located on the Shenandoah River, near the town of Harpers Ferry in Jefferson County, West Virginia (Figure 1). The project's average annual energy production is about 10,723 megawatt-hours (MWh). The project does not occupy federal land.

1.2 PURPOSE OF ACTION AND NEED FOR POWER

1.2.1 Purpose of Action

The purpose of the Millville Project is to provide a source of hydroelectric power. Under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a license to PE Hydro for the Millville 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 will 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 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.

[1] The current license for the Millville Project was issued with an effective date of January 1, 1988, for a term of 30 years, and expires on December 31, 2018.

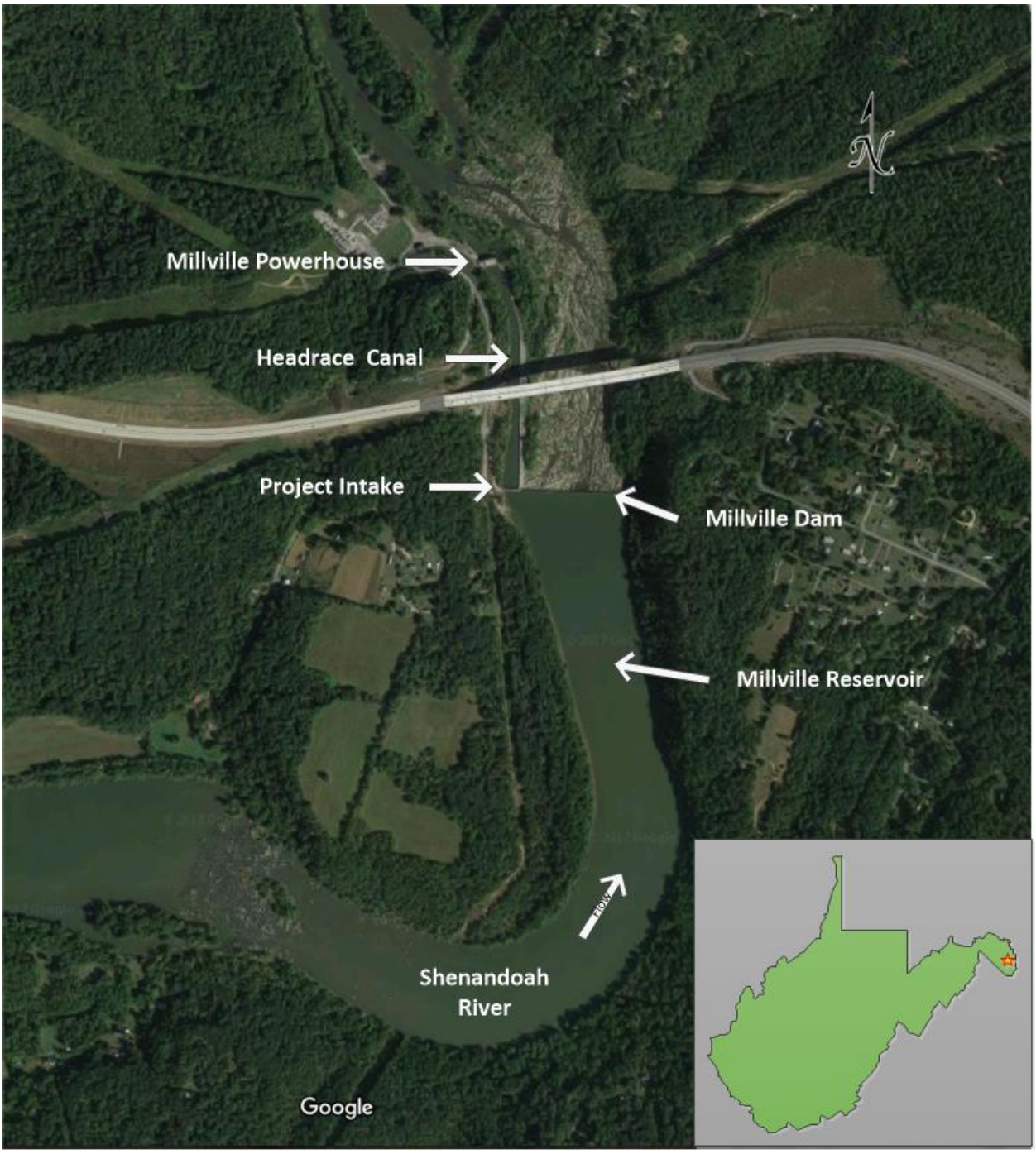

Figure 1. Aerial view of the Millville Project with project location inset. (Source: Google, 2017, as modified by staff)

Issuing a new license for the project would allow PE Hydro to continue to generate electricity, making electric power from a renewable resource available for sale to PJM Interconnection, LLC.

In this draft environmental assessment (draft EA), we assess the effects of operating, and maintaining the project: (1) as proposed by PE Hydro; and (2) with staff's recommended measures (staff alternative with mandatory conditions). For the purposes of conducting our environmental analysis, we also consider the effects of no-action. Under the no-action alternative, the project would continue to operate and no new environmental protection, mitigation, or enhancement measures would be implemented.

1.2.2 Need for Power

The Millville Project provides power which helps meet part of the region's power requirements, resource diversity, and capacity needs. The project has an installed capacity of 2,840 kW and generates an average of about 10,723 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 within PJM Interconnection's region of the NERC. According to NERC's most recent (December 2016) forecast, the summer internal demand for this region is projected to increase by 0.55 percent from 2016 to 2025.

We conclude that power from the Millville Project would help meet a need for power in the PJM Interconnection's region, in both the short and long term. The project provides power that can displace non-renewable, fossil-fired generation and contribute to a diversified generation mix. Displacing the operation of non-renewable facilities may avoid some power plant emissions and create an environmental benefit.

1.3 STATUTORY AND REGULATORY REQUIREMENTS

A license for the Millville Project would be subject to numerous requirements under the FPA and other applicable statutes. The major regulatory and statutory requirements are described below.

1.3.1 Federal Power Act

1.3.1.1 Section 18 Fishway Prescriptions

Section 18 of the FPA, 16 U.S.C. § 811, provides that the Commission shall require the construction, maintenance, and operation by a licensee of such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, as appropriate. The U.S. Department of the Interior (Interior) filed a letter on December 23, 2016, that requested a reservation of authority to prescribe fishways under section 18 of the FPA be included in any license issued for the project.

1.3.1.2 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 laws. 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.

On December 23, 2016, Interior timely filed recommendations under section 10(j), which are summarized in table 13, in section 5.3, *Recommendations of Fish and Wildlife Agencies*. In section 5.3, we also discuss how we address the agency recommendations and comply with section 10(j).

1.3.2 Clean Water Act

Under section 401 of the Clean Water Act (CWA), a license applicant must obtain certification from the appropriate state pollution control agency verifying compliance with the CWA. On April 13, 2016, PE Hydro applied to the West Virginia Department of Environmental Protection (West Virginia DEP) for a section 401 water quality certification (401 certificate or certification) for the Millville Project. West Virginia DEP received this request on April 28, 2016, and issued water quality certification for the project on April 17, 2017. In resolution of PE Hydro's appeal of the certification, West Virginia issued a modified certification on June 21, 2017. The conditions of the certification, including the subsequent modifications, are consistent with the PE Hydro's proposal as described in section 2.2, *Applicant's Proposal*. The certification conditions are attached to this EA as Appendix B (for informational purposes).

1.3.3 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 any endangered or threatened species or result in the destruction or adverse modification of the critical habitat of such species. There are two federally listed endangered or threatened species known to occur in the Millville Project vicinity, the Indiana bat and the northern long-eared bat.

By letter filed February 19, 2013, the U.S. Fish and Wildlife Service (FWS) states that no federally listed species or their habitats will be adversely affected by the project. In a letter filed December 23, 2016, FWS states that the project would not affect either of

the two bat species, or their preferred habitat. In this EA, we conclude that licensing the project would have no effect on the two bat species.

1.3.4 National Historic Preservation Act

Section 106 of the National Historic Preservation Act (NHPA)[2] requires that every federal agency "take into account" how each of 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). By letter dated December 4, 2012, the Commission designated the applicant as the non-federal representative for the purpose of consultation with the West Virginia State Historic Preservation Officer (West Virginia SHPO), pursuant to section 106 of the NHPA. PE Hydro consulted with the West Virginia SHPO to locate and assess potential adverse effects to historic properties associated with the project. By letter dated September 2, 2015 (filed with the license application), the West Virginia SHPO stated that National Register-eligible properties within the project's area of potential effects (APE) would not be adversely affected by the project.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations, 18 CFR § 4.38, require that applicants consult with appropriate federal and state 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, ESA, 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 draft EA, we conducted scoping to determine what issues and alternatives should be addressed. A scoping document (SD1) was distributed to interested agencies and others on January 4, 2013**.** The SD1 was noticed in the Federal Register on January 11, 2013. Two scoping meetings, both advertised in The Journal, were held on February 6, 2013, in Charles Town, West Virginia, to request oral comments on the project. A court reporter recorded the comments and statements made at the scoping meetings, and these are part of the Commission's public record for the project. In addition to the comments provided at the scoping meetings, written comments were filed by FWS (February 19, 2013). We issued a letter on March 29, 2013, stating

[2] 54 U.S.C. § 306108 (2014).

that the comments filed did not affect the substance of, or merits of issues described in SD1, and that a scoping document 2 was not warranted.

1.4.2 Interventions

On November 2, 2016, the Commission issued a notice accepting the application and setting January 3, 2017, as the deadline for filing protests and motions to intervene. Interior and American Whitewater filed motions to intervene on December 5, 2016, and January 3, 2017, respectively.

1.4.3 Comments on the License Application

A notice requesting comments was issued on November 2, 2016. FWS and Interior filed comments on March 1, and December 22, 2016, respectively.[3]

[3] FWS's comments were filed in response to the Project's Notice of Tendered application issued January 12, 2016.

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 existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented. We use this alternative to establish the baseline environmental conditions for comparison with other alternatives.

2.2 APPLICANT'S PROPOSAL

2.2.1 Project Description

The Millville Project is located on the Shenandoah River in the eastern panhandle of West Virginia. The Millville Project consists of the following facilities: (1) a 14.0-foot-high concrete and stone dam consisting of (a) a 36-foot-long non-overflow abutment on the east bank, (b) an 813-foot long, non-gated spillway section, and (c) a 122-foot-long intake structure, equipped with four vertical lift gates and one canal gate, and extending to the west riverbank; (2) a 100 acre reservoir, with a gross storage capacity of 900 acre-feet at elevation 324.0 mean sea level (msl); (3) upstream trap and pass system for juvenile American eels; (4) a 1,600-foot-long, 30-foot-wide, 12-foot-high masonry and concrete sided headrace canal; (5) a 125-foot-long, 40-foot-wide brick powerhouse containing 3 turbine-generating units with a combined capacity of 2.84 megawatts (MW); (6) a 550-foot-long tailrace, excavated in bedrock and returning flow to the river channel; and (7) a 1,006-foot-long, 2.4 kilovolt (kV) transmission line connecting to a 34.5 kV transformer, then a 794-foot-long, 34.5 kV transmission line to the interconnection with the local grid; and (8) appurtenant facilities. The average annual energy production is about 10,723.0 megawatt-hours (MWh).

PE Hydro proposes no additional capacity and/or modifications to project facilities.

As currently licensed, PE Hydro operates the project in run-of-river mode, such that outflow from the project approximates inflow. PE Hydro also provides at all times, a 200-cfs minimum flow to the project bypassed reach as a veil flow over the dam. The project shuts down nightly from September 15 to December 15 to facilitate downstream eel passage. In addition, PE Hydro provides funding for the USGS Gage No. 01636500 located 0.5 miles downstream from the project.

PE Hydro is responsible for four recreation sites within the project boundary: the Big Eddy Access Area, Upper Angling Access Trail, Lower Angling Access Trail, and Downstream Access Area.

2.2.2 Project Boundary Modification

The existing project boundary encloses 287.7 acres, which includes the project works and upland areas associated with the project recreation facilities, as well as additional state- and privately-owned lands that are largely undeveloped. PE Hydro proposes to remove certain lands from the project boundary which it has concluded are unnecessary for project purposes. These lands include: (1) a 91.2-acre parcel at the northwest corner of the project boundary that contains a non-project substation; (2) a 61.6-acre parcel on the southwest side of the river, upslope of the project that consists of undeveloped land upstream of the project impoundment; and (3) two parcels, totaling 8 acres on the east side of the river that consist of undeveloped land above the 100-year flood level (elevation 340 feet msl). This modification would reduce the amount of state- and privately-owned land within the project boundary by excluding those lands that are not needed for project purposes. In response to our request that all lands needed for project purposes be included in the project boundary, PE Hydro revised the boundary to add a 61.5-acre parcel to the project that contains the project's bypassed reach and follows the river's east shoreline.

As currently licensed, PE Hydro operates the project in run-of-river mode, such that inflow to the project equals outflow. It also provides a veil flow over the dam to the project bypassed reach. The project shuts down nightly from September 15 to December 15 to facilitate downstream eel passage.

2.2.3 Proposed Project Operation

PE Hydro proposes to:

- Continue to operate the Millville Project in a run-of-river mode, whereby water flowing into the project impoundment equals water flowing out;

- Continue to release a 200-cfs minimum flow over the project dam to the bypassed reach at all times, which is ensured by maintaining a constant reservoir level;

- Continue to cease project generation nightly from September 15 to December 15 to protect downstream migrating American eel; and

- Continue to fund the U.S. Geological Survey (USGS) Gage No. 01636500 on the Shenandoah River at Millville, which is located 0.5 miles downstream from the project.

2.2.4 Project Safety

As part of the licensing process, the Commission would review the adequacy of the existing project facilities. Special articles would be included in any license issued, as appropriate. Commission staff would also inspect the project after any license is issued. Operational inspections would focus 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. In addition, any license issued would require an inspection and evaluation every 5 years by an independent consultant and submittal of the consultant's safety report for Commission review.

2.2.5 Proposed Environmental Measures

PE Hydro proposes to implement the environmental protection and enhancement measures described below.

- Continue to operate and maintain the upstream American eel trap and passage system to count and pass juvenile eels in the Shenandoah River

- Design and test a model of the downstream migration cues and timing of adult American eels at the project to evaluate the effectiveness of, and if necessary, refine the seasonal project generation shut down schedule.

- Implement the Recreation Management Plan, filed May 11, 2016, which includes provisions for continued operation and maintenance of the four existing project recreation sites: (1) the Big Eddy Access Area, the Upper Angling Access Trail, the Lower Angling Access Trail, and the Downstream Access Area; and (2) construction, operation, and maintenance of a new portage around the Millville dam.

- Implement the Historic Properties Management Plan (HPMP), filed with the final license application, to protect historic properties within the project's APE.

2.3 MODIFICATIONS TO APPLICANT'S PROPOSAL -- MANDATORY CONDITIONS

The following project-specific mandatory conditions have been provided, and are summarized below.

Water Quality Certification Conditions

- Condition 1 requires the licensee to continue to develop and then implement an Eel Passage Operations Plan, in consultation with West Virginia DNR-WRS,

West Virginia DEP-DWWM, U.S. Fish and Wildlife Service, and U.S. Geological Survey, based on a model being produced by North Carolina State University and West Virginia University. The plan will test the model of downstream movement of adult eels, by altering project operations, to improve the effectiveness of project shutdowns for passing eels. The plan will test the model for two years.

Annual briefings on the testing would be provided to West Virginia DEP-DWWM and West Virginia DNR-WRS. If the model test is unsuccessful the licensee will consult to either change the model or return to the current operational nighttime shutdown schedule. The licensee will maintain its current operational nighttime shutdown schedule from September 15 to December 15 until the plan to test the above model is approved.

- Condition 2 requires the licensee to maintain a continuous flow of 200 cfs over the Millville Dam to provide for fishery habitat downstream of the dam.

- Condition 3 requires the licensee to pay $16,289.28 annually, for fish mortality caused by project operations.

- Condition 4 requires the licensee to identify a boat portage and erect and maintain signage.

- Condition 5 requires the licensee to monitor dissolved oxygen (DO) and temperature for two years, beginning in 2018, from May 1 through October 31, hourly in the impoundment just upstream of the dam and near the powerhouse outlet. Monitoring data will be provided each year to the West Virginia DEP-DWWM by March 1 of the following year, and if any dissolved oxygen value is $\leq$ 5.5 milligrams per liter (mg/l), a water quality maintenance and operation adaptive management plan including operating steps that will be taken in that event will be prepared. The plan will be submitted to West Virginia DEP-DWWM for approval. The exact monitoring locations and depths must be approved by West Virginia DEP- DWWM prior to initiation of data collection.

- Condition 6 requires the licensee to install and maintain trash receptacles at the Downstream Access Recreation Area, the Lower Angling Access Trail, the Upper Angling Access Trail, and the Big Eddy Access Area. Trash removal will occur on a regular basis by the licensee.

- Condition 7 requires the licensee to maintain four recreation areas associated with the project to ensure that they continue to be safe and usable. The four recreation areas will be inspected each spring and following any high-water

event to assess public accessibility to the site, condition of parking areas, and condition of the recreation facilities.

- Condition 8 requires the licensee to provide and maintain Americans with Disabilities Act compliant portable restroom facilities at the Downstream Access/Boat Launch Area, Big Eddy Area and the Lower Angling Access Parking Area. These restrooms will be provided at a minimum from April 1 through November 1 of each year.

- Condition 9 requires the licensee to operate the project in a "run-of-the-river" mode.

2.4 STAFF ALTERNATIVE

Under the staff alternative, the project would be operated as proposed by PE Hydro, with 401 Certification Conditions 1, 2, and 4-9, as well as the modifications and additional measures described below.

Our recommended modifications and additional environmental measures include, or are based on, PE Hydro's proposed measures, and recommendations made by federal and state resource agencies that have an interest in resources that may be affected by operation of the proposed project.

- Develop an operation compliance monitoring plan to monitor and document compliance with the operational requirements of any license that may be issued.

- Modify the Recreation Management Plan, filed May 11, 2016, with the provision for accessible, portable restroom facilities at the Big Eddy Access Area, the Lower Angling Access Trail parking area, and the Downstream Access Area, as specified in West Virginia DEP's certification.

- Cease project activities and notify the West Virginia SHPO, and potentially affected Indian tribes if any unknown archaeological or historic resources are discovered as a result of operation or other project-related activities.

- Consult with the West Virginia SHPO regarding effects on historic properties prior to conducting any maintenance activities, land-clearing or land-disturbing activities, or making changes to project operation or modifications to facilities not already authorized by any license issued for the project.

However, the staff alternative does not include: (1) PE Hydro's proposal to implement an HPMP to protect historic properties at the project, as continued operation and maintenance of the project would be unlikely to adversely affect historic properties;

and (2) 401 certification condition #3 which requires the licensee to pay $16,289.28 annually, for fish mortality caused by project operations as there is no indication that West Virginia DNR plans to spend the compensation funds to further enhance the Shenandoah River fishery in the vicinity of the Millville Project to mitigate for these minor losses.

2.5 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

We recognize that the Commission is required to include all water quality certification conditions in any license issued for the project. Therefore, the staff alternative with mandatory conditions includes all the measures included in the staff alternative with the addition of 401 condition #3, which requires the licensee to pay $16,289.28 annually, for fish mortality caused by project operations.

2.6 ALTERNATIVE CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

We considered several alternatives to the applicant's proposal, but eliminated them from further analysis because they are not reasonable in the circumstances of this case. They are: (1) issuing a non-power license; (2) Federal Government takeover of the project; and (3) retiring the project.

2.6.1 Issuing a Non-power License

A non-power license is a temporary license that the Commission will terminate when it determines that another government agency will assume regulatory authority and supervision over the lands and facilities covered by the non-power license. At this point, no agency has suggested a willingness or ability to do so. No party has sought a non-power license and we have no basis for concluding that the project should no longer be used to produce power. Thus, we do not consider issuing a non-power license a realistic alternative to relicensing in this circumstance.

2.6.2 Federal Government Takeover

We do not consider federal takeover to be a reasonable alternative. Federal takeover and operation of the project would require Congressional approval. While that fact alone would not preclude further consideration of this alternative, there is currently no evidence to indicate federal takeover should be recommended by Congress. No party has suggested federal takeover would be appropriate, and no federal agency has expressed an interest in operating the project.

2.6.3 Retiring the Project

Project retirement could be accomplished with or without dam removal. Either alternative would involve denial of the relicense application and surrender or termination of the existing license with appropriate conditions.

In comments on the draft license application, American Whitewater requested FERC consider dam removal as an alternative to relicensing the project, citing that the project generates relatively little power, seems to break even, and has significant resource impacts. No resource agency or other stakeholder recommended dam removal or project retirement.

PE Hydro responded, disagreeing with American Whitewater's opinion of the generation value and stating that the project provides an important source of clean energy with minimal environmental impacts. This source of power would be lost if the project were retired, and replacement power would need to be found. Further, the Millville Dam is in good and safe condition. There would be significant costs and resource effects associated with dam removal and retiring project facilities. In addition, the impoundment serves as an important recreational resource in the area for both fishing and boating. American Whitewater supported PE Hydro's proposed portage trail in the comments filed with their motion to intervene and we assume from their comments that providing a portage around dam provides a reasonable alternative to dam removal for recreation purposes. Given these factors, we find that dam removal is not a reasonable alternative to relicensing the project with appropriate protection, mitigation and enhancement measures.

The second project retirement alternative would involve retaining the dam and disabling or removing equipment used to generate power. Project works would remain in place and could be used for historic or other purposes. This would require us to identify another government agency with authority to assume regulatory control and supervision of the remaining facilities. No agency has stepped forward, and no participant has advocated this alternative. Nor have we any basis for recommending it. Because the power supplied by the project is needed, a source of replacement power would have to be identified. In these circumstances, we don't consider removal of electric generating equipment to be a reasonable alternative.

3.0 ENVIRONMENTAL ANALYSIS

In this section, we present: (1) a general description of the project 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. Under each resource area, historic and current conditions are first described. The existing conditions are 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. Our conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[4]

3.1 General Description of the Area

The Millville Project is located at river mile (RM) 6 on the Shenandoah River in West Virginia. The project lies near the town of Harpers Ferry in Jefferson County, West Virginia. The mainstem Shenandoah River ("mainstem" or "River") is formed by the confluence of its North and South Forks at the north end of Massanutten Mountain at Riverton, Virginia. From Riverton the Shenandoah River flows generally north-northeast 34 miles through Clark County, Virginia, and then flows 19 miles through Jefferson County to its confluence with the Potomac River at Harpers Ferry.

The River has a low gradient, and is moderately wide with an average width of 150 feet. Much of the mainstem exhibits a relatively slow flow, as is typical in low gradient rivers. However, some riffle areas, produce Class I rapids. The mainstem substrate varies, but generally ranges from bedrock and boulder to cobble and gravel. Rooted aquatic vegetation is present in shallow areas and can become quite dense during the summer months. Land use along the mainstem is primarily of agricultural and residential, and nearly all of the riparian area along the Shenandoah River is privately owned (VDGIF, 2015).

With a 3,000 square mile drainage area, the Shenandoah watershed drains a large portion of area west of the Blue Ridge Mountains. This area includes a number of long tributaries flowing through the relatively flat agricultural land to the west of the river and several shorter streams which drain the more forested western slopes of the Blue Ridge Mountains to the east (West Virginia DEP, 1996). The River contains an abundance and variety of gamefish, and fishing is a very popular activity. Other popular water activities

[4] Unless otherwise indicated, our information is taken from the application for license filed by PE Hydro on December 30, 2015, and the response to deficiencies and requests for additional information filed on May 11, 2016 and August 24, 2016.

on the River include canoeing, tubing, kayaking and whitewater rafting (Kleinschmidt, 2012).

There are four hydroelectric dams upstream of the Millville Project, three are located on the South Fork of the Shenandoah River. Farthest upstream is Shenandoah Dam at RM 78, FERC Project No. 2509, followed by Newport Dam at RM 64 and Luray Dam at RM 49, these two dams are under FERC Project No. 2425. Lastly, Warren Dam at RM 52, FERC Project No. 2391 is on the mainstem.

Throughout the Shenandoah watershed an extensive and varied agriculture industry thrives with a growing season of approximately 160 days. Corn, hay, and orchards dominate the cropland, while livestock such as poultry, dairy, beef, and swine are raised on untilled land. The region typically experiences high humidity, with humidity being higher at night, and the average at dawn is about 75 percent in the winter and early spring and about 90 percent in the summer and early fall. The sun shines about 60 percent of the time in summer and 40 percent in winter. The prevailing wind is from the southwest, with average wind speed peaking at around 8 miles per hour in March. Minimum streamflows generally occur in the late summer and early fall (NOAA, 2012).

3.2 Scope of Cumulative Effects Analysis

According to the Council on Environmental Quality's regulations for implementing the National Environmental Policy Act, 40 C.F.R. § 1508.7, an action may cause cumulative impacts on the environment if its impacts overlap in time and/or space with the impacts of other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such actions. Cumulative effects can result from individually minor but collectively significant actions taking place over a period of time, including hydropower and other land and water developmental activities.

Based on our review of the license application and agency and public comments, we have identified American eels as a resource that may be cumulatively affected by the proposed operation and maintenance of the Millville Project.

3.3 Proposed Action and Action Alternatives

Only resources that would be affected, or about which comments have been received, are addressed in detail in this section of the DEA. We have not identified any substantive issues related to aesthetic resources, or socioeconomics associated with the proposed action; therefore, we do not assess environmental effects on these resources in this DEA.

3.3.1 Geological and Soil Resources

3.3.1.1 Affected Environment

The Millville Hydroelectric Project is located near the boundary between the Great Valley and Blue Ridge Provinces, on the eastern edge of the Blue Ridge Province in West Virginia. More specifically, the project is located in the Harpers Formation. This formation is composed of Lower Cambrian age phyllite and metasiltstone (USGS, 2003). This area is characterized by folded and faulted rock with no minable coal, unlike the western two-thirds of the state. Within the Valley and Ridge Province is the Great Valley, which extends from the Blue Ridge Mountains westward for about 20 miles, including most of Jefferson County. This relatively flat, agriculturally rich region is composed of complexly folded and faulted Cambrian and Ordovician limestone and dolomite with one prominent Ordovician shale (the Martinsburg Shale) (West Virginia DOC, 2012). Sinkholes, underground streams, and other karst features have developed on the underlying limestone/dolomite, and as a result, the number of surface streams is low (NRCS, 2012).

The Blue Ridge Province is located primarily in Virginia and Maryland, but also in the very eastern portion of West Virginia. The rocks that form the Blue Ridge Province include a basement complex of Precambrian granite and granulites along with late Precambrian metamorphosed sedimentary rocks (Virginia DEQ, 2012). Structurally, the Blue Ridge Province is a large, eroded anticline. The core of the anticline is composed primarily of igneous and metamorphic rocks. The east and west flanks of the anticlinare much younger volcanic and clastic sediments (James Madison University, 2012).

Dominant soils within the project area, as well as in general vicinity of the project, include the Combs fine sandy loam (Cs), the Lindside silt loam (Ln), the Sylvatus channery silt loam (SvF) and rock outcrop complex (SyF) (Figure 4-1). The Combs fine sandy loam is a well-drained coarse-loamy alluvium with a depth of more than 80 inches. The Lindside silt loam is a moderately well-drained fine-silty alluvium with a depth of more than 80 inches. Both the Combs and Lindside series have a high to moderately high permeability. The Sylvatus series is gravelly residuum with a depth of more than 80 inches, and in places is up to 30 percent rock outcrop. The Sylvatus series has a very low permeability (NRCS, 2012).

The western shoreline of the Shenandoah River, adjacent to the project headrace, dam, and powerhouse, is Sylvatus rock outcrop complex. This series is composed of gravelly residuum weathered from phyllite generally located on hillsides at a 45-65 percent slope. This series has moderately low erodibility (erodibility factor = 0.28). The Sylvatus channery silt, similar to the previous series without the rock outcrops and at a slope of 25-65 percent, is adjacent to much of the eastern shoreline of the project. The Lindside silt loam occupies most of the remaining areas of the project shoreline, with a

few locations of Combs fine sandy loam. The Lindside series is a fine-silty alluvium located on floodplains with moderate erodibility (erodibility factor = 0.32). The Combs series is a coarse-loamy alluvium also found on floodplains with moderately low erodibility (erodibility factor = 0.24) (NRCS 2012).

The majority of the shoreline within the project boundary is forested, limiting the degree of potential erosion. As stated above, soils within the project range from moderately low to moderate erodibility. PE Hydro states that there may be limited amounts of localized erosion, but if present, the extent of such shoreline erosion is insignificant (License Application, Section 4.3.1.1).

3.3.1.2 Environmental Effects

Mode of Operation

PE Hydro proposes to continue to operate the project in run-of-river mode, such that outflow from the project approximates inflow, except for operating emergencies beyond the control of the applicant (e.g., emergency and maintenance drawdowns). The project shuts down nightly from September 15 to December 15 for downstream adult American eel passage.

Our Analysis

There were no comments that there are erosion issues at the Millville Project. Currently, vegetation along the project impoundment is dense, the shoreline remains stable during floods and periods of high water, and no erosion issues are known to exist. Therefore, the proposed project operation would continue to minimize the potential for shoreline erosion, as well as the incidence of dewatering and flooding of riparian vegetation.

3.3.2 Water Resources

3.3.2.1 Affected Environment

Water Quantity

The Millville Project is located about 5.5 miles upstream of the confluence of the Shenandoah and Potomac Rivers. At this point the Shenandoah River has a drainage area of about 3,041 square miles. The project impoundment has a surface area of about 100 acres at the normal operating headpond elevation of 324.0 feet msl, with an estimated gross storage capacity of 900 acre-feet. Since the impoundment does not fluctuate under normal run-of-river operation, there is no usable storage. The total hydraulic capacity of the Project's three generating units is estimated at 1,970 cfs. The project is operated remotely and uses a water level sensor to provide the operators with the ability to ensure

that the reservoir level is maintained above the top of the flashboards to release a 200-cfs minimum flow.

River flow is measured at the U.S. Geological Survey (USGS) Gage No. 01636500 Shenandoah River at Millville located 0.5 miles downstream from the project powerhouse. PE Hydro currently provides funding for maintenance of the gage to USGS. The period of record for daily discharge for this gage is August 1928 until present. Records of monthly discharge also exist for the period of April 1895 to March 1909 (USGS, 2015). The average monthly river flow at the Millville Project from 1928-2013 is 2,702 cfs. The highest average monthly flows are in March and April and the lowest average monthly flows are from July through September. Table 1 presents the mean, maximum, and minimum average monthly flows for the Shenandoah River at Millville.

Table 1. Mean monthly flows on the Shenandoah River just downstream from the Millville Hydroelectric Project.

	MEAN(CFS)	MAX(CFS)	MIN(CFS)
Jan	3,595	95,900	340
Feb	3,976	50,600	418
Mar	5,207	57,400	409
Apr	4,618	61,100	652
May	3,727	43,300	723
Jun	2,638	97,300	345
Jul	1,457	19,500	315
Aug	1,245	18,500	248
Sep	1,811	133,000	308
Oct	1,948	70,700	371
Nov	2,391	125,000	413
Dec	3,056	40,600	390
(USGS, 2015) Period of Record 1970-2014 USGS Station No. 01636500			

Inflows to the project exceeded the proposed 200-cfs minimum flow 100 percent of the time for the period of record. The minimum flow was originally required as a veil flow over the dam for aesthetic purposes and was not quantified to be 200 cfs.

Water Quality

The Shenandoah River is designated Category B (Propagation and Maintenance of Fish and Other Aquatic Life) and Category C (Water Contact Recreation). The Shenandoah River is a Warm Water Fishery Stream (Category B1) (West Virginia DEP,

2014). Criteria for these designations are set forth in the West Virginia DEP Title 47, Series 2 Water Classification and Standards. Criteria potentially relevant to hydropower are presented in Table 2.

Table 2. West Virginia water quality standards relevant to the Millville Project. (Source: West Virginia DEP, 2014).

WATER QUALITY PARAMETER	**STANDARDS**
Dissolved Oxygen (DO)	Not less than 5 mg/l at any time.
pH	No values below 6.0 or above 9.0. Higher values due to photosynthetic activity may be tolerated.
Temperature	No more than 5°F above natural temperature, not to exceed 87°F at any time from May through November and not to exceed 73°F at any time from December through April.
Turbidity	No point or non-point source to West Virginia's waters shall contribute a net load of suspended matter such that the turbidity exceeds 10 NTU's over background turbidity when the background is 50 NTU or less, or have more than a 10% increase in turbidity (plus 10 NTU minimum) when the background turbidity is more than 50 NTUs.
Ammonia	Acute and chronic aquatic life criteria for ammonia shall be determined using the National Criterion for Ammonia in Fresh Water from USEPA's 1999 update of Ambient Water Quality Criteria for Ammonia (EPA-822-R-99-014, December 1999).

West Virginia DEP maintains an Ambient Water Quality Monitoring (AWQM) Network station 4 miles downstream from the project, and samples for DO and other parameters. USGS also collects DO data at the streamflow gage just downstream of the project. PE Hydro compiled this information and found that while the Shenandoah River is currently listed as impaired for fecal coliform and nitrite water quality parameters in the Draft 2014 303(d) list (West Virginia DEP, 2015b), overall water quality meets state standards in the vicinity of the project. For example, average DO, as shown below, far exceeds the state standard of 5.0 mg/L.

	Average	Maximum	Minimum
DO (mg/L)	10.73	15.99 (1/1/11)	7.08 (7/11/07)

3.3.2.2 Environmental Effects

Mode of Operation

PE Hydro proposes to continue operating the Millville Project in a run-of-river mode by maintaining the reservoir surface elevation at 324 feet msl. The project has no peaking capability and the headpond is maintained at an elevation slightly above the spillway crest, to allow a veil of water to overtop the length of the dam and provide a 200-cfs minimum flow to the bypassed reach.

Our Analysis

Continued run-of-river operation of the project would maintain the impoundment level at 324 feet msl, or higher. The consistent impoundment elevation would continue to result in stable conditions along the project shoreline, thus protecting near-shore and riparian habitats used by fish and other aquatic organisms. Downstream of the dam, aquatic and riparian habitats would be unchanged, as a result of the continued run-of-river operation. In addition, maintaining the impoundment elevation at 324 feet msl, or higher, would ensure that, at least, 200 cfs is spilled over the crest of the dam as a minimum flow. This spill flow provides aeration of the water, which protects water quality in the project area and downstream in the Shenandoah River.

Water quality

PE Hydro proposes to continue to release a continuous minimum flow of 200 cfs over the length of Millville Dam, and therefore water quality would likely be similar to conditions that currently exist. Currently water quality conditions in the project area meet and even exceed the concentration specified by West Virginia state water quality standards for DO, and water temperatures recorded at the project are favorable for aquatic life. Notwithstanding current good water quality conditions, PE Hydro would be required to monitor DO at the headrace of the project for 2 years, in order to satisfy the requirements of the 401 certificate.[5] PE Hydro would file annual reports with West Virginia DEP.

[5] Condition 5 of West Virginia DEP's certification requires the licensee, for 2 years beginning in 2018, to monitor water quality (i.e., DO and water temperature) hourly in the impoundment just upstream of the dam and near the powerhouse outlet from May 1 through October 31. Should DO fall to, or below, 5.5 mg/L, PE Hydro is required to developed a water quality maintenance and operation adaptive management plan, setting forth operating steps that will be taken in the event DO does not, or is anticipated to not, meet West Virginia water quality standards.

No other proposed actions are anticipated to affect water quality.

Our Analysis

Low head hydroelectric projects with riverine impoundments and short retention times, like the Millville Project, are not likely to change the DO or water temperature of the river flows, as they pass through the turbine. The impoundment is too small to stratify regularly, which could otherwise result in changes to these water quality parameters.

Certification Condition 5 requires 2 years of DO and water temperature monitoring at the Millville Project. Conducting additional monitoring during the post-licensing period would not be necessary to document any new effects on water quality because there are no proposed changes to project operation. If the project continues to operate as it has historically, water quality would likely be similar to conditions that currently exist, and would continue to meet the State standards. For these reasons, we find that there would be no project-related benefit to monitoring DO and water temperature at the project for 2 years.

3.3.3 Fishery Resources

3.3.3.1 Affected Environment

Fisheries Resources

The fish assemblage of the Shenandoah River mainstem is generally indicative of a moderately sized, low-gradient, mid-Atlantic river. The river is known to support 44 species of freshwater and diadromous fish species (Table 3), including American eel, largemouth bass, redbreast sunfish, and smallmouth bass (FERC, 1987; Virginia Tech, 2003). The fish species present consist primarily of a warm-water fish assemblage, with a few transitional (cool water) and cold water species present in the mainstem.[6] Eight transitional fish species, including blacknose dace, creek chub, muskellunge, northern hogsucker, river chub, creek chub, longnose dace, and walleye are present. These species can be present in either a warm or cold water fish assemblage. In addition, there are three cold water species present in the assemblage: mottled and Potomac sculpin; and rainbow trout. These obligate cold water species are not typically found in warm water systems, suggesting that summertime thermal refuge may be available in the mainstem, or its

[6] Species richness data collected during the previous relicensing (FERC, 1987) did not include most of the transitional and none of the cold water species reported by Virginia Tech (2003). At that time, walleye and creek chub were the only transitional species reported in the project area.

tributaries. Available data did not include information for the sampling dates when these cold water species were observed. These species may only occur in the mainstem during the cool and cold seasons.

Table 3. Fish Assemblage of the Mainstem Shenandoah River. (Source: PE Hydro, 2015; Virginia Tech, 2003).

American eel	Mottled sculpin	Banded killifish
Muskellunge[1]	Northern hogsucker	Blacknose dace
Pearl dace	Bluegill[1]	Potomac sculpin
Bluehead chub	Pumpkinseed sunfish[1]	Bluntnose minnow
Rainbow trout	Brown bullhead	Redbreast sunfish[1]
Central stoneroller	River chub	Channel catfish[1]
Rock bass[1]	Comely shiner	Rosyface shiner
Common carp	Shorthead redhorse	Common shiner
Smallmouth bass[1]	Creek chub	Spotfin shiner
Cutlips minnow	Spottail shiner	Fallfish
Stonecat	Fantail darter	Swallowtail shiner
Golden redhorse	Tessellated darter	Green sunfish[1]
Walleye[1]	Greenside darter	White crappie[1]
Largemouth bass[1]	Yellow bullhead	Longnose dace
Margined madtom	Black crappie[1]	

[1] sport fish present near Millville (PE Hydro, 2015).

The Shenandoah River has several distinctive aquatic habitats present within two miles of the project (EEM Inc., 1992) can be divided into the impoundment, the bypassed reach, and the mainstem of the river. Each river section has habitats that support many resident fish species.

The impoundment upstream of the project dam is the only large pool habitat in this section of the Shenandoah (FERC, 1987). The 100-acre impoundment is about 600-feet-wide along most of its length, and extends about 1 mile upstream of the dam. The impoundment is maintained at an elevation slightly above the spillway crest, to allow a veil of water to overtop the dam. The impoundment is mostly riverine in nature and surrounded by wooded hillsides along both shorelines. The pool attracts larger gamefish species such as large and smallmouth bass, tiger muskellunge, sunfish, and crappie. The pool also has large shoals of forage species

The 600-foot-wide bypassed reach below the dam is characterized by about 0.4 miles of exposed rock outcrops with meandering flow channels which merge with the project tailrace. Aquatic mesohabitats include riffles, runs, and shallow riverine pools characterized by bedrock outcrops, boulders, and smaller substrates. The resident fish assemblage in the bypassed reach include warm water and cool water species (e.g.,

smallmouth bass, sunfish, and catfish). The veil flow of water over the project dam is used to satisfy the current/proposed 200-cfs minimum flow requirement to the bypassed reach. The 200 cfs minimum flow is less than lowest streamflow registered at the downstream USGS gage.[7]

The confluence of the bypassed reach and tailrace consolidates the river flows and becomes a large river habitat. Large areas of boulder fields, large cobble, and extensive low gradient rapids and deeper runs are found in this section of river. Smallmouth bass and redbreast sunfish are the most common predatory species. Channel catfish are also very common.

Special Status Aquatic Species

Green Floater Mussel

The green floater mussel (*Lasmigona subviridis*) is a federal Species of Concern, currently under review for federal listing, and is a West Virginia State Endangered Species. Recently, the species has been found less frequently and in lower numbers than in the past, with many documented extirpations throughout its range, which extends from West Virginia to the Hudson River in New York (Barfield and Watters, 1998). The species typically inhabits streams, small rivers, and canals of low to medium gradient with slow pools and eddies, fine gravel, and sand bottom (Ortmann, 1919). The species is a bradytictic brooder,[8] with the reproductive season extending from August, when spawning occurs, to May when glochidia[9] are released (Ortmann, 1919). Host fish have not been determined for the green floater; however, there is documentation of direct transformation of glochidia into juvenile mussels (Barfield and Watters, 1998; Lellis and King, 1998).[10]

---

[7] USGS gage 01636500 Shenandoah River at Millville, WV

[8] Bradytictic mussel brooders spawn late in the year, their embryos and glochidia overwinter in the marsupia, and larvae are released in the spring (Cummings and Graf, 2010).

[9] Glochidia are mussel larvae.

[10] Although many mussel species require fish hosts for glochidia dispersal and transformation to the juvenile stage, there is evidence that juvenile green floaters can metamorphose within the gills of the adult female and without a host. (Barfield and Watters, 1998; Lellis and King, 1998)

American Eels

The Shenandoah River is a tributary to the Potomac River, which is a coastal river. The only migratory fish species known to occur in the project area is the American eel. American eels are catadromous, which means they spawn in the ocean (specifically in the Sargasso Sea) and travel inland up streams and rivers to grow and mature, spending the majority of their lives in freshwater or estuarine habitats. Juvenile American eels migrate upstream in rivers over an extended period from March through October (Richkus and Whalen, 1999), and adult eels migrate downstream from mid-August to December (Haro et al., 2003). After developing in fresh and brackish water for 7-20 years, sexually mature adults return to the Sargasso Sea to spawn and die (Hartel et al., 2002).

This catadromous life history necessitates long migrations up and down rivers to successfully complete their life cycle. Barriers to migration such as dams can be problematic for the eel. However, American eel are remarkable climbers and can travel over land during wet weather conditions rendering only larger dams as migration impediments. Upstream passage at the Millville Project is afforded by an eel ladder that is installed annually in May or June and operated through September. In 2010, more than 5,000 juvenile eels navigated the ladder (Table 4). Downstream migration measures at the project for adult eels include nightly operational shutdowns from September 15 through December 15.

Table 4. Installation and Removal Dates and Success of the Millville Eel Ladder. (Source: PE Hydro, 2014).

YEAR	DATE OF INSTALLATION	DATE OF REMOVAL	NUMBER PASSED
2003	Aug 28	Sep 17	409
2004	May 12	Sep 30	4,199
2005	Jun 1	Jul 31	650
2007	May 10	Nov 6	852
2008	Jun 6	Nov 6	1,616
2009	Jun 22	Nov 16	1,313
2010	May 6	Nov 9	5,394
2011	Jun 28	Nov 8	1,122
2012	May 9	Nov 12	4,185
2013	May 2, Jul 1	May 6, Oct 21	2,378

Juvenile eels using the ladder from 2003 through 2005 were caught in a barrel at the end of the ladder and counted by hand. The eel ladder was fitted with an electronic fish counter in 2007 (Welsh and Aldinger, 2014). The motion activated digital camera

system provides daily counts of eels, documents time of eel passage, and estimates eel length photogrammetrically.[11] The fish counter can be active on a continuous basis.

3.3.3.2 Environmental Effects

Mode of Operation

PE Hydro's proposed and agency-recommended run-of-river operation and minimum flow were previously described in section 3.3.2 Water Resources.

Our Analysis

Operating the project in a run-of-river mode and continuing to provide a minimum flow of 200 cfs over the length of the dam would minimize water level fluctuations in the impoundment and downstream, and would maintain downstream flow conditions for aquatic life, including during natural low-flow and drought periods. In addition, maintaining run-of-river flows would continue to reduce the potential for fish and macroinvertebrate stranding within the impoundment, which is often a consequence of unnatural water level fluctuations. Run-of-river operations would also minimize water level and flow disruption to any spawning and rearing habitat that might exist both within the project impoundment and in the reach downstream from the project. Maintaining relatively stable impoundment levels would also benefit fish and other aquatic organisms that rely on near-shore habitat for feeding, spawning, and cover.

Monitoring compliance with the operating requirements of any license could be accomplished through implementation of an operation compliance monitoring plan. The plan could include procedures for documenting compliance with run-of-river operation, providing the minimum flow, and with any other operational requirement.

Impingement and Entrainment

Water intake structures at hydropower projects can injure or kill fish that come into contact with intake screens/trash racks or turbines. Fish that are wider than the intake screen or trash rack bar spacing and have burst swim speeds[12] lower than approach velocities[13] can become trapped against intake screens or bars of a trash rack. This

---

[11] The process of making precise measurements by means of photography.

[12] Burst swimming speed is the maximum swimming speed that can only be sustained for a few seconds. It is usually used to escape danger (Murray, 1974).

[13] Approach velocity is the calculated water flow velocity component perpendicular to the trash rack face.

situation is known as impingement, and can cause physical stress, suffocation, and death of some organisms (EPRI, 2003). The trashracks at the Millville Project have 3-inch spacing which would only impinge fish that are larger than 3 inches in width and cannot swim away from the trashrack. Fish of a size large enough that they could be impinged on 3-inch spaced trashracks, however, are generally the most able to reach swimming burst speeds that prevent impingement.

Entrainment occurs if fish are small enough to pass between trashrack bars, and they do not behaviorally avoid passage into the intake structures. Generally, even if fish are small enough to fit through trashrack bars, they are likely to behaviorally avoid entrainment if their burst swim speeds exceed the approach velocity in front of the trashracks (Knapp et al., 1982). If entrainment occurs, fish injury or mortality can result from collisions with turbine blades, exposure to pressure changes, shear forces[14] in turbulent flows, or water velocity accelerations created by turbines (Rochester et al. 1984). The number of fish entrained and at risk of turbine mortality at a hydroelectric project is dependent upon site-specific factors, including physical characteristics of the project (i.e., head, approach velocity, etc.), as well as the size, age, and seasonal movement patterns of fish present within the impoundment (EPRI, 2003). Fish that are entrained and killed are removed from the river population and no longer available for recruitment to the fishery.

A desktop study was performed by PE Hydro to assess fish entrainment and turbine mortality at the projects (PE Hydro, 2014c). A partial netting study[15] was previously conducted by Energy and Environmental Management (EEM, 1992) at the Millville Project on a single unit, the Francis turbine. This site-specific data was applied to the desktop study.

The EEM netting entrainment studies provided monthly entrainment data for four time periods: June through September 1986; September through December 1989; January through August and December 1990; and January through December 1991 (EEM, 1992). Two 12-month datasets were constructed from the entrainment data, which were then scaled up using West Virginia DNR fish population abundance data from 1975 and 2011 (unpublished data). Then, the number of netted fish was divided by the gross turbine flow from the testing period to get a raw monthly entrainment rate, which was converted to fish per million cubic feet (MCF) of water passed through the turbines (Table 5; PE Hydro, 2014c).

---

[14] Shear forces are caused by layers of water moving at different velocities.

[15] Partial netting means that only a part of the entire flow through the project is netted and catch data is scaled up to account for the un-netted a flows.

Table 5. Escalated average monthly entrainment rates for Millville Hydroelectric Project. (Source: PE Hydro, 2014c; as modified by Staff).

AVERAGE MONTHLY ENTRAINMENT RATE (FISH/MCF)	
January	1.01
February	0.39
March	0.99
April	18.67
May	13.08
June	26.42
July	12.71
August	3.54
September	7.31
October	14.88
November	10.13
December	3.24

For PE Hydro's study, West Virginia DNR's data was sorted based on the fish community distribution, broken out by family and season. This information was used to model the number of fish entrained and the number of fish killed (Table 6). The EEM studies also counted the survivorship of the fish caught in the tailrace net. Dividing the number of dead fish by the total number caught produces a mortality percentage of the entrained fish (as shown in the last column of Table 6).

Table 6. Seasonal fish community distribution ratio and entrainment mortality rates by family. (PE Hydro, 2014c; as modified by Staff).

FAMILY-GENUS SEASONAL ENTRAINMENT					MORTALITY RATE
GROUP	WINTER	SPRING	SUMMER	FALL	
Anguillidae (eels)	55.8%	0.3%	0.3%	29.7%	0.49%
Catostomidae (suckers)	0.0%	4.9%	0.2%	0.1%	75.00%
Lepomis (sunfish)	26.3%	77.1%	86.4%	56.0%	2.83%
Cyprinidae (minnows)	6.3%	1.2%	0.9%	2.6%	43.37%
Esocidae (muskellunge)	1.1%	0.0%	0.1%	0.0%	0.00%
Ictaluridae (catfish)	4.2%	11.4%	1.6%	2.0%	10.82%
Micropterus (bass)	0.0%	4.4%	10.7%	8.9%	7.28%
Percidae (darters)	0.05%				20.83%
Salmonidae (trout)	0.05%				0%
Total	100%	100%	100%	100%	[a]

[a] Mortality rates are for individual Families and will not total 100%.

The model estimated the total fish entrainment at the Millville Project based on the volume of water passed during an average year, to be about 357,000 fish annually. The seasonal estimates of entrainment and associated mortality are presented in Table 7. The annual total number of entrained fish undergoing turbine mortality is estimated to be about 21,000.

Table 7. Total estimated annual numbers of fish entrained, with the estimated number of fish killed shown in parenthesis. (PE Hydro, 2014c; as modified by Staff).

FAMILY	WINTER	SPRING	SUMMER	FALL	TOTAL
Anguillidae (eels)	8,774 (43)	407 (2)	360 (2)	13,673 (67)	23,214 (114)
Catostomidae (suckers)	0 (0)	7,466 (5,600)	216 (162)	48 (36)	7,730 (5,798)
Lepomis (sunfish)	4,139 (117)	118,241 (3,3478)	122,849 (3,478)	25,805 (731)	271,033 (7,673)
Cyprinidae (minnows)	993 (431)	1,765 (765)	1,223 (530)	1,204 (522)	5,184 (2,249)
Esocidae (muskellunge)	166 (0)	0 (0)	72 (0)	0 (0)	237 (0)
Ictaluridae (catfish)	662 (72)	17,512 (1,896)	2,230 (241)	915 (99)	21,319 (2,308)
Micropterus (bass)	0	6,788 (494)	15,176 (1,104)	4,092 (298)	26,056 (1,896)
Percidae (darters)	993 (207)	815 (170)	72 (15)	361 (75)	2,241 (467)
Salmonidae (trout)	0 (0)	272 (0)	0 (0)	0 (0)	272 (0)
Total	15,728 (870)	153,265 (12,274)	142,197 (5,532)	46,097 (1,828)	357,286 (20,504)

Suckers were later removed from the mortality results when it was determined that almost all of the suckers caught in the netting study were adults that were moving upstream to spawn in the spring.

Aside from the existing trashracks with 3-inch bar spacing and supporting the current Fishery Compensation Plan (see discussion below), PE Hydro proposes no additional measures to minimize fish mortality related to entrainment and impingement. West Virginia DEP supports continuation of the Fishery Compensation Plan in a letter filed with the Commission on June 26, 2017.

Our Analysis

Based on our analysis, the project intake structure includes trash racks with 3-inch bar spacing. This spacing size would make fish impingement during project operation unlikely. Fish impingement has not been documented at the project over the course of the current license.

Data from previous field entrainment studies (EEM, 1992) conducted at the project were used to estimate an annual mortality of about 21,000 fish at the project and that a large portion of those fish entrained are small smallmouth bass, small sunfish, and small catfish. This estimate is consistent with published literature on entrainment field studies, finding that most of the fish entrained at projects were smaller than 4 inches in length and were often juvenile fish or species such as minnows that never exceed a length of 3 or 4 inches. A review by EPRI (1997) found that overall, 90 percent of the fish entrained in 43 studies were smaller than 4 inches long. The West Virginia DNR fishery data for the Shenandoah River showed a similar distribution for fish entrained in the Millville Project. The loss of these young of year fish and minnows, which typically experience high natural mortality in fish populations unaffected by hydro operations, would be unlikely to affect the overall fish populations in the project area. In fact, the project area supports a robust sport fisheries, and does not appear to be substantially affected by any existing turbine mortality.

Review of the data indicates that entrainment and turbine mortality that could occur is likely to be minimal and exclusive to younger and smaller fish based on the fish population abundance data collected at the site. Further, the population abundance data shows an improving fishery. PE Hydro is proposing no changes in its operation and project facilities there is no reason to believe that the effects of the entrainment and mortality that is currently occurring would change in the future. The fishery has adapted to the current operational regime and is expected to continue to respond similarly in the future. Continued operation of the project would likely have little adverse effect on the overall fish community in the project impoundment.

Fishery Compensation Plan

PE Hydro supports the West Virginia DNR proposed Fishery Compensation Plan, which requires the applicant to pay West Virginia DNR annual, inflation-adjusted compensation that equates to the replacement value of all fishes assumed to suffer entrainment mortality at the project. In a letter filed with the Commission on December 8, 2016, PE Hydro recalculated the fish abundance scaling after removing the Catostomid (suckers) as previously stated (see Table 8). On April 19, 2017 West Virginia DWWM issued a 401 certificate that included the compensation plan as a requirement and set the first year cost of fish lost to be $21,137.64. PE Hydro requested a re-evaluation by West Virginia DWWM of the value of the fish lost because of turbine mortality in a letter filed

with the Commission May 4, 2017. On June 26, 2017 West Virginia DEP filed a revised 401 water quality certificate changing the first year value of the fish lost to $16,389.28.

As we noted above, there is no evidence that the current level of entrainment and mortality has any appreciable effect on the fish populations at the project (Table 8). Fish populations have generally evolved to withstand losses of smaller and younger individuals with little or no effect on long-term population sustainability (EPRI, 1987). The species predicted to be subject to the largest mortality (by number) also have a large average fecundity[16] and produce enough eggs to equal the estimated annual lost fish in a single spawn (Jenkins and Burkhead, 1994). In addition, the three species highlighted in Table 8 all use some form of parental care for their broods, increasing the likelihood of recruitment. As a result, the species most affected by entrainment are among the least vulnerable to the loss of a moderate number of juveniles.

Table 8. Recalculated annual fish entrainment mortality at the Millville Project and select annual spawn size ranges.

Species	Recalculated Estimated Annual Entrainment Mortality[a]	Single Year Spawn size range[a]
American Eel	64	Not applicable
Musky/Esox	0	Not applicable
Black Crappie	1	Not applicable
Largemouth/Micropterus sp.	20	Not applicable
Walleye	73	Not applicable
Bluntnose Minnow	76	Not applicable
Ictalurid (catfish) sp.	179	Not applicable
Yellow Perch/Greenside Darter	187	Not applicable
Carp	206	Not applicable
Shiner	977	Not applicable
Smallmouth bass	1,053	2,601-27,716
Channel Catfish	1,120	4,200-10,600
Lepomis (sunfish)	4,282	963-8,250[c]
Total	8,238	Not applicable

[a] Kleinschmidt letter filed December 8, 2016.
[b] Jenkins and Burkhead (1994).
[c] Spawn sizes for redbreast sunfish was chosen as the most typical species in this region.

[16] The fecundity of fish is described as seasonal spawning potential and alternatively is defined as the number of eggs ripening between current and next spawning period in a female. (Bagenal and Tesch, 1978)

Our Analysis

Review of the available data for the resident fishery in the project area (PE Hydro, 2014c) indicates a robust and improving fishery. Thus, while entrainment and turbine mortality of smaller individuals could occur, losses are not expected to affect fish populations appreciably, nor result in overall losses to the fishery at the project. We note that while conducting the study, the population numbers for the river reach had to be scaled up in the mortality model to account for the increases of fish abundance in the project area indicating that the project is not damaging the local resident fishery. In addition, there is no indication that West Virginia DNR plans to spend the compensation funds to further enhance the Shenandoah River fishery in the vicinity of the Millville Project to mitigate for these minor losses.

Special Status Species

Green Floater

PE Hydro proposes no new measures for the protection of this species. FWS made no recommendations, but states that it is may request measures to avoid impacts to green floater should the species be listed in the future.

Our Analysis

As stated above in section 3.3.2, *Water Resources*, and section 3.3.3, *Fishery Resources*, continuing to operate the project in run-of-river mode would maintain good water quality conditions and stable water levels in the project vicinity, which would serve to protect all aquatic organisms, including the green floater mussel. The green floater is a West Virginia State Special Concern Species, and is under review for federal listing. While this mussel may occur downstream of the project, continuance of the minimum flow and run-of-river operation would continue to provide the same environmental conditions under the new license that have sustained the mussel under the existing license.

American eel

PE Hydro proposes to continue to operate the Millville Project in a run-of-river mode, with a 200-cfs minimum flow released to the bypassed reach and nightly shutdowns from September 15 to December 15 for downstream eel passage. In addition, PE Hydro proposes to continue operating and maintaining the upstream trap and pass system for juvenile American eels and to further study the downstream migration timing and cues for adult American eels with possible adjustments to project operations. The desktop turbine entrainment fish mortality study estimated an annual average loss of 64 adult American eels at the Millville Project. (Table 8 above)

Downstream passage of adult American eel at the project has been the subject of on-going studies since 1994, and beginning in 2006, the PE Hydro began funding an eel study at Millville, Luray, and Warren Dams with West Virginia University (WVU) through a cooperative agreement with West Virginia DNR. The WVU studies (summarized in Eyler et al., 2016) indicate that several variables are associated with eel movement: a low lunar illumination (moon light) index, increased river flow, water temperature, and cloud cover. The studies further show that turbine shutdowns reduce eel mortality, and that September 15 to December 15 nightly shutdowns may not be the most effective at reducing eel mortality.

In November 2014, PE Hydro consulted with USGS and FWS regarding WVU and North Carolina State University developing a model to better predict when the project units should be shut down in order to accommodate downstream eel passage, while still maintaining the viability of the project. This model would consider the many environmental variables associated with adult eel migration. Once the model is developed, PE Hydro plans to develop an Eel Passage Operations Plan to test the project passage optimization model. PE Hydro would develop the operations plan in consultation with WVU, North Carolina State University, USGS, West Virginia DNR, and FWS. The plan would:

1) Describe the model;

2) Identify the environmental triggers for shutting down project operations;

3) Identify triggers for restarting project operations;

4) Define a mechanism for measuring success of implementing the model, both for downstream eel passage and for project economics; and

5) Propose a schedule for testing and adaptation of the model.

It is likely that the testing phase would continue for two years. If testing shows that implementation of the model is viable, then PE Hydro will petition the Commission to amend any new license issued for the project to make the new eel passage operations permanent. Should implementing the model fail to be successful, PE Hydro proposes to continue to operate under the existing agreement with the USFWS and would resume seasonal nightly shutdowns from September 15 to December 15. PE Hydro proposes to continue ongoing efforts with WVU, NC State University, USGS, and USFWS to develop and implement a predictive model to optimize downstream eel passage and project generation. Completing this plan is a special condition of the 401 certificate.

Our Analysis

Nightly shutdowns are designed to protect adult eels migrating downstream through the project area from turbine entrainment injury and mortality, although some injuries and mortalities could occur from the resulting spillway passage. The cost of deferred generation from temporary shutdowns as a protective measure for eels migrating downstream is less than the cost of building and maintaining permanent downstream eel passage and protection structures. Some projects implement 24-hour shutdowns for the entire migration season, while others, like the Millville Project, only shutdown from dusk to dawn during the period of peak migration based on site-specific monitoring or information from upstream projects (Richkus and Whalen, 1999). The results of Eyler et al. (2016) suggest that timing shutdowns based on site-specific eel monitoring data and environmental conditions would continue to reduce project-related eel mortality.

Cumulative effects

The existing hydroelectric projects located in the Shenandoah River Basin, including the Millville Project, have the potential to cumulatively affect American eels. Providing upstream passage for juvenile eels expands access to potential habitat upstream of the project dam, but eels must migrate back downstream (and to the ocean) to spawn as mature eels. The cumulative adverse effects, can occur as a result of interference with eel movements and turbine-related injuries and mortality from at multiple hydroelectric developments within a river basin (Eyler et. al., 2016).

Existing downstream passage measures reduce entrainment and turbine-related mortality and improve survival and outmigration rate for eels.

3.3.4 Terrestrial Resources

3.3.4.1 Affected Environment

Vegetation

The Millville Project is located along the boundary of the Ridge and Valley and Blue Ridge Ecoregions. The Ridge and Valley region is characterized by oak forests to the north and oak-hickory forests to the south. The Blue Ridge region is characterized by temperate broadleaf forests with a high diversity of flora, primarily made up of Appalachian oak forests; other species such as hemlock, hardwoods, and pine (Wiken et al., 2011).

Upland communities in the project area primarily consist of a mixed deciduous forest dominated by black oak, red oak, red maple, mockernut hickory, flowering dogwood, and American beech (FERC, 1987). Other common overstory trees in the project vicinity that are common along many of West Virginia's river valleys may

include red maple, black gum, and red oak at higher elevations and white ash, basswood, bitternut hickory, slippery elm, and tulip poplar at lower elevations. Sycamore, green ash, cottonwood, and silver maple are commonly found in floodplain habitats. Shrub layer vegetation varies, but could include mountain laurel, black huckleberry, maple leaf viburnum, American hornbeam, spicebush, and pawpaw (National Park Service; NPS, 2015).

Common herbaceous vegetation found in forested settings along the Shenandoah River include sunflowers, Virginia blue-bells, polypody fern, and Christmas fern. Lower elevations and floodplains support shield fern, New York fern, monkeyflower, joe-pyed weed, and New England aster (NPS, 2015).

Wetlands

As a result of the steep surrounding topography, wetlands that occur at the project are limited to a few narrow floodplain areas adjacent to the Shenandoah River and its tributaries. Based on the NWI maps, the area within the project boundary includes about 0.3 acres of emergent and 4.7 acres of forested wetland habitat. Most of the wetlands occur along the eastern shore, south of the dam, near the head of the impoundment, extending south to an area outside of the project boundary

The forested wetland habitat is dominated by broad-leaved woody vegetation that is at least 20 feet in height, typically sycamore, red-osier dogwood, yellow birch, and black willow. Other tree species within the local forested wetlands include red maple, ash, and other willow species. The only emergent wetland located to the south of the project, and within the project boundary, is vegetated with cattail, rushes, sedges, and purple loosestrife (FERC 1987). The NWI mapping classification indicates that this emergent wetland is dominated by common reed, a non-native invasive emergent species that typically forms a monoculture with low native plant diversity resulting in a poor wetland wildlife habitat (FWS, 2009).

Wildlife

There are over 200 resident and transient bird species, over 50 species of mammals, and 38 herptile species (Table 9) found in the habitats associated with the Shenandoah River corridor (NPS, 2015).

The species likely to be present within forested portions of the project area include white-tailed deer, red fox, raccoon, Virginia opossum, gray squirrels, and black bear. Open areas or grassland habitats support populations of eastern cottontail and meadow-jumping mouse (NPS, 2015).

Table 9. Herptiles potentially found in the Millville Project area. (Source: Marshall University, 2015).

Spring peeper	American toad	Upland chorus frog
Grey tree frog	Green frog	Pickerel frog
Cricket frog	Bullfrog	Fowler's toad
Wood frog	Northern leopard frog	Black ratsnake
Garter snake	Northern water snake	Queen snake
Black racer	Copperhead	Northern ring-neck snake
Smooth earthsnake	Timber rattlesnake	Worm snake
Five-lined skink	Jefferson salamander	Spotted salamander
Marbled salamander	Four toed salamander	Red-spotted newt
Northern two-lined salamander	Redback salamander	Long-tailed salamander
Valley and ridge salamander	Northern red salamander	Northern dusky salamander
Painted turtle	Snapping turtle	Box turtle
Common musk turtle	Red-eared slider	

Birds

Some of the most common bird species found along the Shenandoah River include warblers, vireos, crows and mourning doves. Other less-common bird species that are found in the area include red-breasted and Common mergansers that are seen during the winter months near the powerhouse, and grebes, osprey, bald eagles, and ducks which are seen downstream of the project later in the year (Potomac Valley Audubon Society, 2015; and staff observations). Game birds of the surrounding forest include eastern turkey and ruffed grouse (Venable, 1989). Additional species that may occur in the vicinity of the project are noted in table E4-11 (page 4-40) of the Millville revised final license application.

Special Status Species

Bald Eagle

The bald eagle was listed as federally-endangered on March 11, 1967, in part because of the significant population declines attributed to the use of the pesticide, DDT. After a DDT ban and other measures, bald eagle populations increased in the following decades. On July 9, 2007, FWS issued a final rule (Final Delisting Rule effective on August 8, 2007) removing the bald eagle from the list of endangered and threatened wildlife. The bald eagle, however, is still protected under the Bald and Golden Eagle Protection Act, as amended, and the Migratory Bird Treaty Act, as amended, both of which prohibit the take of bald eagles.

FWS developed National Bald Eagle Management Guidelines (May 2007) that recommend the following to avoid disturbance of nesting bald eagles:

- keep a distance between the activity and the nest (distance buffers);
- maintain preferably forested (or natural) areas between the activity and around nest trees (landscape buffers); and
- avoid certain activities during the breeding season.

Bald eagles are known to occur in West Virginia, however, eagles are a transient species unless nesting. FWS indicates that this species has the potential to occur in any county in West Virginia where suitable habitat exists. Currently there is no evidence of active or abandoned eagle nests in the project area.

3.3.4.2 Environmental Effects

Vegetation, Wetlands and Wildlife

PE Hydro proposes to continue operating the project in a run-of-river mode, with a 200-cfs minimum flow over Millville Dam. The agencies recommend this mode of operation, with no changes.

Our Analysis

Continued run-of-river operation of the project would maintain the impoundment level at 324 feet msl, or higher. The consistent impoundment elevation would continue to provide stable conditions along the project shoreline and protect riparian habitat used by wildlife. Downstream of the dam, riparian areas would be unchanged by continued run-of-river flows.

The vegetation and wetlands in the project area have adapted to the existing impoundment and flow releases and no changes to project operation are proposed. Therefore, no new effects to wetlands or riparian areas downstream of the dam would be expected. Maintaining the current operations would not result new effects to wildlife or their habitats.

Special Status Species

Bald Eagle Protection Measures

No bald eagles have been documented at the Millville Project, but suitable foraging habitat can be found within the project boundary. Given current population trends for the species, future use of the project area by bald eagles is likely, as suitable

habitat is widespread throughout the Shenandoah River valley. No proposals for bald eagle protection measures were recommended.

Our Analysis

The project's existing suitable habitat is reflective of current activities, having been shaped by long-term operation of the project. PE Hydro does not propose any changes to operation, except for the downstream American eel study and possible eel protection measures (e.g., operation schedule). The protection measures for American eels, however, are proposed for nighttime hours and during the fall and early winter, outside of the eagle nesting period. Continued operation and maintenance of the Millville Project would not disturb bald eagles or associated habitats.

3.3.5 Endangered Species

Bats

The Indiana and northern long-eared bats hibernate colonially in caves, mines, and other underground areas through the winter. Summer habitat requirements 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 which have exfoliating bark; and (3) barns or sheds. There are no known hibernacula or maternity roost trees in the project area. These bats are susceptible to the fungal white-nose syndrome[17], disturbance during hibernation by human activity in or near the entrances of their caves, loss or fragmentation of summer forest habitat, and pesticide usage that reduces the number of flying insects or causes accumulation of toxins in the bats (FWS, 2015b).

The Indiana bat is a federally listed endangered species that is known to occur in Jefferson County, West Virginia. The FWS listed the Indiana bat as endangered on March 11, 1967. Critical habitat for the Indiana bat was designated on September 24, 1976 and consisted of 11 caves and two mines in six states. The original recovery plan for the species was published in 1983 followed by a revised version was released in 2007. The non-hibernation season (roughly April 1 through November 15) includes spring emergence and migration, summer reproduction in maternity roosts, and

[17] White-nose syndrome is a white fungus affecting hibernating bats, named for the white fungal infection that appears on the muzzle and other parts of hibernating bats.

fall migration, swarming, and mating. Loss, degradation, and fragmentation of roosting habitat in hibernacula or maternity colonies are major factors in their decline.

The northern long-eared bat was listed as federally threatened on April 2, 2015. In January 2016, FWS finalized the 4(d) rule for the this species which focuses on preventing effects on bats in hibernacula associated with the spread of white-nose syndrome and effects of tree removal[18] on roosting bats or maternity colonies (FWS, 2016). As part of the 4(d) rule, FWS proposes that take incidental to certain activities conducted in accordance with the following habitat conservation measures, as applicable, would not be prohibited: (1) occurs more than 0.25 mile from a known, occupied hibernacula; (2) avoids cutting or destroying known, occupied maternity roost trees during the pup season (June 1 - July 31); and (3) avoids clearcuts within 0.25 mile of known, occupied maternity roost trees during the pup season (June 1 - July 31).

Traditional ranges for the northern long-eared bat include most of the central and eastern U.S., as well as the southern and central provinces of Canada, coinciding with the greatest abundance of forested area. Habitat includes large tracts of mature, upland forests and typically feeds on moths, flies, and other insects. These bats are flexible in selecting roost sites, choosing roost trees that provide cavities and crevices. Winter hibernation typically occurs in caves and the areas around them can be used for fall-swarming and spring-staging. No critical habitat has been designated for this species.

Bat Protection Measures

PE Hydro proposes to operate the project in a run-of-river mode, with a 200-cfs minimum flow in the bypassed reach. The agencies also recommend this mode of operation. In addition to project operation, PE Hydro also would conduct project-related maintenance activities of the project works and transmission lines, which currently are not forested. No other measures are proposed or recommended that would affect the two bat species.

In a letter filed December 23, 2016, based on the information available, FWS assessed relicensing the Millville Project as having no effect on the northern long-eared bat. FWS based its assessment on the facts that the proposal was limited to continuing operations with no changes and updating the project boundary.

---

[18] FWS defines "tree removal" as cutting down, harvesting, destroying, trimming, or manipulating in any other way the trees, saplings, snags, or any other form of woody vegetation likely to be used by northern long-eared bats (81 Federal Register 1902 (January 14, 2016)).

Our Analysis

Indiana bat and northern long-eared bat are known to occur in Jefferson County, West Virginia. These species could occur adjacent to the boundaries of the Millville Project, but are not known to hibernate near the project.

There are very few trees that could potentially provide adequate habitat for the Indiana and northern long-eared bats within the project boundary, and no new project construction is proposed. PE Hydro does not propose any actions that would result or require damaging or clearing forested lands. Project operations would not cause adverse effects on bat habitat or food availability. For these reasons, we conclude that relicensing the project would have no effect on the Indiana bat or the northern long-eared bat.

3.3.6 Recreation and Land Use

3.3.6.1 Affected Environment

Recreation

Statewide Recreation Plan

West Virginia's Statewide Comprehensive Outdoor Recreation Plan (SCORP) 2015-2020 guides recreation planning and development in the state. The SCORP sets three broad goals for recreation planning, which include: (1) ensuring repair, restoration, and maintenance of existing parks to support growing demand; (2) encouraging park renovations that promote active lifestyles, revitalize community cores, and retain visitors; and (3) supporting recreational trail development. The SCORP identifies the need to maintain and enhance parks to accommodate increased demand and changes in use over time as a primary issue facing West Virginia's public recreation areas (West Virginia DOC, 2015).

Regional Recreation

West Virginia's Eastern Panhandle supports a number of recreational uses and is a regional recreation destination for both cultural-heritage and outdoor-recreation based tourism (JCCVB, 2017). Recreation destinations include the George Washington and Jefferson National Forests, Harpers Ferry National Historical Park, the Appalachian National Scenic Trail, Berkeley Springs State Park, Cacapon Resort State Park, Shannondale Springs Wildlife Management Area, Sleepy Creek Wildlife Management Area, and Widmeyer Wildlife Management Area. These federally- and state-managed recreation areas offer opportunities for hiking, camping, fishing, hunting, wildlife viewing, and sightseeing. Local parks also provide a wide variety of recreation amenities.

Recreation on the Shenandoah River

The Shenandoah River is an important recreation destination in Jefferson County. The river is used for water-based activities like (motorized) boating, whitewater rafting and kayaking, float tubing, canoeing, and fishing. Parks and trails along the river are used for land-based activities such as hiking, camping, sightseeing, bird watching, and picnicking. Several public boat-launch facilities are located along the Shenandoah River in Jefferson County, including the Meyerstown boat launch, about 6 miles south (upstream) of the project; the Shannondale Springs boat launch, about 4 miles southwest (upstream) of the project; and the Harpers Ferry boat launch, about 5 miles northeast (downstream) of the project. Four commercial outfitters provide guided canoe, kayak, or raft tours and float tubing on the Shenandoah River in the project vicinity.

Stocked trout fishing opportunities are plentiful, including Bullskin Run, a tributary of the Shenandoah River about 6 miles southwest of the project; Evitts Run, a tributary or the Shenandoah River about 5 miles west of the project; and Long Marsh Run, a tributary of the Shenandoah River about 5 miles southwest of the project. The mainstem Shenandoah is known for its warm water sport fishery and is considered one of the top smallmouth bass rivers in the eastern United States. Recreational fishing pressure is high, but harvest is generally low because of high levels of PCB contamination rendering fish within the basin unfit for consumption.

Recreation at the Millville Project

Recreation access is plentiful within the project boundary. Two non-project recreation sites, located on lands outside of the existing Millville project boundary, provide direct access to the project's impoundment: Bloomery Informal Access Site and Moulton Park. The non-project Millville boat launch, which is located within the project boundary, but managed by West Virginia DNR, provides boat access to the impoundment from the south. In addition to these non-project recreation sites, PE Hydro provides project recreation at four sites: the Big Eddy Recreation Area, the Upper Angling Access Trail, the Lower Angling Access Trail, and the Downstream Access Recreation Area. The locations of these existing recreation sites, relative to the project, are depicted in figure 2, below.

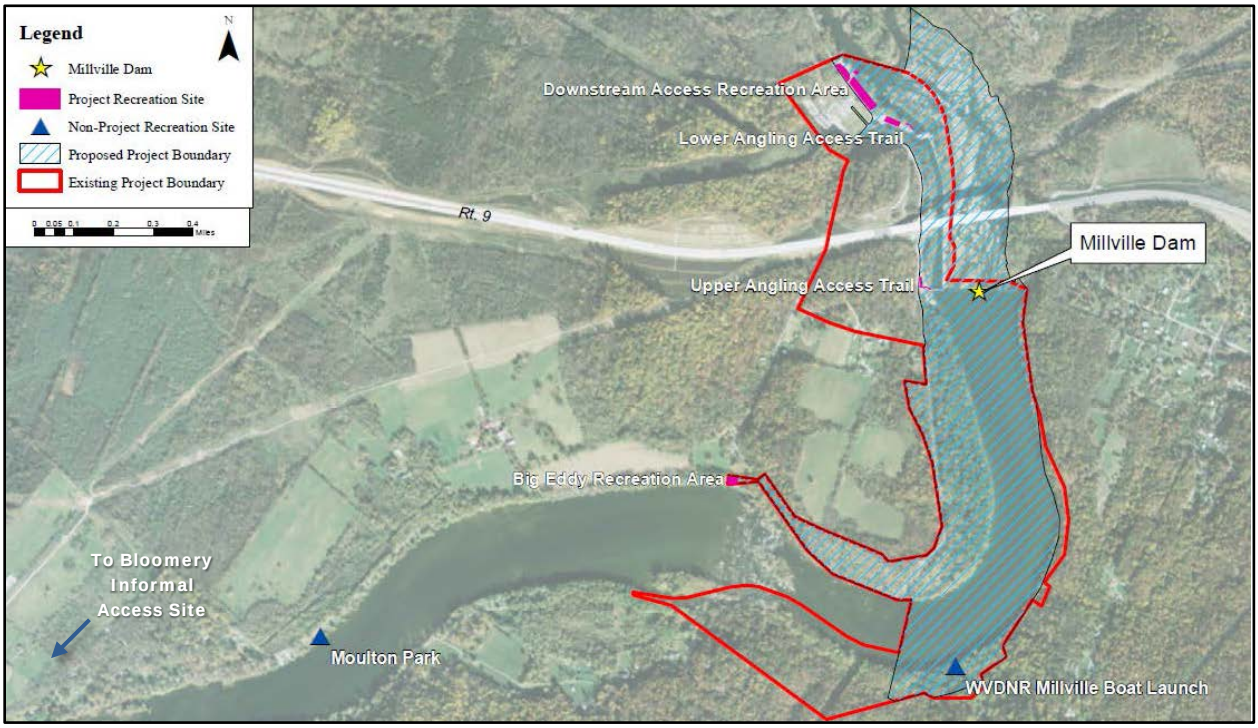

Figure 2. Recreation facilities (Source: Kleinschmidt, 2015b, as modified by staff).

Non-project Recreation

Bloomery Informal Access Site is located approximately 2 miles upstream of the project, below the Route 115 Bridge on Wilt Road. The site, which is managed by West Virginia DNR, provides informal angling access to the Shenandoah River. Boaters also use this site as a hand-carry put-in and take-out, providing direct access to the project impoundment (West Virginia DNR, 2003). The site provides roadside parking for approximately nine vehicles (Kleinschmidt, 2015b).

Moulton Park is located upstream of the project, approximately one mile from Big Eddy Recreation Area. Moulton Park provides 11 tent camping sites, as well as picnic tables, an interpretive display, and a restroom. Accessible parking, camping, and restroom facilities are provided for persons with disabilities. Moulton Park is managed by the Jefferson County Parks and Recreation Commission (Kleinschmidt, 2015b).

West Virginia DNR owns, operates, and maintains the Millville boat launch, which is located about 4,500 feet upstream of the dam, on the south bank of the Shenandoah River. This site contains a single-lane concrete boat launch, paved parking area marked for 10 vehicles, and gravel parking area to accommodate an additional 20 to 25 vehicles (Kleinschmidt, 2015b).

Project Recreation

Recreation activity at the project is supported by four existing license-required public recreation sites. The Big Eddy Recreation Area and the Downstream Access Recreation Area were developed by the licensee as required under the original license for the project. Development of pedestrian angler access to the bypassed reach (i.e., the Upper Angling Access Trail) and a walkway and fishing platform providing angling access to the tailrace (i.e., the Lower Angling Access Trail) were required under Article 408 of the existing license, through a Recreation Resource Plan approved by the Commission on January 19, 1989.[19]

Located upstream of the dam, the Big Eddy Recreation Area contains a single-lane, gravel boat ramp for non-motorized, car-top boat access. An associated gravel parking area provides space for approximately 12 vehicles. Shoreline angling access is also available at the site. The site is operated under an agreement between PE Hydro and West Virginia DNR, where West Virginia DNR operates and manages the site and the licensee provides for collection and disposal of refuse and other maintenance.

The Upper Angling Access Trail provides angling access to the impoundment, upstream of the dam, and to the bypassed reach of the Shenandoah River downstream from the dam and adjacent to the project headrace. The trail is served by the headrace parking area with three roadside parking spaces. The angler trail continues from the parking area to Millville Dam, where it splits. An unimproved trail continues south to provide shoreline access to the impoundment. Anglers may also cross Millville Dam at the headgate structure and follow a concrete catwalk and steps leading to the western shoreline of the bypassed reach between the Shenandoah River and the headrace canal. The Upper Angling Access Trail is operated under an agreement between PE Hydro and West Virginia DNR, where West Virginia DNR operates and manages the site and the licensee provides for the collection and disposal of refuse and other maintenance.

The Lower Angling Access Trail, located directly downstream of the powerhouse, is a short trail that includes steps and a walkway to a small concrete fishing platform along the left bank of the Shenandoah River. A small gravel parking area provides space for three vehicles. This site is operated and maintained by PE Hydro.

---

[19] *See* Order Approving and Modifying Recreational Resources Plan, 46 FERC ¶ 62 047 (1989). This plan also approved construction of an access road and boat slide about 300 feet above the dam for boat access to the reservoir; this facility was not constructed. Instead, the licensee worked cooperatively with West Virginia DNR to construct the Millville boat launch, described above.

Just downstream of the powerhouse, the Downstream Access Recreation Area provides access to the lower tailwater and river shoreline for angling and non-motorized boating. This area includes a 2-lane gravel boat launch for non-motorized, car-top boats, a picnic area with 5 picnic tables and a gravel parking area with space for approximately 25 vehicles. This site is also used by commercial outfitters for float tube trips. The Downstream Access Recreation Area is operated under an agreement between PE Hydro and West Virginia DNR, under which West Virginia DNR operates and manages the site and the licensee provides for the collection and disposal of refuse and other maintenance.

Land Use

The existing project boundary encloses 287.7 acres, which include the project facilities and upland areas associated with the project recreation facilities, as well as additional state- and privately-owned lands that are not used for project purposes. Land use near the project is largely undeveloped, consisting of deciduous forest, pasture/hay, and some evergreen and mixed forest. Other land uses in the vicinity of the project include cultivated crops, evergreen forest, and low-intensity residential development.

There is no land in the immediate vicinity of the project that is included in the national trails system or designated as wilderness. No portion of the Shenandoah River is included on the list of Wild and Scenic Rivers.

3.3.6.2 Environment Effects

Existing Public Access and Recreation Facilities

In 2014, PE Hydro conducted a Recreational Use Assessment to evaluate existing recreation use, facility conditions, and visitor needs at the project and to collect data that would inform calculations of future recreation use. The study was conducted using on-site observations, visitor surveys, and commercial outfitter surveys.

The Recreation Use Assessment suggested that the existing recreation facilities receive low-to-moderate use and are currently adequate to support existing demand. For the April 2014 to October 2014 summer recreation season, a total of 108,841 recreation days[20] were spent at the project. Commercial outfitter trips originating from the project's Downstream Access Area account for about 66 percent (60,980 recreation days) of all recreation use. The remaining 44 percent were individuals visiting the project (47,861 recreation days). On weekends during the recreation season, Big Eddy had the lowest recreation pressure, at 20.1 percent of capacity as measured by parking space availability,

[20] Recreation days are equivalent to the number of people visiting the project to participate in a recreation activity at any time during a 24-hour period.

while the Lower Angling Access Trail had the highest recreation pressure, at 63.4 percent of capacity. Winter use was much lower across all sites, estimated at only five percent of the total recreation use (Kleinschmidt, 2015b).

Surveyed visitors[21] ranked bank/shoreline fishing as the most popular primary recreation activity (36 percent) followed by picnicking (14 percent). Swimming was also popular as a secondary recreation activity. Forty percent of visitors to the project cited the Downstream Access Area as their most frequently visited recreation site, not only at the project, but also for all recreation sites in the region. When asked about the condition of the project's recreation facilities, 56 percent of visitors rated the condition as "good." The Lower Angling Access Trail was rated in the best condition with an average rating of 3.4 (on a scale from 1"poor" to 5 "excellent). The Upper Angling Access trail had the lowest reported score for condition, with an average rating of 2.5. Over 68 percent of survey respondents indicated the need for additional site amenities or improvements. Approximately 28 percent of respondents stated that trash cans were needed. Restrooms and picnic tables were also cited frequently as needed amenities by survey respondents. In a separate survey of commercial outfitters, respondents requested facility enhancements at the Downstream Access Area, including restrooms, trash pickup, expanded parking, and improved boat ramp access below the dam (Kleinschmidt, 2015b).

Future recreation use at the project was estimated based on population projections for Jefferson County. The regional population is expected to increase by approximately 5 percent through 2020 and an additional 8.6 percent through 2030. Assuming that participation rates in recreation activities remain relatively stable, the change in visitor use is expected to be commensurate with the change in population.

Based on the results of the Recreational Use Assessment, as well as conversations with stakeholders, PE Hydro developed a Final Recreation Management Plan (RMP) for the project (Kleinschmidt, 2016). The plan establishes procedures and guidelines for the management of project recreation facilities at the Millville Project. In the plan, PE Hydro proposes to maintain existing project recreation facilities: the Big Eddy Recreation Area, the Upper Angling Access Trail, the Lower Angling Access Trail, and the Downstream Access Area. At the existing facilities, PE Hydro would add trash receptacles and provide trash removal from the sites on a regular basis. PE Hydro also proposes to

---

[21] Surveyed visitors were individuals visiting the Upper Angling Access Area, Lower Angling Access Trail, Downstream Recreation Area, Big Eddy Recreation Area, and West Virginia DNR's Millville Boat Launch. Visitors participating in trips sponsored by commercial outfitters were not specifically targeted. Commercial outfitters received a separate request for monthly visitor use totals and were surveyed about perceptions of crowdedness, conditions of the Downstream Access Area, and recommended improvements.

increase monitoring and maintenance of the existing facilities in collaboration with West Virginia DNR.

In addition to maintaining the existing recreation sites, PE Hydro proposes to formalize a portage trail around the dam to allow paddlers to carry non-motorized boats around the dam and launch downstream at the Downstream Access Area. PE Hydro would also add signage at appropriate locations along the route.

The plan also contains provisions for PE Hydro to review the RMP every 6 years at the time of the filing of the Licensed Hydropower Recreation Report (FERC Form 80) in consultation with West Virginia DNR. PE Hydro would revise or update the plan, and file with the Commission for approval, if modifications were needed to meet recreation access and demand at the project.

In their comments on the ready for environmental analysis notice, Interior (FWS) and American Whitewater support PE Hydro's proposal to maintain the existing public access sites at the project. American Whitewater and Interior (NPS) also support PE Hydro's proposed portage around the project, which would provide an important link and safety feature for boaters and encourage long-distance downstream travel on the Shenandoah River. West Virginia DEP's 401 certification includes requirements for: (1) a boat portage around the dam with associated signage, as proposed by PE Hydro; (2) trash receptacles and trash removal at the four project recreation sites, as proposed by PE Hydro; (3) inspection of the four project recreation areas each spring and following any high-water event to assess public accessibility to the site, the condition of the parking areas, and the condition of the recreation facilities, as proposed by PE Hydro; and (4) ADA-compliant portable restroom facilities at the Downstream Access Area, Big Eddy Access Area, and Lower Angling Trail Parking Area beginning from, at a minimum, April 1 through November 1 of each year, beginning in 2018.

Our Analysis

PE Hydro's proposed RMP helps address needs identified in the West Virginia SCORP (West Virginia DOC, 2015). In particular, the plan's emphasis on increased monitoring and maintenance of the project recreation sites helps meet the SCORP's goal of ensuring repair, restoration, and maintenance of existing parks to support growing recreational demand. The addition of trash receptacles at all project recreation sites and provision of garbage removal on a regular basis would also address these goals.

By adding a portage trail at the project, the RMP supports the West Virginia SCORP's goal of encouraging development of recreational trails by encouraging use of the Shenandoah River as a water trail. The portage trail would also help formalize any informal portaging that occurs currently at the site by guiding visitors to a signed path between the reservoir and the Downstream Access Area. This signed path would

improve visitor safety by directing users away from hazardous areas near the dam to a suitable location for portaging.

Although the RMP addresses stakeholder requests for improved facility conditions (particularly garbage collection and removal), adding restroom facilities as required by the 401 certification, at the Downstream Access Area, Big Eddy Access Area, and Lower Angling Access Trail parking area, would facilitate use of the site by both individuals and visitors on trips sponsored by commercial outfitters. Restrooms were identified as needed in both the on-site surveys and commercial outfitter surveys. Providing restrooms would help improve visitor comfort and sanitation at the project's recreation areas.

Effects of Continued Project Operation on Float and Paddle Trips

PE Hydro proposes to continue to operate the project in run-of-river mode with a minimum flow of 200 cfs, or inflow, to the bypassed reach. Under its existing license, PE Hydro shuts down the project during the fall (from September 15 to December 15) from 6 p.m. until 6 a.m. to support downstream adult eel passage. Under a new license, PE Hydro proposes to manage adult eel passage shutdowns using a predictive model and implementation plan developed in consultation with West Virginia University, North Carolina State University, USGS, West Virginia DNR, and FWS. If implementation of the model fails to be successful, PE Hydro proposes to operate the project using the existing shutdown regime.

In comments provided during scoping and on the draft license application, Matthew Knott, owner of River Riders (a commercial outfitter), identified fluctuations in flow downstream of the project dam (logged at the USGS Millville stream gauge, USGS 01636500, approximately 0.5 miles downstream of the project) during eel shutdowns as an area of both interest and concern for commercial outfitters and paddlers. In comments on the Draft License Application, American Whitewater, the Canoe Cruisers Association of Greater Washington, DC, and the Potomac and Shenandoah Riverkeeper also identify fluctuations and flow during eel passage project shutdowns as an area of interest for paddlers. In comments on the Commission's notice that the project was ready for environmental analysis, American Whitewater requests that recreation interests be represented in discussions of the predictive model for eel passage shutdowns and associated implementation plan so that paddlers can take advantage of any beneficial flows from shutdowns for eel passage.

In its response to comments on the draft license application, PE Hydro acknowledges the short-term fluctuations in flows measured at the USGS Millville stream gauge that occur during shutdowns for downstream eel passage. PE Hydro states that the change in flows following unit shut-down or start-up attenuates within approximately two hours of a change in flow. The changes in flow result from several factors, including the shift in location of flow releases between the spillway and powerhouse, location and design of the power canal, and location of the stream gauge

relative to the powerhouse tailrace. In response to comments requesting that recreation interests be represented in discussions of shutdowns for downstream eel passage, PE Hydro stated that shutdowns were likely to continue occurring at night when recreational boating interests were unlikely to be affected. However, if eel passage protocols resulted in a scenario where shutdowns did not occur at night, PE Hydro would be willing to consult with local commercial outfitters to discuss boating opportunities.

Our Analysis

Although the Millville Project operates in run-of-river mode, where inflow is equal to outflow, unique characteristics of the project's location and design contribute to fluctuations in flow when the project shuts down nightly from September 15 through December 15 to allow for downstream adult eel passage. When shutdowns occur, the Millville stream gauge shows a temporary decrease in flow (at approximately 6 p.m.). When the project resumes operations at 6 a.m., the Millville stream gauge shows a temporary increase in flow. The changes in flows at start-up and shut-down attenuate within approximately two hours (see figure 3).

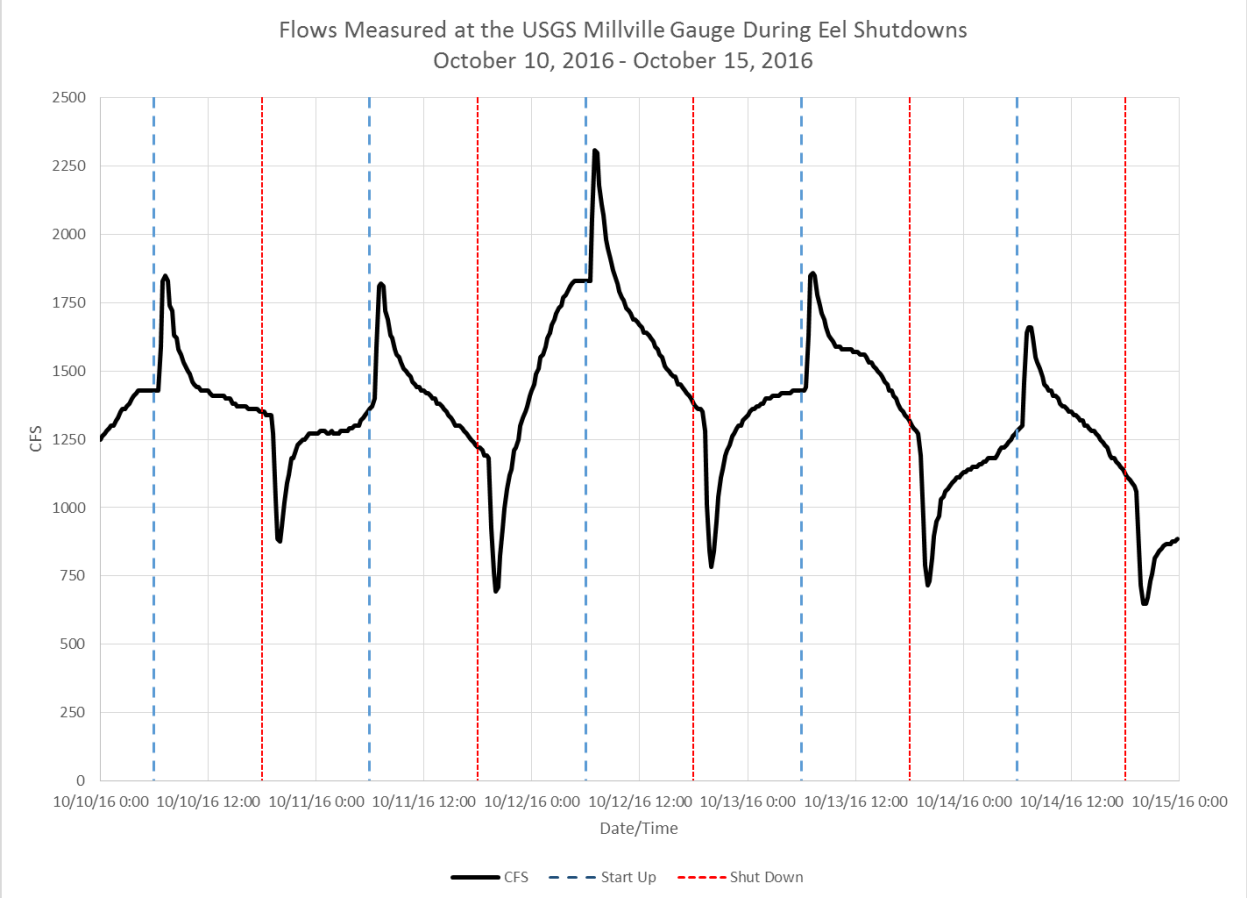

Figure 3. Flows Measured at USGS Millville stream gauge 01636500 during eel shutdown period. (Source: USGS, 2016, as modified by staff).

Several factors may contribute to the flow fluctuations that occur as a result of the shutdowns. One factor is the shift in the location of flow releases (i.e., through the powerhouse or over the dam). Flows through the powerhouse are concentrated in a relatively narrow area, while flows over the dam are spread across a much larger cross section on river (see figure 4). Additionally, the design of the project provides a limited area for storage of water within the power canal, which is located upstream of the powerhouse, along the left bank of the river. When the project shuts down, flows from the river continue to pass down the power canal, pooling behind the powerhouse gates. Excess flows that would otherwise be diverted through the powerhouse during normal operations then begin spilling over the dam. Similarly, when the turbines are turned on in the morning, water held overnight in the power canal is added to what is already in the river downstream of the project, causing the gauge to read higher flows while water pooled in the power canal drains.

Figure 4. Project configuration in relation to the Millville stream gauge. (Source: Google, Inc., 2016, as modified by staff).

PE Hydro does not use shutdowns as a way to store water for peaking operations or any other purpose. Rather, the shutdowns for eel passage inadvertently create a situation where a limited amount of water is stored when the project is not generating, which is released as soon as a shutdown ends. Outside of project shutdowns, there is no viable way for PE Hydro to provide specialized flows for recreation or any other purpose using releases through the powerhouse. Although PE Hydro could alter project operations to increase flows through the bypassed reach, because the project operates as run-of-river, there would be no discernable effect on downstream recreation. The majority of float/paddle recreation downstream of Millville Dam initiates at the Downstream Access Area, which is below the confluence of the project tailrace and bypassed reach, where flows from the tailrace and bypassed reach have merged and any increased flow resulting from project shutdowns has attenuated.

Under PE Hydro's proposal, eel shutdowns would continue to have minor, temporary effects on recreation downstream of the project. Because eel shutdowns occur in the Fall from September 15 through December 15, when flows in the Shenandoah River are naturally low, shutdowns may negatively affect paddlers on fall evenings when shutdowns occur (assuming a 6 p.m. shutdown time), exacerbating existing low-flow conditions in the river. Further, when the project resumes operations, increased flows at project start-up may be desirable for some recreationists wishing to take advantage of the temporarily higher flows. Because PE Hydro proposes to implement a predictive model for eel shutdowns rather than a consistent schedule of shutdowns as under the current license, providing information via a public website or telephone line, detailing the days and hours of shutdowns could help inform commercial outfitters and individuals about changes in project operations that may affect flows downstream of the project.

Project Boundary Modification

PE Hydro proposes to remove lands from the project boundary which it has concluded are unnecessary for project operations. These lands include: (1) a 91.2-acre parcel at the northwest corner of the existing boundary, which contains a non-project substation (parcel A); (2) a 61.6-acre parcel on the southwest side of the river, upslope of the project (parcel B); and (3) two parcels (parcels C and D), totaling 8 acres on the east side of the river. Figure 5 depicts these parcels. PE Hydro also proposes to add a 61.5-acre parcel to the project which contains the project's bypassed reach and follows the river's east shoreline.

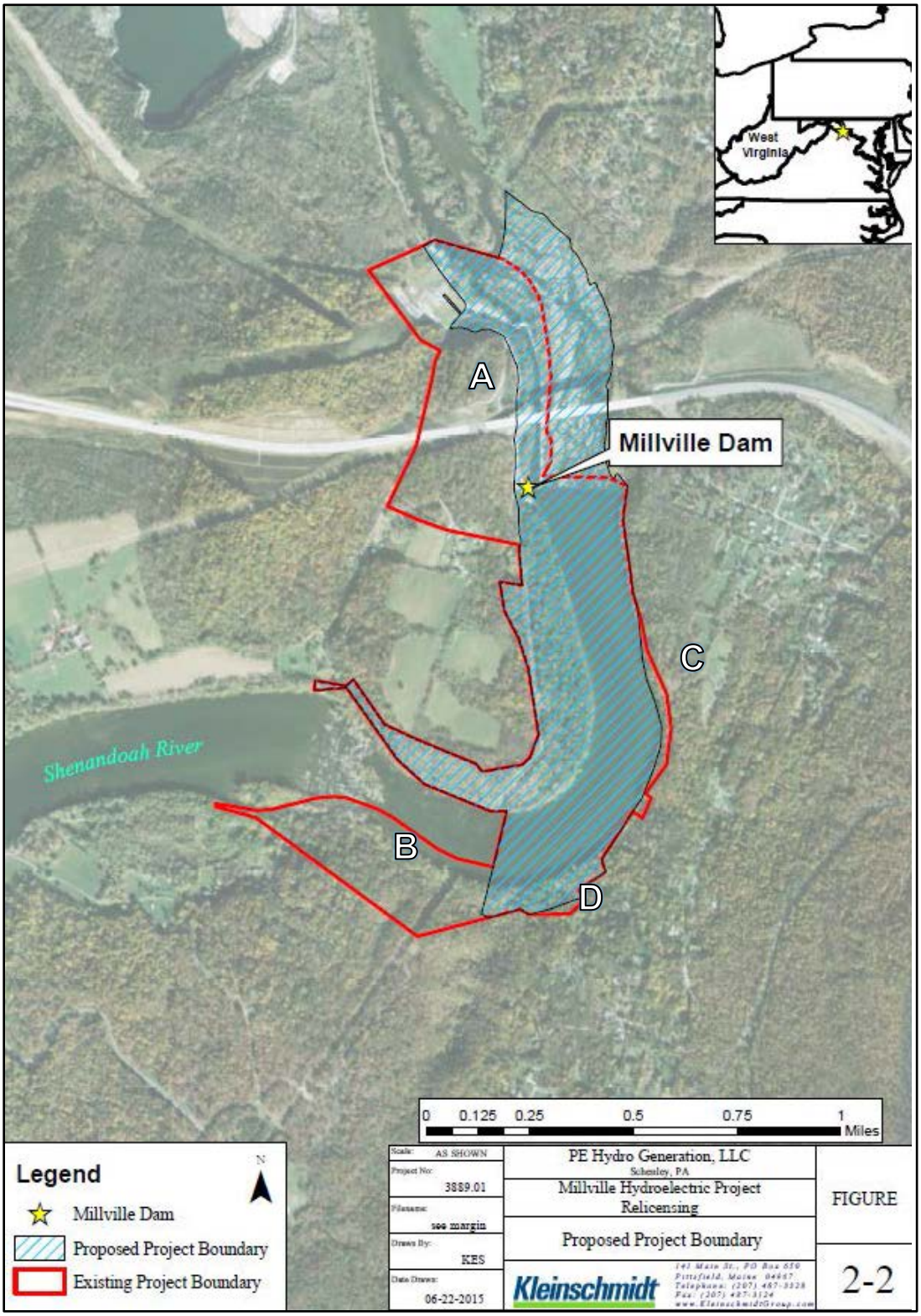

Figure 5. Proposed project boundary modifications. (Source: license application, as modified by staff).

Interior (NPS) comments that PE Hydro did not provide a clear description of the possible uses for some lands recommended for removal from the project boundary (particularly, parcel B). The NPS requests that any potentially developable lands proposed for removal from the project boundary be subject to a commitment from PE Hydro to ensure that the lands remain undeveloped, or be used to enhance recreational uses.

In reply comments, PE Hydro reiterates its purpose in revising the project boundary. It plans only to remove lands from the project boundary that occur outside of the flowage area, and that are not needed for operation or maintenance of the project or for other project purposes.

Our Analysis

PE Hydro proposes to enclose within the project boundary all lands associated with project operation, maintenance, and public access. The project boundary follows the 340-foot contour, which corresponds to the 100-year flood elevation except where it also extends upland to enclose project facilities and project recreation areas. The excess lands PE Hydro proposes to remove from the project boundary are not currently used for any project purpose, nor are they required to provide public access to the project.

Typically, the Commission does not include lands within a project boundary where the sole purpose for doing so is to protect them from undesirable use or development.[22] The NPS identified no specific resource management goals associated with the project or its effects that would warrant permanent protection of the lands that PE Hydro proposes to remove from the project boundary.

Regarding NPS's request to develop the lands for recreation use, PE Hydro's Recreation Use Assessment indicated that the existing recreation facilities typically were used well below capacity and that additional facilities were not warranted (Kleinschmidt, 2015b). In addition, these lands are not well-suited for public access, because of steep topography or they are not needed for public access because of the close proximity of other, existing recreation access points.

[22] *See* Great Northern Paper Co., 85 FERC ¶ 61,316 (1988), reconsideration denied, 86 FERC ¶ 61,184 (1999), aff'd on other grounds, CLF v. FERC, 216 F.3d 41 (D.C. Cir. 2000); Wisconsin River Power Co., 27 FERC ¶ 61,225 (1984).

3.3.7 Cultural Resources

3.3.7.1 Affected Environment

Area of Potential Effects

Under section 106 of the NHPA of 1966, as amended, the Commission must take into account whether any historic properties within a project's APE could be affected by the project. The Advisory Council on Historic Preservation defines an APE as the geographic area or areas in which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. We define the APE for the Millville Project as the project boundary. The West Virginia SHPO concurred with use of the project boundary as the APE by email dated October 30, 2014 (filed with the license application).

Cultural History Overview

Prehistory

Prehistoric occupation of West Virginia first occurred during the Paleo-Indian Period (10,500–9000 B.C.). Paleo-Indian peoples were big-game hunters with widely scattered, temporary settlements. The characteristic artifacts of this period are fluted projectile points, including those known as Clovis and Cumberland. The Terminal Paleo-Indian period (9000–8000 B.C.) is marked by the appearance of a variety of corner and side-notched projectile points such as Thebes and Dovetails. These points have heavy basal grinding and flaking patterns characteristic of Clovis, but differ in that the blades are broader and the bases are notched rather than fluted. Artifacts from the Paleo-Indian Period are found rarely in West Virginia; primarily along the Ohio and Kanawha Rivers (Maslowski, 2016).

During the Archaic period (8000–1000 B.C.), a more temperate climate led to a shift from big game hunting to more varied or broad-spectrum hunting and gathering, which included the hunting of deer and small mammals as well as the collecting of nuts, berries, seeds, and other plant foods. Artifacts made by pecking, grinding, and polishing include adzes, axes, and bannerstones which were used as balance weights on spear throwers. Mortars and pestles and nutting stones indicate increased use of plant foods. The Late Archaic period (3000–1000 B.C.) was a time of population increase with more complex social organization, with wild plants being cultivated and domesticated. Distinct cultural groups began to appear, which would to continue to develop into the societal groups of the Woodland Period (Maslowski, 2016).

The Woodland Period (1000 BC to 1200 AD) includes two major developments, the manufacture of pottery and the construction of burial mounds. During this period Woodland peoples continued to experiment with plant domestication. Woodland

horticulture is also documented in the analysis of charcoal from Woodland pits, which have an increase in pine and other woods that are associated with land clearing. Cultural groups within the Woodland Period are documented based on the characteristics of their ceramics and burial practices. The earliest known settlements in the eastern panhandle region of West Virginia date to the Woodland Period (Maslowski, 2016; Thornton, 2013).

The Late Prehistoric Period (A.D. 1200–1550) is marked by the advent of intensive corn cultivation and a more sedentary village life. Diagnostic artifacts include shell-tempered pottery, triangular arrow points, ceramic pipes, shell hoes, shell beads, bone beads, and bone fishhooks. Late Prehistoric villages were generally circular and ranged from two to five acres in size. Evidence of several late prehistoric village complexes has been found in areas around the Potomac River and its tributaries. As trade increased, these villages traded goods more frequently. By the Protohistoric period (A.D. 1550–1690) the existing villages had access to European trade goods but no direct contact with Europeans. By the time of European contact in the early 1700s, all Prehistoric/Protohistoric villages were abandoned because of incursions from the Iroquois. Other tribes, including the Shawnee and Delaware, used the region as a hunting ground (Maslowski, 2015).

History

Early European exploration of the Shenandoah Valley, in what is now Virginia and West Virginia, began in the late 17th century, with the junction of the Potomac and Shenandoah Rivers first mapped in 1707. After this era of early exploration, Europeans began establishing settlements in the area in the 1710s and 1720s. What is now Millville, located on the Shenandoah River 5 miles upstream of the junction with the Potomac, emerged as a small settlement near a ford in the river. Ferry service was established at the ford in 1746, and the area became known as Keyes Ford. Because of the ferry service and a natural gap (Vaughn's Gap) in the Blue Ridge Mountains, the settlement became an important link between the shipping hub of Alexandria, Virginia and the fertile farmlands in the Shenandoah Valley (Harvey and Green, 2015).

Millville, and the Shenandoah River in its vicinity, became the center of a variety of industrial enterprises in the late 18th and early 19th centuries. The most important transportation-related undertaking in the region was carried out by the Potowmack Company, which received permission from the State of Virginia in 1802 to build a canal and set of locks along the river to bypass Little's Falls, immediately downstream of Big Eddy, a large bend in the river that now forms the upstream extent of the project boundary. Construction of the canal and locks were complete by 1806. At that time, a mill was also constructed to use water from the canal as a power source (Harvey and Green, 2015).

By 1852, industrial developers had constructed two dams in the Millville vicinity. The dam at Little Falls Canal supplied water to power Katz's Woolen Mill and Hopewell Mills, while a dam in the vicinity of the existing project's dam supplied water to power Millville Mills—a grist mill that had a capacity of 125 barrels of flour per day. Millville Mills, constructed in 1836, was located in approximately the same location as the project's powerhouse. By the late 1880s, the Little Falls Canal had fallen into disuse and Katz's Woolen Mill and Hopewell Mills were abandoned. In aerial photography from approximately 1900, only one of the two buildings remained standing. Millville Mills was replaced with present Millville Project powerhouse in 1906 (Harvey and Green, 2015).

Development of a power plant at Millville was initiated by the Winchester and Washington City Railway Company in 1906. The goal for the project was to supply electricity to supply electricity for the towns of Charles Town, Berryville, and Winchester, as well as other small communities within 20 miles of the project. The company removed the remains of Millville Mills and the original timber crib dam. A new dam was built using a combination of stone and Portland cement. The company enlarged the mill's existing 800-foot raceway and built a 12-to-18-foot stone wall that separated the raceway from the river. It was also elongated by an additional 800 feet. The two segments compose the project's existing power canal. A 28-foot-tall concrete and brick powerhouse was constructed housing four flywheel generators with a total capacity of 3,000 horsepower. In 1938, the original brick powerhouse was destroyed in a fire and the existing powerhouse was constructed in 1939. The current powerhouse contains three generating units: unit 1 dates to 1913, and survived the 1938 fire; units 2 and 3 were installed in 1939. Other modifications to the project's original features include a rebuilt intake structure (1960), concrete braces on the headrace wall (1960s), and removal of a weir gate at the upstream end of the power canal and recovering of the headrace wall (2010-2012) (Harvey and Green, 2015).

Historic Properties

There are no known National Register-eligible archeological resources within the project's APE. By letter dated December 10, 2012 and filed with the final license application, the West Virginia SHPO indicated that no previously documented archeological sites were located within the project's APE. Further, the SHPO commented that archeological surveys within the project's APE were not necessary because no ground disturbing activities were proposed as part of the project's relicensing.

Harvey and Green (2015) evaluated three existing architectural properties within the project's APE for National Register eligibility. These properties include: the Millville Project facilities; the remains of Little Falls Canal; and a wall associated with the Hopewell Mills factory. Of these, Harvey and Green recommended the Little Falls Canal and the Hopewell Mills factory wall as National Register-eligible. Little Falls

Canal was recommended eligible under Criterion A of the NHPA,[23] for its association with the development of transportation improvement on the Potomac and Shenandoah River carried out by the Potowmack Company and under Criterion C[24] for its engineering design and construction. The Hopewell Mills factory building is represented only by a single, partial wall. While only a portion of the factory remains intact, its placement on the ground clearly indicates a historic relationship to the Little Falls Canal. Therefore the Hopewell Mills factory is recommended National Register-eligible as a contributing resource to the significance of Little Falls Canal (Harvey and Green, 2015). By letter dated September 2, 2015 and filed with the final license application, the West Virginia SHPO concurred.

Overall, the Millville Project facilities retain fair to good integrity. The plan of the complex consisting of the dam, intake, headrace, and powerhouse is intact. None of the components that make up the project have been removed, although the current powerhouse is a replacement of the original building. Among the individual components, however, integrity varies as various changes occurred both following the 1938 fire and in the 1960s. Although these alterations are historic in their own right, they do not reflect periods that are either significant to the history of hydroelectric power or the region. On that basis, the Millville Project was not recommended eligible for listing on the NRHP. By letter dated December 3, 2015, and filed with the final license application, West Virginia SHPO concurred.

Traditional Cultural Properties

By letter dated November 16, 2011, we initiated consultation with potentially affected Indian tribes[25] to determine if the tribes desired to participate in the relicensing

---

[23] Historic properties qualifying under Criterion A of the NHPA include those properties that are associated with events that have made a significant contribution to the broad patterns of our history.

[24] Historic properties qualifying under Criterion C of the NHPA are those properties that embody distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant and distinguishable entity whose components may lack individual distinction.

[25] Tribes initially contacted about consulting on the project relicensing proceedings included: Absentee-Shawnee Tribe of Indians in Oklahoma, Eastern Shawnee Tribe of Oklahoma, Shawnee Tribe, Delaware Nation, Cherokee Nation, Eastern Band of Cherokee Indians, United Keetoowah Band of Cherokee Indians in

process. To date, no tribes have responded to the Commission's requests to consult and have not reported any known traditional cultural properties within the project's APE.

3.3.7.2 Environmental Effects

Effects on Historic Properties

Potential future actions related to operation and maintenance of the project may affect cultural resources. PE Hydro proposes no changes to the project's existing run-of-river mode of operation, with the exception of potentially changing the schedule of fall nighttime eel shutdowns for the purpose of downstream eel passage based on predictive modeling results. PE Hydro proposes no new construction or other ground-disturbing activities. To protect historic properties within the project's APE, PE Hydro proposes to implement the Historic Properties Management Plan (HPMP) filed with the final license application on December 30, 2015.

By letter dated September 2, 2015, and filed with the final license application, the West Virginia SHPO stated that although two National Register-eligible properties (the Little Falls Canal and associated Hopewell Mills factory ruins) fall within the project's APE, they would not be adversely affected by continued operation of the Millville Project. The West Virginia SHPO also stated that not further consultation was necessary regarding architectural resources, unless the project proposal changed.

In comments filed in response to the Commission's ready for environmental analysis notice, Interior recommended that PE Hydro consult with any tribes whose rights may be affected by the Millville Project. If known tribal resources exist in lands proposed to be removed from the project boundary, the licensee should inform the tribe. The licensee should also consult with affected tribes if any tribal resources are discovered during the term of a new license.

Our Analysis

Section 106 of the NHPA requires the Commission to take into account the effect of licensing a hydropower project on historic properties. Project-related effects on cultural resources within the APE may result from: (1) project construction and other ground disturbing activities, including construction of recreational enhancement measures; (2) project operations, such as reservoir and regulated river reach fluctuations;

Oklahoma, Seneca-Cayuga Tribe of Oklahoma, Tuscarora Nation of New York, Saint Regis Mohawk Tribe, Oneida Nation of New York, Onondaga Nation of New York, Cayuga Nation of New York, Tonawanda Band of Seneca Indians of New York, Seneca Nation of New York, and Catawba Indian Nation.

and/or (3) routine maintenance or modification to NRHP-eligible properties associated with the project.

PE Hydro proposes no significant changes in the operation of the project. Because the project operates in run-of-river mode and no new construction is proposed, we find that continued operation and maintenance of the project, including the proposed modifications to existing recreation facilities would not affect historic resources, including the Little Falls Canal and associated Hopewell Mills Factory ruins. PE Hydro proposes a series of protective measures for known historic properties and any undiscovered cultural resources at the project in the HPMP filed with its final license application. However, because the West Virginia SHPO has determined that historic properties would not be adversely affected by the proposed project, no HPMP is necessary. Rather if PE Hydro conducts any maintenance activities, land-clearing or land-disturbing activities, or makes changes to project operation or modifications to facilities not authorized in any license issued for the project, consulting with the West Virginia SHPO about potential effects would ensure the continued protection of known historic properties.

It is also possible that unknown archaeological or historic resources may be discovered in the future, as a result of project operation or other project-related construction or maintenance activities. If such resources are discovered, immediately stopping work and consulting with the West Virginia SHPO to define appropriate treatment would prevent any further harm to previously unidentified resources.

3.4 No-Action Alternative

Under the no-action alternative, the project would continue to operate as it has in the past. None of the applicant's proposed measures or the resource agencies' recommendations would be required. No new environmental protection, mitigation, or enhancement measures would be implemented.[26]

[26] We use this alternative only for the purposes of establishing the baseline environmental conditions for our analysis contained in this EA.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the project's use of the Shenandoah River for hydropower purposes and assess the effect various environmental measures would have on the projects' costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[27] 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 Corp*., 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 draft 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 continued operation of the project 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 ECONOMIC BENEFITS OF THE PROJECT

Table 10 summarizes the assumptions and economic information we use in our analysis for the project. This information was provided by PE Hydro, in his license application and subsequent submittals. We find that the values provided by the applicant are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs; estimated capital investment required to develop the project; licensing costs; normal operation and maintenance cost; and Commission fees.

---

[27] *See Mead Corp., Publishing Paper Division*, 72 FERC ¶ 61,027 (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.

Table 10. Parameters for the economic analysis for Millville Project. (Source: PE Hydro and staff.)

Economic Parameter	Value	Source
Proposed capacity (MW)	2.84	PE Hydro
Dependable Capacity (MW)	0.0	PE Hydro
Proposed average annual generation (MWh)	10,723	PE Hydro
Annual operation and maintenance (O&M) cost ($/year)	480,000	PE Hydro
Cost to prepare license application ($)	1,200,000	PE Hydro
Period of economic analysis	30 years	Staff
Term of financing	20 years	Staff
Cost of capital (Long-term interest rate)	7.0	Staff
Federal tax rate (%)	34	Staff
Local tax rate (%)	3	Staff
Insurance rate	Included in the O & M cost	PE Hydro
Energy rate ($/MWh)	44.64	PE Hydro

4.2 COMPARISON OF ALTERNATIVES

Table 11 summarizes the installed capacity, annual generation, cost of alternative power, estimated total project cost, and the difference between the cost of alternative power and total project cost for each of the action alternatives considered in this draft EA: no-action, PE Hydro's proposal, the staff recommended alternative and the staff alternative with mandatory conditions.

Table 11. Summary of the annual cost of alternative power and annual project costs for alternatives for the Millville Project. (Source: Staff.)

	No-Action Alternative	PE Hydro's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Installed capacity (MW)	2.84	2.84	2.84	2.84
Annual generation (MWh)	10,723	10,723	10,723	10,723
Annual cost of alternative power ($/MWh)	$478,675 $44.64	$478,675 $44.64	$478,675 $44.64	$478,675 $44.64
Annual project cost ($/MWh)	$800,686 $74.67	$803,903 $74.97	$814,412 $75.95	$825.242 $76.96
Difference between cost of alternative power and project cost ($/MWh)	($322,011) ($30.03)	($325,228) ($30.33)	($335,737) (31.31)	($346,567) ($32.32)

Numbers in parenthesis are negative.

4.2.1 No-Action Alternative

Under the no-action alternative, the Millville Project would continue to operate under the terms and conditions of the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented. There are no costs associated with this alternative, other than applicants' costs for preparing the license application.

4.2.2 PE Hydro's Proposal

Under PE Hydro's proposal, the Millville Project would have an installed capacity of 2.84 MW and generate an average of 10,723 MWh of electricity annually. The average annual cost of alternative power would be $478,675, or $44.64/MWh. In total,

the average annual project cost would be $803,903, or about $74.97/MWh. Overall, the project would produce power at a cost that is $325,228, or $30.33/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative

Under the staff recommended alternative, the Millville Project would have an installed capacity of 2,840 MW and generate an average of 10,723 MWh of electricity annually. The average annual cost of alternative power would be $478,675, or $44.64/MWh. The average annual project cost would be $814,412, or about $75.95/MWh. Overall, the project would produce power at a cost which is $335,737, or $31.31/MWh, more than the cost of alternative power.

4.2.4 Staff Alternative with Mandatory Conditions

Under the staff recommended alternative with mandatory conditions, the Millville Project would have an installed capacity of 2,840 MW and generate an average of 10,723 MWh of electricity annually. The average annual cost of alternative power would be $478,675, or $44.64/MWh. The average annual project cost would be $828,351, or about $77.25/MWh. Overall, the project would produce power at a cost which is $349,676, or $32.61/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 12 gives the cost of each of the environmental enhancement measure considered in our analysis. We convert 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.

Table 12. Cost of environmental mitigation and enhancement measures considered in assessing the environmental effects of the proposed Millville Project. (Source: Staff).

Enhancement/mitigation measure	Entities	Capital cost (2017$)	Annual cost (2017$)	Levelized cost (2017$)	Notes
Aquatic Resources					
1. Run-of-River operation.	WV DNR WV DEP FWS, PE Hydro Staff	0	0	0	
2. Minimum flow; 200 cfs released over the dam.	WV DNR WV DEP FWS Staff	0	0	0	
3. Monitor DO and water temperature at the project headrace and powerhouse for first 2 years of the license.	WV DNR WV DEP FWS	$2,500	$0	$298	
4. Upstream eel passage.	WV DNR WV DEP FWS Staff	0	0	0	
5. Downstream eel protection; PE Hydro shuts down the project nightly from September 15 to December 15 to protect adult eels migrating downstream.	WV DNR WV DEP FWS Staff	0	0	0	
6. Continue to fund the downstream USGS Gaging station.	WV DNR WV DEP FWS	0	0	0	

Enhancement/mitigation measure	Entities	Capital cost (2017$)	Annual cost (2017$)	Levelized cost (2017$)	Notes
7. Fish entrainment compensatory mitigation; reimbursing the State of West Virginia for fish entrainment leading to mortality.	WV DNR WV DEP	0	$16,289.28	$10,817	
8. Completion of study to protect downstream migrating adult eels.	WV DNR WV DEP FWS	0	0	0	[a]
Recreation Resources					
9. Implement the Recreation Management Plan, filed May 11, 2016, which includes provisions for (1) continued operation and maintenance of four existing project recreation sites: the Big Eddy Access Area; the Upper Angling Access Trail; the Lower Angling Access Trail; and the Downstream Access Area; and (2) construction, operation, and maintenance of a new portage around Millville Dam.	PE Hydro, Interior, American Whitewater	$3,000	$4,500	$3,189	
10. Implement the Recreation Management Plan, with an additional provision for accessible portable restroom facilities at the Big Eddy Access Area, the Lower Angling Access Trail parking area, and the Downstream Access Area, as specified in the certification issued by West Virginia DEP on April 19, 2017.	WV DEP, Staff	$3,000	$20,000	$13,419	[b]

Enhancement/mitigation measure	Entities	Capital cost (2017$)	Annual cost (2017$)	Levelized cost (2017$)	Notes
Cultural Resources					
11. Implement HPMP to protect historic properties within the project's APE.	PE Hydro	0	0	0	
12. Cease project activities and notify the West Virginia SHPO if any unknown archaeological or historic resources are discovered as a result of operation or other project-related activities.	Staff	0	0	0	[c]
13. Consult with the West Virginia SHPO about effects on historic properties prior to conducting any maintenance activities, land-clearing or land-disturbing activities, or making changes to project operation or modifications to facilities not already authorized by any license issued for the project.	Staff	0	0	0	[c]

[a] Study not yet defined, so cost could not be estimated.
[b] Cost estimated by staff.
[c] Staff estimates that the cost to implement this measure would be negligible.

5.0 CONCLUSIONS AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

Sections 4(e) and 10(a) of the FPA, 16 U.S.C. §§ 797(e), 803(a), 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 licenses issued shall be such as in the Commission's judgment will be best adapted to a comprehensive plan for improving or developing waterway or waterways for all beneficial public uses. This section contains the basis for, and a summary of, our recommendations for licensing the Millville Project. We weigh the costs and benefits of our recommended alternative against other proposed alternatives and measures.

Based on our independent review of agency comments filed on this project, and our review of the environmental and economic effects of the proposed project and economic effects of the project and its alternatives, we selected the staff alternative as the preferred alternative. We recommend the staff alternative because: (1) the project would provide a dependable source of electrical energy for the local area; (2) the 2,840-kW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution, including greenhouse gases; (3) the public benefits of this alternative would exceed those of the no-action alternative; and (4) the proposed measures would protect or enhance geological and soils, aquatic, terrestrial, recreational, and cultural resources.

In the following sections, we make recommendations as to which environmental measures recommended by agencies or other entities should be included in any license issued for the project. We also recommend additional environmental measures to be included in any license issued for the project.

5.1.1 Measures Proposed by PE Hydro

Based on our environmental analysis of PE Hydro's proposal, as described in section 2 and discussed in section 3, as well as the costs discussed in section 4, we conclude that the environmental measures proposed by PE Hydro, and listed below, would protect and enhance environmental resources and be worth the cost. Therefore, we recommend including these measures in any new license issued for the project:

- Continue to operate the Millville Project in a run-of-river mode, whereby water flowing into the project impoundment equals water flowing out;

- Continue to release a 200-cfs minimum flow over the project dams to the bypassed reach at all times, which is ensured by maintaining a constant reservoir level;

- Continue to cease project generation nightly from September 15 to December 15 to protect downstream migrating American eel;

- Continue to fund the USGS Gage No. 01636500 on the Shenandoah River at Millville, located 0.5 miles downstream from the project;

- Continue to operate and maintain the upstream American eel trap and passage system to count and pass juvenile eels on the Shenandoah River;

- Design and test a model of downstream migration cues and timing of adult American eels at the project to evaluate the effectiveness of, and if necessary, refine the seasonal project generation shut down schedule; and

- Implement the Recreation Management Plan that includes: (1) provisions for continued operation and maintenance of four existing project recreation sites: the Big Eddy Access Area, the Upper Angling Access Trail, the Lower Angling Access Trail, and the Downstream Access Area; and (2) construction, operation, and maintenance of a new portage around the Millville dam, with the modifications described below.

5.1.2 Additional Measures Recommended by Staff

In addition to PE Hydro's proposed measures outlined above, we recommend 401 Certification Conditions 1, 2, 4-9 and the following measures be included in any new license issued to PE Hydro.

- Develop an operation compliance monitoring plan to monitor and document compliance with the operational requirements of any license that may be issued.

- Modify the Recreation Management Plan, filed May 11, 2016, to include the provision for accessible, portable restroom facilities at the Big Eddy Access Area, the Lower Angling Access Trail parking area, and the Downstream Access Area, specified in West Virginia DEP's certification.

- Cease project activities and notify the West Virginia SHPO and potentially affected Indian tribes if any unknown archaeological or historic resources are discovered as a result of operation or other project-related activities.

- Consult with the West Virginia SHPO about effects on historic properties prior to conducting any maintenance activities, land-clearing or land-disturbing activities, or making changes to project operation or modifications to facilities not already authorized by any license issued for the project.

The staff alternative does not include: (1) PE Hydro's proposal to implement an HPMP to protect historic properties at the project, as continued operation and maintenance of the project would be unlikely to adversely affect historic properties; and (2) 401 certification condition #3 which requires the licensee to pay $16,289.28 annually to the State of West Virginia. Below, we discuss the rationale for modifying PE Hydro's proposal and the basis for our additional recommended measures.

Modifications to the Recreation Management Plan

PE Hydro's proposed RMP addresses the need for continued repair, restoration, and maintenance of the project's existing recreation sites and partially addresses stakeholder requests for improved facility conditions (particularly garbage collection and removal). However, restrooms were a need identified for the Downstream Access Area, Big Eddy Access Area, and Lower Angling Access Trail parking area in both the on-site surveys and commercial outfitter surveys. Providing portable restrooms at these three sites would help improve visitor comfort and sanitation. Including a provision in the RMP to provide portable restroom facilities would have an annual levelized cost of $13,419. We find that the benefits of adding the portable restroom facilities to the sites would be worth this cost. Therefore, we recommend that PE Hydro modify its RMP to include a provision for adding the portable restroom facilities at the sites.

Cultural Resources

There is a possibility that unknown archaeological or historic resources may be discovered as a result of project operation or other project-related activities (e.g., maintenance activities, land-clearing or land-disturbing activities, or making changes to project operation or modifications to facilities not anticipated by a license issued for the project) regarding potential effects on those resources. To ensure proper treatment of any unknown cultural resources that may be discovered at the project, we recommend that, in the case of any such discovery, PE Hydro notify, and consult with the West Virginia SHPO and potentially affected Indian tribes, and: (1) cease project-related activities and determine if the discovered archaeological or historic resource is eligible for the National Register; (2) determine if continued operation of the project would adversely affect the resource; and (3) if the resource would be adversely affected, obtain guidance from the West Virginia SHPO on how to avoid, lessen, or mitigate for any adverse effects. Also, we recommend that PE Hydro inform the Commission of any discovery of unknown cultural resources, and any measures proposed if the resource is eligible for the National

Register and is adversely affected by project construction or operation. There is no additional estimated cost associated with this measure.

5.1.3 Measures Not Recommended by Staff

Compensatory Fishery Mitigation Payments

West Virginia DNR and Interior recommend and Condition 3 of the West Virginia DEQ's WQC requires that PE Hydro annually pay West Virginia DNR an inflation-adjusted compensation that equates to the replacement value of all fishes assumed to suffer entrainment mortality at the project.

Data from previous field entrainment studies conducted at the project were used to estimate an annual mortality of about 21,000 fish at the project of which a large portion of those fish entrained are juvenile smallmouth bass, sunfish, and catfish under 4 inches in length. These species typically experience high natural mortality which is balanced by high fecundity. In fact, the project area supports a robust sport fishery consisting of among others, these three species, and this robust fishery shows no signs of being adversely affected by the existing level of turbine mortality. Because no changes to project operation are proposed, there would be no project-related change to the existing mortality rate. For these reasons, we have no basis for recommending mitigation measures for entrainment mortality at the project and do not adopt under the Staff Alternative, West Virginia DNR's and Interior's recommendations, and Condition 3 of the WQC for PE Hydro to provide mitigation for entrainment mortality.

Historic Properties Management Plan

The 2015 investigations of the two National Register-eligible properties located within the Millville Project's APE conducted by Harvey and Green indicated that continued operation and maintenance of the Millville Project would result in no adverse effects. The West Virginia SHPO concurred with this finding, stating that no additional consultation was necessary unless PE Hydro made changes to the project proposal in the future. Therefore, we do not recommend implementing the HPMP filed by PE Hydro with the final license application.

Although an HPMP is not recommended as a license measure, PE Hydro may base procedures related to the protection of historic properties on the protocols outlined in the HPMP filed by PE Hydro, should these protection measures become necessary. As discussed above, we recommend including an article in any new license issued for the project, that requires PE Hydro to stop all work, consult with the West Virginia SHPO and potentially affected Indian tribes, and develop an HPMP if the licensee discovers previously unidentified archeological or historic properties during the course of constructing, maintaining, or developing project works or other facilities at the project. We also recommend that any new license issued for the project include an article

requiring PE Hydro to consult with the West Virginia SHPO prior to implementing project modifications not specifically authorized by a license, including but not limited to maintenance activities, land-clearing or land-disturbing activities, or changes to project operation or facilities. Under those circumstances, it would be appropriate to revisit the protection measures included in PE Hydro's proposed HPMP.

5.2 UNAVOIDABLE ADVERSE EFFECTS

Continued operation of the project would result in some unavoidable fish entrainment and turbine mortality. However, the However, most fish that would experience mortality would be small, and the numbers entrained relative to species fecundity would be minimal. Therefore, entrainment and turbine mortality would have minimal to no effect on the sustainability of the fish community at the project.

5.3 FISH AND WILDLIFE AGENCY RECOMMENDATIONS

Under the provisions of section 10(j) of the FPA, 16 U.S.C. § 803(j), each hydroelectric license issued by the Commission shall 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.

Section 10(j) of the FPA states that whenever the Commission believes that any fish and wildlife agency recommendation is inconsistent with the purposes and the requirements of the FPA or other applicable law, the Commission and the agency shall attempt to resolve any such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of such agency. In response to our Notice of Application Ready for Environmental Analysis and Soliciting Comments, Recommendations, Terms and Conditions, and Prescriptions, FWS filed five recommendations on December 23, 2016, for the proposed project, of which we determined three to be within the scope of section 10(j). Of the section 10(j) recommendations, we recommend adopting two (table 13).

Table 13. FWS section 10(j) recommendations for the Millville Project. (Source: Staff, 2016.)

Recommendation	Agency	Within the Scope of Section 10(j)	Annualized Cost	Adoption? And Basis for Preliminary Determination of Inconsistency
1. Upstream eel passage facility	FWS	Yes	$0 [a]	Adopted.
2. Seasonal downstream adult eel passage shutdowns	FWS	Yes	$0 [a]	Adopted.
3. Monitor downstream eel passage	FWS	Yes	$0 [a]	Adopted.
4. New nighttime eel shutdown protocol measures	FWS	No [b]	$0	Not adopted
5. Testing of new eel shutdown protocol	FWS	No [b]	$0	Not adopted

[a] Existing measure, so there would be no additional cost.

[b] Recommendations premature, as the protocol has not been developed and the method for testing has not been proposed.

5.4 CONSISTENTCY WITH COMPREHENSIVE PLANS

Section 10(a)(2)(A) of the FPA, 16 U.S.C. § 803(a)(2)(A), requires the Commission to consider the extent to which a project is consistent with the federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed eight comprehensive plans that are applicable to the project. No inconsistencies were found.

Atlantic States Marine Fisheries Commission. 2000. Interstate Fishery Management Plan for American eel (*Anguilla rostrata*). (Report No. 36). April 2000.

National Park Service. 1993. The Nationwide Rivers Inventory. Department of the Interior, Washington, D.C. 1993.

National Park Service. 2013. Chesapeake Bay Public Access Plan. Annapolis, Maryland. January 2013.

U.S. Fish and Wildlife Service. Undated. Fisheries USA: the recreational fisheries policy of the U.S. Fish and Wildlife Service. Washington, D.C.

West Virginia Department of Natural Resources. 1976. Wildlife Resources Division strategic plan, 1975 - 1985. Charleston, West Virginia. 122 pp.

West Virginia Department of Natural Resources. 1977. Today's plan for tomorrow's wildlife: a strategic plan for fish, game, and nongame management, 1975 - 1985. Charleston, West Virginia. 59 pp.

West Virginia Department of Natural Resources. 2015. 2015 West Virginia State Wildlife Action Plan. Charleston, West Virginia. September 1, 2015.

West Virginia Governor's Office of Community and Industrial Development. West Virginia State Comprehensive Outdoor Recreation Plan (SCORP): 1988-1992. Charleston, West Virginia.[28]

[28] The West Virginia SCORP: 1988-1992 has been superseded by a more recent plan, the West Virginia SCORP: 2015-2020 (West Virginia Development Office, 2015). We request that the State of West Virginia file the revised SCORP for approval under section 10(a)(2)(a) of the FPA. For the purposes of relicensing, we reviewed the updated plan under section 10(a) of the FPA.

6.0 FINDING OF NO SIGNIFICANT IMPACT

On the basis of our independent analysis, the issuance of a new license for the Millville Project, with our recommended environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment.

7.0 LITERATURE CITED

Barfield, M.L. and E.T. Watters. 1998. Non-parasitic life cycle in the green floater, Lasmigona subviridis (Conrad, 1835). Triannual Unionid Report, 16: 22.

Bagenal, TB and Tesch, FW. 1978. "Age and growth". In Methods for assessment of fish production in fresh waters, 3rd ed. IBP Handbook No. 3, Edited by: Begenal, T. 101–136. Oxford, UK: Blackwell Science Publications.

Energy & Environmental Management, Inc. (EEM) 1992. Millville Hydro Station, FERC Project No. 2343, License Articles 405 & 406, 1989 Fish Entrainment studies and 1990 and 1991 Economic Worth of Lost Fishery. Murrysville, PA.

Electric Power Research Institute (EPRI). 1987. Mechanisms of Compensatory Response of Fish Populations: Workshop Proceedings. Prepared by R.G Otto & Associates, Key West, Florida. EPRI Report No. EA 5202, Project 1633. June 1987.

_____. 1992. Fish entrainment and turbine mortality review and guidelines. Prepared by Stone and Webster Environmental Services, Boston, Massachusetts. EPRI Report No. TR-101231, Project 2694-01. September 1992.

_____. 1997. Turbine entrainment and survival database – field tests. Prepared by Alden Research Laboratory, Inc., Holden, Massachusetts. EPRI Report No. TR-108630.

_____. 2003. Evaluating the effects of power plant operations on aquatic communities: Summary of impingement survival studies. Palo Alto, CA. EPRI Report No. 1007821.

_____. 2004. Extrapolating impingement and entrainment losses to equivalent adults and production foregone. Palo Alto, CA, EPRI Report No. 1008471.

Eyler, S. M., S. A. Welsh, D. R. Smith and M. M. Rockey. 2016. Downstream Passage and Impact of Turbine Shutdowns on Survival of Silver American Eels at Five Hydroelectric Dams on the Shenandoah River. Transactions of the American Fisheries Society 145:964-976.

Federal Energy Regulatory Commission (FERC). 1987. Order Issuing New License (Major Project – Existing Dam) (Issued December 10, 1987) (P 62,233). The Potomac Edison Company, Project No. 2343-002.

Federal Energy Regulatory Commission (FERC). 1995. Preliminary assessment of fish entrainment at hydropower projects -volume 1 (Paper No. DPR-10).Office of Hydropower Licensing, FERC, Washington, DC.

Friends of the Shenandoah River (FOSR). 2007. The Status of Water Quality in the Rivers and Tributaries of the Shenandoah River Watershed. Final Report (third edition). August, 2007.

Google, Inc. (2009). Google Earth (Version 7.1.8.3036). [Software]. Location: Millville, West Virginia. Available: http:///www.google.com/earth. Accessed April 11, 2017.

Haro, A., T. Castro-Santos, and Jacques Boubée. 2000. Behavior and passage of silver-phase American eels, Anguilla rostrata (LeSueur), at a small hydroelectric facility. Dana 12:33-42.

Haro, A., T. Castro-Santos, K. Whalen, G. Wippelhauser, L. McLaughlin. 2003. Simulated effects of hydroelectric project regulation on mortality of American eels. Pages 357-365 in D. A. Dixon, editor. Biology, management, and protection of catadromous eels. American Fisheries Society, Symposium 33, Bethesda, Maryland.

Hartel, K. E., D. B. Halliwell, and A. E. Launer. 2002. Inland fishes of Massachusetts. Massachusetts Audubon Society, Lincoln.

Harvey, B.G. (2015). Historic Properties Management Plan, Millville Hydroelectric Project, FERC No. 2343. December 2015. Prepared for PE Hydro by Harvey Research and Consulting and Kleinschmidt Associates, Pittsfield, ME. Filed December 30, 2015.

Harvey, B.G. and W.G. Green. (2015). Millville Hydroelectric Project, FERC No. 2343, Jefferson County, West Virginia: Historic Resources Survey. May 2015. Prepared for PE Hydro, LLC by Harvey Research and Consulting and Kleinschmidt Associates, Pittsfield, ME. Filed September 21, 2015.

Helfman, G. S., D. E. Facey, L. S. Hales, Jr., E. L. Bozeman, Jr. 1987. Reproductive ecology of the American eel. Pages 42-56 in M. J. Dadswell, R. J. Klauda, C. M. Moffitt, R. L. Saunders, R. A. Rulifson, and J. E. Cooper, editors. Common strategies of anadromous and catadromous fishes. American Fisheries Society Symposium 1, Bethesda, Maryland.

James Madison University. 2012. Department of Geology and Environmental Studies. Lynn S. Fitcher and Steve J. Baedke. Geologic and Physiographic Provinces.

Available: http://csmres.jmu.edu/geollab/vageol/vahist/PhysProv.html#provinces. Accessed June 4, 2012.

James Madison University. 2012. Department of Geology and Environmental Studies. Lynn S. Fitcher and Steve J. Baedke. Geologic and Physiographic Provinces. [Online] URL: http://csmres.jmu.edu/geollab/vageol/vahist/PhysProv.html#provinces. Accessed June 4, 2012. Copyright 1999.

Jefferson County Convention & Visitors Bureau (JCCVB). 2017. Discover Jefferson County. Available: www.discoveritallwv.com. Accessed March 7, 2017.

Jenkins, R. E. and N. M. Burkhead, 1993, Freshwater Fishes of Virginia, American Fisheries Society, Bethesda, Maryland.

Kleinschmidt. 2015a. Historic Properties Management Plan: Millville Hydroelectric Project. Prepared by Kleinschmidt for PE Hydro Generation, LLC. December 2015. Filed December 30, 2015.

_____. 2015b. Recreation Use Assessment: Millville Hydroelectric Project. Prepared by Kleinschmidt for PE Hydro Generation, LLC. September 2015. Filed September 21, 2015.

_____. 2016. Final Recreation Management Plan: Millville Hydroelectric Project FERC No. 2343. Prepared by Kleinschmidt for PE Hydro Generation, LLC. May 2016. Filed May 11, 2016.

Knapp, W. E., B. Kynard, and S. P. Gloss (eds.). 1982. Potential effects of Kaplan, Osseberger, and bulb turbines on anadromous fishes of the northeastern United States. FWS/OBS-82/62. U.S. Fish and Wildlife Service, Newton, Massachusetts. September 1982. 132 pp.

Lellis, W.A. and T.L. King. 1998. Release of metamorphosed juveniles by the green floater, Lasmigona subviridis. Triannual Unionid Report, 16: 23.

Maslowski, R.F. 2016. Prehistoric People. E-WV: The West Virginia Encyclopedia. November 23, 2016. Available: https://www.wvencyclopedia.org/articles/1913. Accessed April 13, 2017.

National Oceanic and Atmospheric Administration (NOAA). 2012. Hydrograph. Available: http://water.weather.gov/ahps2/hydrograph.php?wfo=lwx&gage=milw2. Accessed May 31, 2012.

National Resource Conservation Service (NRCS). 2012. West Virginia Chesapeake Bay. Headwaters. [Online] URL: http://www.wv.nrcs.usda.gov/chesapeake_bay/wv_bay_area.html. Accessed June 4, 2012.

Natural Resources Conservation Service (NRCS). 2012. Web Soil Survey. Jefferson County, West Virginia. Available: http://websoilsurvey.nrcs.usda.gov/app/ WebSoilSurvey.aspx. Accessed June 12, 2012.

Natural Resources Conservation Service (NRCS). 2012. Web Soil Survey. Jefferson County, West Virginia. [Online] URL: http://websoilsurvey.nrcs.usda.gov/app/WebSoilSurvey.aspx. Accessed June 12, 2012.

Ortmann, A.E. 1919. Monograph of the naiades of Pennsylvania. Part III. Systematic account of the genera and species. Memoirs of the Carnegie Museum 8(1):1-385.

PE Hydro Generation, LLC (PE Hydro). 2014a. Fisheries assessment survey and habitat characterization. Phase 1. Habitat mapping report. Millville Hydroelectric Project FERC Project No. 2343. 18 pages.

PE Hydro Generation, LLC (PE Hydro). 2014b. Eel passage analysis Millville Hydroelectric Project. FERC Project No. 2343. 19 pages.

PE Hydro Generation, LLC (PE Hydro). 2014c. Fish entrainment and turbine mortality analysis. Millville Hydroelectric Project. FERC Project No. 2343. 14 pages.

Potomac Valley Audubon Society. 2015. Shenandoah River (Bloomery and John Rissler Roads). URL: http://www.potomacaudubon.org/ShenandoahRiver.html. Accessed May 23, 2017.

Rochester, H., Jr., T. Lloyd, and M. Farr. 1984. Physical impacts of small scale hydroelectric facilities and their effects on fish and wildlife. FWS/OBS-84/19. U.S. Fish and Wildlife Service. 191 pp.

Richkus, W. A., and D. A. Dixon. 2003. Review of research and technologies on passage and protection of downstream migrating catadromous eels at hydroelectric facilities. Pages 377-388 in D.A. Dixon, editor. Biology, management, and protection of catadromous eels. American Fisheries Society, Symposium 33, Bethesda, Maryland.

Richkus, W. and K. Whalen. 2000. Evidence for a decline in abundance of American eel, Anguilla rostrata (LeSueur), in North America since the early 1980s. Dana 12:83-97.

Smogor, R. A., P. L. Angermeier, and C. K. Gaylord. 1995. Distribution and abundance of American eels in Virginia streams: tests of null models across spatial scales. Transactions of the American Fisheries Society 124:789–803.

Southwick, R. I., and A. J. Loftus, editors. 2003. Investigation and monetary values of fish and freshwater mussel kills. American Fisheries Society, Special Publication 30. Bethesda.

Sweka, J. A., S. Eyler, and M. J. Millard. 2014. An egg-per-recruit model to evaluate the effects of upstream transport and downstream passage mortality of American eel in the Susquehanna River. North American Journal of Fisheries Management 34:764-77.

Thornton, R. Archeological Evidence in the Shenandoah Valley. February 1, 2013. Available: https://www.accessgenealogy.com/virginia/the-archaeological-evidence-in-shenandoah-valley.htm. Accessed April 13, 2017.

United States Environmental Protection Agency and Virginia Department of Environmental Quality (USEPA and VDEQ). 2001. Development of the Shenandoah River PCB TMDL. Final Report. September, 2001.

United States Geologic Survey (USGS). 2003. Digital geologic map and database of the Frederick 30 X 60 minute quadrangle, Maryland, Virginia, and West Virginia. Southworth, Scott, Brezinski, D.K., Drake, A.A., Burton, W.C., Orndorff, R.C., Froelich, A.J., Reddy, J.E., and Denenny, Danielle. Open-File Report OF-2002-437. Published by USGS: 2003. Available: http://ngmdb.usgs.gov/Prodesc/proddesc_61989.htm. Accessed June, 4, 2012.

_____. 2017. USGS 01636500 Shenandoah River at Millville, WV. National Water Information System: Web Interface. Available: https://waterdata.usgs.gov/nwis/uv?01536500. Accessed April 11, 2017.

United States Geologic Survey (USGS). 2003. Digital geologic map and database of the Frederick 30 X 60 minute quadrangle, Maryland, Virginia, and West Virginia. Southworth, Scott, Brezinski, D.K., Drake, A.A., Burton, W.C., Orndorff, R.C., Froelich, A.J., Reddy, J.E., and Denenny, Danielle. Open-File Report OF-2002-437. Published by USGS: 2003. [Online] URL: http://ngmdb.usgs.gov/Prodesc/proddesc_61989.htm. Accessed June, 4, 2012.

United States Geologic Survey (USGS). 2008. 2008 United States National Seismic Hazard Maps. Fact Sheet 2008-3018. April 2008. [Online] URL: http://pubs.usgs.gov/fs/2008/3018/. Accessed June 4, 2012.

United States Geologic Survey (USGS). 2012. Hazard Mapping Images and Data. [Online] URL: http://earthquake.usgs.gov/hazards/products/. Accessed June 4, 2012.

United States Geological Survey (USGS). 2015. USGS 01636500 Shenandoah River at Millville, WV. [Online] URL: http://waterdata.usgs.gov/usa/nwis/uv?site_no=01636500. Accessed April 22, 2015.

Venable, Norma Jean, 1989, Guide to common birds of West Virginia, Series 807, West Virginia University Extension Service. Available: anr.ext.wvu.edu/r/download/48155 Accessed May 23, 2017.

Virginia Department of Environmental Quality (VDEQ). 2012. Virginia's Minerals and Energy Resources. [Online] URL: http://www.deq.virginia.gov/ConnectWithDEQ/EnvironmentalInformation/VirginiaNaturally/VirginiasNaturalResourcesEducationGuide/VirginiasMineralsEnergyResources.aspx. Accessed June 4, 2012.

Virginia Department of Game and Inland Fisheries (VDGIF). 2013. Shenandoah River – Main Stem. Available: http://www.dgif.virginia.gov/fishing/waterbodies/display.asp?id=171. Accessed May 1, 2015.

Virginia Tech (VT) Department of Forestry. 2003. Fish of the Shenandoah River, Mainstem Shenandoah River. [Accessed May 26, 2017]. Available from: http://web1.cnre.vt.edu/plt/potomacshenandoah/aquaticinsects/fishoftheshenandoahriver.htm

West Virginia Department of Commerce (West Virginia DOC). 2012. Geology. Available:http://www.wvcommerce.org/resources/geology/default.aspx. Accessed June 4, 2012.

_____. 2015. Statewide Comprehensive Outdoor Recreation Plan 2015-2020 West Virginia. Available: http://www.wvcommerce.org/App_Media/assets/pdf/peopleandplaces/communityresources/2015-2020_WV_SCORP.pdf. Accessed March 7, 2017.

West Virginia Department of Commerce (West Virginia DOC). 2012. Geology. [Online] URL: http://www.wvcommerce.org/resources/geology/default.aspx. Accessed June 4, 2012.

West Virginia Department of Environmental Protection (West Virginia DEP). 1998. An Ecological Assessment of the West Virginia Portions of the Shenandoah River Watershed – 1996. September 1998.

West Virginia Department of Environmental Protection (West Virginia DEP). 1996. An Ecological Assessment of the West Virginia Portions of the Shenandoah River Watershed.

West Virginia Department of Environmental Protection (West Virginia DEP). 2015a. Water Quality Monitoring Efforts. [Online] URL: http://www.dep.wv.gov/WWE/watershed/wqmonitoring/Pages/waterquality.aspx. Accessed April 22, 2015.

West Virginia Department of Environmental Protection (West Virginia DEP). 2015b. 2012 Draft Section 303(d) List. [Online] URL: http://www.dep.wv.gov/WWE/watershed/IR/Pages/303d_305b.aspx. Accessed April 22, 2015.

West Virginia Department of Environmental Protection (West Virginia DEP). 2015c. Water Quality Data Report. Jefferson County. Shenandoah River Watershed. Dissolved Oxygen. [Online] URL: https://apps.dep.wv.gov/dwwm/wqdata/. Accessed April 22, 2015.

West Virginia Department of Environmental Protection (West Virginia DEP). 2014. West Virginia Code of State Rules. Title 47. Series 2. Requirements Governing Water Quality Standards (47CSR2). Effective June 21, 2014.

West Virginia Department of Natural Resources (West Virginia DNR). 2003. Fishing and Boating Points of Interest: Jefferson County. Available: http://www.wvdnr.gov/fishing/public_access.asp?county=Jefferson&type=all. Accessed March 7, 2017.

Wiken, Ed, Francisco Jiménez Nava, and Glenn Griffith. 2011. North American Terrestrial Ecoregions—Level III. Commission for Environmental Cooperation, Montreal, Canada.

8.0 LIST OF PREPARERS

Michael Spencer – Project Coordinator, Need for Power, Engineering and Developmental Analysis (Civil Engineer; B.S., Civil Engineering)

Rachel McNamara – Recreation, Land Use, and Cultural Resources (Outdoor Recreation Planner, B.A. Public Policy and Environmental Studies, M.C.P., Land Use and Environmental Planning)

Sean Murphy – Aquatic and Terrestrial Resources (Fish and Wildlife Biologist, B.S Zoology, M.S. Fish and Wildlife Management)

APPENDIX A

Draft License Conditions Recommended by Staff

In this section, we present license articles for staff-recommended measures that would not be addressed by mandatory conditions. On April 17, 2017, West Virginia DEP issued a water quality certification with mandatory conditions for the project. These conditions would be included in any license that is issued for the project. They are reproduced in Appendix B of this EA for informational purposes.

Draft Article 201. *Administrative Annual Charges.* The licensee must pay the United States the following annual charges, as determined in accordance with provisions of the Commission's regulations in effect from time to time, effective as of the date by which the licensee is required to commence project construction, or as that date may be extended, but in no case longer than four years after license issuance, to reimburse the United States for the cost of administration of Part 1 of the Federal Power Act. The authorized installed capacity for that purpose is 2.84 megawatts.

Draft Article 202. *Exhibit F Drawings.* Within 45 days of the date of issuance of this license, as directed below, the licensee must file two sets of the approved exhibit drawings and geographic information system (GIS) data in electronic file format on compact disks.

(a) Digital images of the approved exhibit drawings must be prepared in electronic format. Prior to preparing each digital image, the FERC Project-Drawing Number [i.e., P-2343-1001 through P-2343-10XX] must be shown in the margin below the title block of the approved drawing. The licensee must file two separate sets of exhibit drawings in electronic format on compact disks with the Secretary of the Commission, ATTN: OEP/DHAC. Exhibit F drawings must be segregated from other project exhibits, and identified as **Critical Energy Infrastructure Information (CEII) material under 18 CFR §388.113(c)**. Each drawing must be a separate electronic file, and the file name must include: FERC Project-Drawing Number, FERC Exhibit, Drawing Title, date of this License, and file extension in the following format [e.g., P-2343-1001, F-1, Plan View, MM-DD-YYYY.TIF]. All digital images of the exhibit drawings must meet the following format specification:

IMAGERY – black & white raster file
FILE TYPE – Tagged Image File Format (TIFF) CCITT Group 4 (also known as T.6 coding scheme)
RESOLUTION – 300 dots per inch (dpi) desired, (200 dpi minimum)
DRAWING SIZE FORMAT – 22" x 34" (minimum), 24" x 36" (maximum)
FILE SIZE – less than 1 megabyte desired

Draft Article 203. *Revised Exhibit G Drawings*. Within 90 days of the issuance date of the license, the licensee must file, for Commission approval, revised Exhibit G drawings showing the modified project boundary as described in the licensing order. Each Exhibit G drawing that includes the project boundary must contain a minimum of three known reference points (i.e., latitude and longitude coordinates, or state plane coordinates). The points must be arranged in a triangular format for GIS georeferencing the project boundary drawing to the polygon data, and must be based on a standard map coordinate system. The spatial reference for the drawing (i.e., map projection, map datum, and units of measurement) must be identified on the drawing and each reference point must be labeled. The Exhibit G drawings must comply with sections 4.39 and 4.41 of the Commission's regulations.

Draft Article 204. *Amortization Reserve*. Pursuant to section 10(d) of the Federal Power Act, a specified reasonable rate of return upon the net investment in the project must be used for determining surplus earnings of the project for the establishment and maintenance of amortization reserves. The licensee must set aside in a project amortization reserve account at the end of each fiscal year one half of the project surplus earnings, if any, in excess of the specified rate of return per annum on the net investment. To the extent that there is a deficiency of project earnings below the specified rate of return per annum for any fiscal year, the licensee must deduct the amount of that deficiency from the amount of any surplus earnings subsequently accumulated, until absorbed. The licensee must set aside one-half of the remaining surplus earnings, if any, cumulatively computed, in the project amortization reserve account. The licensee must maintain the amounts established in the project amortization reserve account until further order of the Commission.

The specified reasonable rate of return used in computing amortization reserves must be calculated annually based on current capital ratios developed from an average of 13 monthly balances of amounts properly included in the licensee's long-term debt and proprietary capital accounts as listed in the Commission's Uniform System of Accounts. The cost rate for such ratios must be the weighted average cost of long-term debt and preferred stock for the year, and the cost of common equity must be the interest rate on 10-year government bonds (reported as the Treasury Department's 10-year constant maturity series) computed on the monthly average for the year in question plus four percentage points (400 basis points).

Draft Article 205. *Headwater Benefits.* If the licensee's project was directly benefited by the construction work of another licensee, a permittee, or the United States on a storage reservoir or other headwater improvement during the term of the prior license (including extensions of that term by annual licenses), and if those headwater benefits were not previously assessed and reimbursed to the owner of the headwater improvement, the licensee must reimburse the owner of the headwater improvement for those benefits, at such time as they are assessed, in the same manner as for benefits

received during the term of this new license. The benefits will be assessed in accordance with Part 11, Subpart B, of the Commission's regulations.

Draft Article 301. *Project Modification Resulting From Environmental Requirements*. If environmental requirements under this license require modification that may affect the project works or operations, the licensee must be consult with the Commission's Division Dam Safety and Inspections – New York Regional Engineer. Consultation must allow sufficient review time for the Commission to ensure that the proposed work does not adversely affect the project works, dam safety, or project operation

Draft Article 401. *Commission Approval and Reporting.*

(a) *Requirement to File Report.*

The licensee must file with the Commission the following report as required by the West Virginia Department of Environmental Protection's (Virginia DEP) water quality certification.

Alabama DEM WQC Condition No.	**Report Name**	**Commission Due Date**
5	Dissolved oxygen and water temperature monitoring report	Within 90 days following the end of the annual monitoring period

(b) *Requirement to File Plans for Commission Approval*

Condition 1 of West Virginia DEP's water quality certification (Appendix B) requires the licensee to prepare an Eel Passage Operations Plan. The plan must also be submitted to the Commission for approval.

The licensee must include with the plan filed with the Commission documentation that the licensee developed the plan after consultation with the West Virginia DEP, U.S. Fish and Wildlife Service, and other entities described in Condition 1 of the water quality certification. The licensee must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information. The Commission reserves the right to make changes to any plan submitted. Upon Commission approval, the plan becomes a requirement of the license, and the licensee must implement the plan or changes in project operation or facilities, including any changes required by the Commission.

(c) *Requirement to File Amendment Applications*

Certain conditions of West Virginia DEP's water quality certification contemplate unspecified, long-term changes to project operation or facilities based on the results of studies or monitoring (e.g., condition 1 contemplates alternative project operations and condition 2 contemplates project changes to address low dissolved oxygen concentrations). Such changes may not be implemented without prior Commission authorization granted after the filing of an application to amend the license.

Draft Article 4XX. *Reservation of Authority to Prescribe Fishways*. Authority is reserved to the Commission to require the licensee to construct, operate, and maintain, or to provide for the construction, operation, and maintenance of such fishways as may be prescribed by the Secretary of the Interior pursuant to section 18 of the Federal Power Act.

Draft Article 4XX. *Operation Compliance Monitoring Plan*. With six months of license issuance, the licensee must file for Commission approval, an operation compliance monitoring plan that describes how the licensee will document compliance with the operational requirements of this license.

The plan must include, at a minimum, the following:

(1) a detailed description of how the licensee will document compliance with the operational requirements of the license established under conditions 1, 2, and 9 of West Virginia Department of Environmental Quality's (West Virginia DEP's) water quality certification;

(2) a description of all gages or recording devices that will be used to monitor operation compliance;

(3) the method of calibration of each gage and/or measuring device;

(4) the frequency of recording for each gage and/or measuring device;

(5) a provision to maintain a log of project operation;

(6) procedures for recording, maintaining, and reporting the monitoring data to the Commission; and

(7) a provision for reporting to the Commission as soon as possible, but no later than 10 days after discovery, deviations from the operational requirements of the license, along with proposed actions that will be taken to avoid reoccurrence of the deviation.

The licensee must prepare the plan after consultation with the West Virginia DEP, West Virginia Department of Natural Resources, and U.S. Fish and Wildlife Service. The licensee must include with the plan documentation of consultation, copies of comments and recommendations on the completed plan after it has been prepared and provided to the agencies, and specific descriptions of how the agencies' comments are accommodated by the plan. The licensee must allow a minimum of 30 days for the agencies to comment and to make recommendations before filing the plan with the Commission. If the licensee does not adopt a recommendation, the filing must include the licensee's reasons, based on project-specific information.

The Commission reserves the right to require changes to the plan. The plan must not be implemented until the licensee is notified by the Commission that the plan is approved. Upon Commission approval, the licensee must implement the plan, including any changes required by the Commission.

Draft Article 4XX. *Protection of Northern Long-eared Bat and Indiana Bat.* For the protection of the threatened northern long-eared bat and the endangered Indiana bat, the licensee must limit the cutting, trimming or destruction of trees on project land, to the period of November 15 through March 31. The licensee is permitted to remove hazardous or fallen trees for protection of human life and property along the transmission line corridor at any time. From April 1 through November 14, the licensee may only conduct tree-trimming and tree-removal activities on project lands after consultation with U.S. Fish and Wildlife Service, the West Virginia Department of Natural Resources, and the West Virginia Department of Environmental Protection.

Draft Article 4XX. *Recreation Management Plan.* The Final Recreation Management Plan filed on May 11, 2016 as Attachment 4 of the Response to Request for Additional Information is approved. Upon license issuance, the licensee must implement the Recreation Management Plan.

Within 60 days of license issuance, the licensee must update the Recreation Management Plan to include a provision for the operation and maintenance of portable restroom facilities at the Big Eddy Access Area, the Lower Angling Access Trail parking area, and the Downstream Access Area, and file a courtesy copy of the updated plan with the Commission. The Commission reserves the right to require changes to the plan during the term of the license.

The licensee must continue to operate and maintain, or provide for the operation and maintenance of the Big Eddy Access Area, the Upper Angling Access Trail, the Lower Angling Access Trail, and the Downstream Access area, as described in section 2.1 of the Recreation Management Plan for the term of the license.

Draft Article 4XX. *Protection of Previously Undiscovered Cultural Resources.* If the licensee discovers previously unidentified cultural resources during the course of

maintaining, or developing project works or other facilities at the project, the licensee must stop all land-clearing and land-disturbing activities in the vicinity of the resource and consult with the West Virginia State Historic Preservation Officer (West Virginia SHPO) and potentially affected Indian tribes to determine the need for any cultural resource studies or measures. If no studies or measures are needed, the licensee must file with the Commission documentation of its consultation with the West Virginia SHPO and potentially affected tribes immediately.

If a discovered cultural resource is determined to be eligible for the National Register of Historic Places (National Register), the licensee must file for Commission approval a historic properties management plan (HPMP) prepared by a qualified cultural resource specialist after consultation with the West Virginia SHPO. In developing the HPMP, the licensee must use the Advisory Council on Historic Preservation and the Federal Energy Regulatory Commission's Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects, dated May 20, 2002. The HPMP must include the following items: (1) a description of each discovered property, indicating whether it is listed in or eligible to be listed in the National Register; (2) a description of the potential effect on each discovered property; (3) proposed measures for avoiding or mitigating adverse effects; (4) documentation of consultation; and (5) a schedule for implementing mitigation and conducting additional studies. The Commission reserves the right to require changes to the HPMP.

The licensee must not resume land-clearing or land-disturbing activities in the vicinity of a cultural resource discovered during construction, until informed by the Commission that the requirements of this article have been fulfilled.

Draft Article 4XX. *Protection of Cultural Resources*. Prior to implementing any project modifications not specifically authorized by this license, including but not limited to maintenance activities, land-clearing or land-disturbing activities, or changes to project operation or facilities, the licensee must consult with the West Virginia State Historic Preservation Officer (West Virginia SHPO) to determine the effects of the activities and the need for any cultural resource studies or measures. If no studies or measures are needed, the licensee must file with the Commission documentation of its consultation with the West Virginia SHPO.

If a project modification is determined to affect an historic property, the licensee must file for Commission approval an historic properties management plan (HPMP). The HPMP must be prepared by a qualified cultural resource specialist after consultation with the West Virginia SHPO. In developing the HPMP, the licensee must use the Advisory Council on Historic Preservation and the Commission's *Guidelines for the Development of Historic Properties Management Plans for FERC Hydroelectric Projects*, dated May 20, 2002. The HPMP must include the following items: (1) a

description of each historic property; (2) a description of the potential effect on each historic property; (3) proposed measures for avoiding or mitigating adverse effects; (4) documentation of the nature and extent of consultation; and (5) a schedule for implementing mitigation and conducting additional studies. When filing the HPMP for Commission approval, licensee must include any documentation of consultation with the West Virginia SHPO and any potentially affected Indian tribes consulted during the development of the HPMP.

The Commission reserves the right to require changes to the HPMP. The licensee must not implement any project modifications, other than those specifically authorized in this license, until informed by the Commission that the requirements of this article have been fulfilled.

Draft Article 4XX. *Use and Occupancy.* (a) In accordance with the provisions of this article, the licensee must have the authority to grant permission for certain types of use and occupancy of project lands and waters and to convey certain interests in project lands and waters for certain types of use and occupancy, without prior Commission approval. The licensee may exercise the authority only if the proposed use and occupancy is consistent with the purposes of protecting and enhancing the scenic, recreational, and other environmental values of the project. For those purposes, the licensee must also have continuing responsibility to supervise and control the use and occupancies for which it grants permission, and to monitor the use of, and ensure compliance with the covenants of the instrument of conveyance for, any interests that it has conveyed, under this article. If a permitted use and occupancy violates any condition of this article or any other condition imposed by the licensee for protection and enhancement of the project's scenic, recreational, or other environmental values, or if a covenant of a conveyance made under the authority of this article is violated, the licensee must take any lawful action necessary to correct the violation. For a permitted use or occupancy, that action includes, if necessary, canceling the permission to use and occupy the project lands and waters and requiring the removal of any non-complying structures and facilities.

(b) The types of use and occupancy of project lands and waters for which the licensee may grant permission without prior Commission approval are: (1) landscape plantings; (2) non-commercial piers, landings, boat docks, or similar structures and facilities that can accommodate no more than 10 water craft at a time and where said facility is intended to serve single-family type dwellings; (3) embankments, bulkheads, retaining walls, or similar structures for erosion control to protect the existing shoreline; and (4) food plots and other wildlife enhancement. To the extent feasible and desirable to protect and enhance the project's scenic, recreational, and other environmental values, the licensee must require multiple use and occupancy of facilities for access to project lands or waters. The licensee must also ensure, to the satisfaction of the Commission's authorized representative, that the use and occupancies for which it grants permission

are maintained in good repair and comply with applicable state and local health and safety requirements. Before granting permission for construction of bulkheads or retaining walls, the licensee must: (1) inspect the site of the proposed construction, (2) consider whether the planting of vegetation or the use of riprap would be adequate to control erosion at the site, and (3) determine that the proposed construction is needed and would not change the basic contour of the impoundment shoreline. To implement this paragraph (b), the licensee may, among other things, establish a program for issuing permits for the specified types of use and occupancy of project lands and waters, which may be subject to the payment of a reasonable fee to cover the licensee's costs of administering the permit program. The Commission reserves the right to require the licensee to file a description of its standards, guidelines, and procedures for implementing this paragraph (b) and to require modification of those standards, guidelines, or procedures.

(c) The licensee may convey easements or rights-of-way across, or leases of project lands for: (1) replacement, expansion, realignment, or maintenance of bridges or roads where all necessary state and federal approvals have been obtained; (2) storm drains and water mains; (3) sewers that do not discharge into project waters; (4) minor access roads; (5) telephone, gas, and electric utility distribution lines; (6) non-project overhead electric transmission lines that do not require erection of support structures within the project boundary; (7) submarine, overhead, or underground major telephone distribution cables or major electric distribution lines (69-kV or less); and (8) water intake or pumping facilities that do not extract more than one million gallons per day from a project impoundment. No later than January 31 of each year, the licensee must file with the Commission a report briefly describing for each conveyance made under this paragraph (c) during the prior calendar year, the type of interest conveyed, the location of the lands subject to the conveyance, and the nature of the use for which the interest was conveyed.

(d) The licensee may convey fee title to, easements or rights-of-way across, or leases of project lands for: (1) construction of new bridges or roads for which all necessary state and federal approvals have been obtained; (2) sewer or effluent lines that discharge into project waters, for which all necessary federal and state water quality certification or permits have been obtained; (3) other pipelines that cross project lands or waters but do not discharge into project waters; (4) non-project overhead electric transmission lines that require erection of support structures within the project boundary, for which all necessary federal and state approvals have been obtained; (5) private or public marinas that can accommodate no more than 10 water craft at a time and are located at least one-half mile (measured over project waters) from any other private or public marina; (6) recreational development consistent with an approved report on recreational resources of an Exhibit E; and (7) other uses, if: (i) the amount of land conveyed for a particular use is five acres or less; (ii) all of the land conveyed is located at least 75 feet, measured horizontally, from project waters at normal surface

elevation; and (iii) no more than 50 total acres of project lands for each project development are conveyed under this clause (d)(7) in any calendar year. At least 60 days before conveying any interest in project lands under this paragraph (d), the licensee must file a letter with the Commission, stating its intent to convey the interest and briefly describing the type of interest and location of the lands to be conveyed (a marked Exhibit G map may be used), the nature of the proposed use, the identity of any federal or state agency official consulted, and any federal or state approvals required for the proposed use. Unless the Commission's authorized representative, within 45 days from the filing date, requires the licensee to file an application for prior approval, the licensee may convey the intended interest at the end of that period.

(e) The following additional conditions apply to any intended conveyance under paragraph (c) or (d) of this article:

(1) Before conveying the interest, the licensee must consult with federal and state fish and wildlife or recreation agencies, as appropriate, and the State Historic Preservation Officer.

(2) Before conveying the interest, the licensee must determine that the proposed use of the lands to be conveyed is not inconsistent with any approved report on recreational resources of an Exhibit E; or, if the project does not have an approved report on recreational resources, that the lands to be conveyed do not have recreational value.

(3) The instrument of conveyance must include the following covenants running with the land: (i) the use of the lands conveyed must not endanger health, create a nuisance, or otherwise be incompatible with overall project recreational use; (ii) the grantee must take all reasonable precautions to ensure that the construction, operation, and maintenance of structures or facilities on the conveyed lands will occur in a manner that will protect the scenic, recreational, and environmental values of the project; and (iii) the grantee must not unduly restrict public access to project lands or waters.

(4) The Commission reserves the right to require the licensee to take reasonable remedial action to correct any violation of the terms and conditions of this article, for the protection and enhancement of the project's scenic, recreational, and other environmental values.

(f) The conveyance of an interest in project lands under this article does not in itself change the project boundaries. The project boundaries may be changed to exclude land conveyed under this article only upon approval of revised Exhibit G drawings (project boundary maps) reflecting exclusion of that land. Lands conveyed under this article will be excluded from the project only upon a determination that the lands are not necessary for project purposes, such as operation and maintenance, flowage, recreation, public access, protection of environmental resources, and shoreline control, including

shoreline aesthetic values. Absent extraordinary circumstances, proposals to exclude lands conveyed under this article from the project must be consolidated for consideration when revised Exhibit G drawings would be filed for approval for other purposes.

(g) The authority granted to the licensee under this article must not apply to any part of the public lands and reservations of the United States included within the project boundary.

APPENDIX B

State 401 Water Quality Certification Special Conditions
Issued by the West Virginia Department of Environmental Protection
June 21, 2017

Special Conditions:

1. The applicant will continue its consultation with WVDNR-WRS, US Fish and Wildlife Service, U.S. Geological Survey, West Virginia University, and North Carolina State University in developing and implementing an Eel Passage Operations Plan. This plan would utilize a model to more effectively predict the movement of eels downstream, prompting more appropriate shutdowns in the Project's operations. The model will need to be properly tested to demonstrate its viability before permanent implant. Until the model testing begins, the applicant will maintain its current seasonal nightly shutdown regimen from September 15 to December 15. During testing of the model the applicant will monitor the success of its implementation for two years. Annual briefings on the testing shall be provided to WVDEP-DWWM and WVDNR-WRS. Should managing operations via model output prove to be problematic/unsuccessful, the applicant will consult with WVDNR-WRS to explore model refinement or direction to return to the current shutdown procedure.

2. The applicant will maintain a continuous flow of 200 cfs over the length of the Millville Dam in order to provide for suitable fishery habitat downstream of the dam.

3. Mitigation for the incidental take of fish due to the project's operation shall be provided in an amount made payable to the WVDNR-WRS. Payments shall be submitted to WVDNR-WRS by March 1 of each year for the previous year’s payment. WVDNR- WRS will provide the applicant with the appropriate payment submission information. Monetary reimbursement will be based on the fish mortality calculations from the desktop model submitted on 12/06/2016. The reimbursement amount calculation incorporates the projected numbers of lost fish, fish replacement values from the latest American Fisheries Society (AFS) replacement costs, and an annual inflation adjustment based on the Bureau of Labor's Consumer Price Index. Currently, the total amount due will be $16,389.28, provided annually, and will be adjusted periodically to reflect WVDNR-WRS's latest fish replacement costs. This amount will be adjusted when AFS publishes new replacement values (next expected in 2017), for inflation, to include any updated mortality estimations and to incorporate any future

entrainment study results. Regardless, the operative amount will be adjusted every five years to reflect WVDNR- WRS's latest fish replacement costs.

4. A portage route will be identified with signage indicating the specific route. Signage will be erected and maintained by the applicant. Contact information will be provided for on all signs for visitors to use should they wish to report any issues related to the conditions of the recreation facilities.

5. To determine possible effects of project operation on dissolved oxygen, the licensee shall monitor water quality hourly in the impoundment just upstream of the dam and near the powerhouse outlet (exact monitoring locations and depths must be approved by WVDEP- DWWM prior to data collection). The licensee shall monitor for dissolved oxygen (DO) and temperature. Beginning in 2018, monitoring shall be conducted for two years, from May 1 through October 31. The water quality monitoring information shall be provided each year of operation to the WVDEP-DWWM by March 1 of the following year. During the monitoring period, if any dissolved oxygen value is $\leq$ 5.5 mg/l a water quality maintenance and operation adaptive management plan shall be prepared, and submitted to WVDEP-DWWM for approval, setting forth operating steps that will be taken in the event dissolved oxygen will not be in compliance, or is anticipated to not be in compliance, with West Virginia Water Quality Standards (47CSR2). This dissolved oxygen management plan, if necessary, would become applicable for the duration of the license.

6. Receptacles for trash will be installed and maintained at the Downstream Access Recreation Area, the Lower Angling Access Trail, the Upper Angling Access Trail, and the Big Eddy Access Area. Trash removal will occur on a regular basis by the applicant.

7. The four recreation areas associated with the project will be inspected each spring and following any high-water event to assess public accessibility to the site, condition of parking areas, and condition of the recreation facilities. The applicant will maintain these areas to ensure that they continue to be safe and usable.

8. The applicant will provide and maintain Americans with Disabilities Act (ADA) compliant portable restroom facilities at the Downstream Access/Boat Launch Area, Big Eddy Area and the Lower Angling Access Parking Area. These restrooms are to be provided at a minimum from April 1st through November 1st of each year. The facilities are to be operational beginning in 2018. Should vandalism become excessive at any/all of the locations, the applicant shall provide details and suggested operational/placement modifications to the WVDNR-WRS for their concurrence.

9. The developments shall operate in a "run-of-the-river "mode.

10. Any modifications to the FERC license must be recertified.

11. Water Quality Certification will be reevaluated at least every five (5) years from the date of this certification to reflect updates and results from special condition 3 above.

12. The licensee is responsible for compliance with water quality standards as contained in Title 47CSR2 of the West Virginia Code of State Regulations, Requirements Governing Water Quality Standards.

13. Violation of any of the conditions listed above shall negate this water quality certification.