ENVIRONMENTAL ASSESSMENT
FOR
HYDROPOWER LICENSE

American Tissue Hydroelectric Project

FERC Project No. 2809-034

Maine

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

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ACRONYMS AND ABBREVIATIONS

ACHP	Advisory Council on Historic Preservation
American Tissue	American Tissue Hydroelectric Project
APE	area of potential effect
°C	degree Celsius
Certification	water quality certification
CFR	Code of Federal Regulations
cfs	cubic feet per second
cm	centimeters
Commission	Federal Energy Regulatory Commission
Commerce	U.S. Department of Commerce
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
EA	environmental assessment
EFH	essential fish habitat
ESA	Endangered Species Act
°F	degree Fahrenheit
FERC	Federal Energy Regulatory Commission
FPA	Federal Power Act
Fishway Plan	Fishway Operations and Maintenance Plan
fps	feet per second
FWS	U.S. Fish and Wildlife Service
GOM DPS	Gulf of Maine Distinct Population Segment
IPaC	U.S. Fish and Wildlife Service Information for Planning and Consultation
Interior	U.S. Department of the Interior
KEI Power	KEI (Maine) Power Management (III) LLC
kV	kilovolt
Maine DEP	Maine Department of Environmental Protection
Maine DIFW	Maine Department of Inland Fisheries and Wildlife
Maine DMR	Maine Department of Marine Resources
Maine SHPO	Maine State Historic Preservation Commission Officer
mg/L	milligrams per liter
msl	mean sea level
MW	megawatt
MWh	megawatt-hours
National Register	National Register of Historic Places
NERC	North American Electric Reliability Corporation
NHPA	National Historic Preservation Act
NLEB	northern long-eared bat
NMFS	National Marine Fisheries Service
NPCC	Northeast Power Coordinating Council, Inc.

NRI	Nationwide Rivers Inventory
PAD	Pre-Application Document
RM	river mile
SCORP	Statewide Outdoor Recreation Plan
SHRU	Salmon Habitat Recovery Unit
Strategic Plan	Strategic Plan for the Restoration of Shad and Alewives to the Kennebec River above Augusta
THPO	Tribal Historic Preservation Officer
USGS	U.S. Geological Survey

ENVIRONMENTAL ASSESSMENT

Federal Energy Regulatory Commission
Office of Energy Projects
Division of Hydropower Licensing
Washington, DC

AMERICAN TISSUE HYDROLECTRIC PROJECT
Project No. 2809-034 – Maine

1.0 INTRODUCTION

1.1 APPLICATION

On April 28, 2017, KEI (Maine) Power Management (III) LLC (KEI Power) filed an application with the Federal Energy Regulatory Commission (Commission) for a subsequent license to continue to operate and maintain the American Tissue Hydroelectric Project No. 2809 (American Tissue Project or project).[1] The 1.0-megawatt (MW) project is located on Cobbosseecontee Stream, in the Town of Gardiner, Kennebec County, Maine (Figure 1). 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 American Tissue Project is to provide a source of hydroelectric power. Therefore, under the provisions of the Federal Power Act (FPA), the Commission must decide whether to issue a subsequent license for the American Tissue Project and what conditions should be placed on any license issued. In deciding whether to issue a license for a hydroelectric project, the Commission must determine that the project would be best adapted to a comprehensive plan for improving or developing the waterway. In addition to the power and developmental purposes for which licenses are issued (such as flood control, irrigation, and water supply), the Commission must give equal consideration to the purposes of: (1) energy conservation; (2) the protection, 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 Commission issued the current, original license for the project on May 9, 1979 with an effective date of May 1, 1979, and a term of 40 years *See Maine Hydroelectric Development Corporation*, 7 FERC ¶ 61,146 (1979).

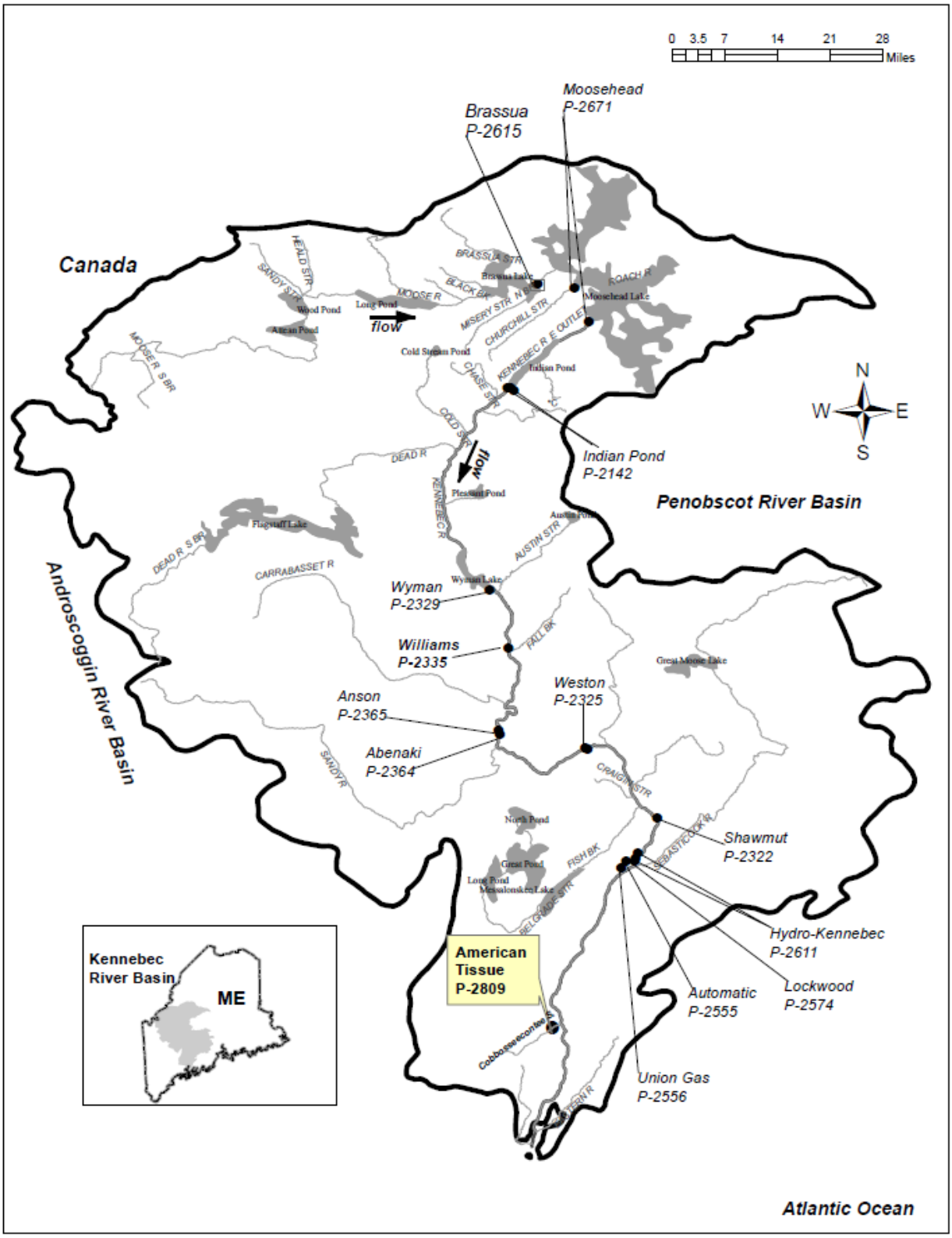

Figure 1. Location of the American Tissue Hydroelectric Project and other dams in the Kennebec River Basin. (Source: staff).

Issuing a subsequent license for the American Tissue Project would allow KEI Power to continue to generate electricity at the project for the term of the subsequent license, making electric power from a renewable resource available to the regional grid.

This environmental assessment (EA) analyzes the effects associated with operation of the project and alternatives to the project, and makes recommendations to the Commission on whether to issue a license, and under what terms and conditions.

The EA assesses the environmental and economic effects of: (1) operating and maintaining the project as proposed by KEI Power; (2) operating and maintaining the project as proposed by KEI Power, with additional staff-recommended measures (staff alternative); and (3) the staff alternative with mandatory conditions. We also consider the effects of the no-action alternative. Under the no-action alternative, the project would continue to operate as it does under the existing license, and no new environmental protection, mitigation, or enhancement measures would be implemented. The primary issues associated with relicensing the project are upstream and downstream passage for alewife and American eels, and flow in the bypassed reach of Cobbosseecontee Stream.

1.2.2 Need for Power

The American Tissue Project has an installed capacity of 1.0 MW and an average annual generation of about 5,430 megawatt-hours (MWh). The project provides power that helps meet part of the region's power requirements, resource diversity, and capacity needs.

The power generated is sold to the Independent System Operator of New England. To assess the need for power, we looked at the needs in the operating region in which the project is located. The North American Electric Reliability Corporation (NERC) annually forecasts electrical supply and demand nationally and regionally for a 10-year period. The American Tissue Project is located within the Northeast Power Coordinating Council's New England region (NPCC-New England) of the NERC. According to NERC's 2017 Long-Term Reliability Assessment, the summer internal demand for this region is projected to decrease by 0.03 percent from 2018 to 2027.

We conclude that power from the American Tissue Project would help continue to meet the need for power in the NPCC-New England region. The project provides power that can displace non-renewable, fossil-fired generation and contributes 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 subsequent license for the 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 states that the Commission is to require construction, operation, and maintenance by a licensee of such fishways as may be prescribed by the Secretaries of the U.S. Department of Commerce (Commerce) or the U.S. Department of the Interior (Interior). On November 27, 2017, the U.S. Fish and Wildlife Service (FWS), on behalf of Interior, and the National Maine Fisheries Service (NMFS), on behalf of Commerce, each timely filed preliminary fishway prescriptions for the project and requested that the Commission include a reservation of authority to prescribe fishways under section 18 in any license issued for the project. The agencies' preliminary fishway prescriptions are summarized in section 2.3, *Modifications to Applicant's Proposal – Mandatory Conditions*, and included in Appendix A (Commerce) and Appendix B (Interior).

1.3.1.2 Section 10(j) Recommendations

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

On November 22, 2017, the Maine Department of Marine Resources (Maine DMR) filed timely recommendations under section 10(j). In addition, on November 27, 2017, Interior and Commerce filed timely recommendations under section 10(j). These recommendations are summarized in Table 11 and discussed in section 5.3, *Summary of Section 10(j) Recommendations*.

1.3.2 Clean Water Act

Under section 401(a)(1) of the Clean Water Act (CWA), 33 U.S.C. § 1341(a)(1), a license applicant must obtain either a water quality certification (certification) from the

appropriate state pollution control agency verifying that any discharge from the project would comply with applicable provisions of the CWA, or a waiver of such certification. A waiver occurs if the state agency does not act on a request for certification within a reasonable period of time, not to exceed one year after receipt of such request.

On December 13, 2017, KEI Power applied to the Maine Department of Environmental Protection (Maine DEP) for section 401 certification for the American Tissue Project. Maine DEP received the request on the same day. Maine DEP has not yet acted on the application.

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. On May 9, 2018, we accessed FWS's Information for Planning and Consultation (IPaC) database to determine federally listed species that could occur in the project vicinity. According to the IPaC database, the federally endangered Atlantic salmon (*Salmo salar*) and threatened northern long-eared bat (*Myotis septentrionalis*) could occur in the project vicinity.[2] No critical habitat for either species is present in the project vicinity.

Our analysis of project impacts on the northern long-eared bat and Atlantic salmon is presented in section 3.3.3.2, *Threatened and Endangered Species – Environmental Effects*. Based on available information, we conclude that licensing the project would have no effect on the northern long-eared bat or Atlantic salmon.

1.3.4 Coastal Zone Management Act

The Coastal Zone Management Act (CZMA) of 1972, as amended, requires review of the project's consistency with a state's Coastal Management Program for projects within or affecting the coastal zone. Under section 307(c)(3)(A) of the CZMA, 16 U.S.C. §1456(c)(3)(A), the Commission cannot issue a license for a project within or affecting a state's coastal zone unless the state's CZMA agency concurs with the license applicant's certification of consistency with the state's CZMA Program, or the agency's concurrence is conclusively presumed by its failure to act within 180 days of its receipt of the applicant's certification.

[2] *See* Interior's official list of threatened and endangered species, accessed by staff using the IPaC database (https://ecos.fws.gov/ipac/) on May 9, 2018, and filed on May 11, 2018.

On February 7, 2018, KEI Power submitted a consistency certification to the Maine DMR for compliance with the CZMA. In its submittal, KEI Power states that the continued operation of the American Tissue Project with proposed environmental measures for fish passage and continued provision of downstream minimum flows is consistent with the core laws of Maine's Coastal Program. KEI Power requests Maine DMR's confirmation that the proposed project is consistent with Maine's Coastal Program.

Maine DMR received KEI Power's certification of consistency on February 7, 2018. On March 19, 2018, KEI Power filed an agreement between itself and Maine DMR pursuant to 15 C.F.R. § 930.60(b), which provides that state agencies and applicants may mutually agree in writing to stay the six-month consistency review period. The agreement states that Maine DMR's response to KEI Power's consistency certification will be based on Maine DEP's water quality certification under section 401 of the Clean Water Act, and that the one-year period for Maine DEP's section 401 review expires on December 12, 2018. As a result, the agreement essentially stays Maine DMR's review process until December 12, 2018, and states that Maine DMR's review period will end on or before May 10, 2019.

1.3.5 National Historic Preservation Act

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

In response to KEI Power's April 30, 2014 request, Commission staff designated KEI Power as its non-federal representative for the purposes of conducting section 106 consultation under the NHPA on June 10, 2014. Pursuant to section 106, and as the Commission's designated non-federal representative, KEI Power initiated consultation with the Maine State Historic Preservation Commission, which functions as the State Historic Preservation Officer (Maine SHPO) to identify historic properties, determine National Register eligibility, and assess potential adverse effects on historic properties within the project's area of potential effects (APE).

On January 22, 2016,[3] the Maine SHPO informed KEI Power that licensing the project would not affect architectural properties. On February 21, 2017, the Maine SHPO recommended a reconnaissance-level archaeological survey during the next scheduled

[3] *See* KEI Power's April 28, 2017 license application at Appendix C.

project drawdown to identify potentially significant archaeological resources submerged in the impoundment of the project, including the remains of the 19th century Gardiner Mill. The Maine SHPO recommended that KEI Power assess the condition of the archaeological resources, and the need for documentation and eligibility for listing in the National Register. In an April 13, 2017 letter to the Maine SHPO, KEI Power stated that it will coordinate with the SHPO on any drawdown for maintenance or inspection purposes that is sufficiently low to dewater the mill. KEI Power has not reached a conclusion with the Maine SHPO on the effects of the project on the mill.

Absent a drawdown of the project impoundment, there is no imminent threat to the archaeological resources identified by the Maine SHPO. Conducting a reconnaissance survey and determining the National Register eligibility of the mill remains during the next impoundment drawdown would inform the need for protective measures. If the Gardiner Mill remains are eligible for listing on the National Register, then KEI Power would need to develop specific measures to ensure the protection of the historic property in consultation with the Maine SHPO. Our analysis presented in section 3.3.5, *Cultural Resources*, concludes that relicensing the project as proposed and with the staff-recommended measures would not be likely to affect cultural resources that are eligible for or listed on the National Register because the project would only involve new construction for fish passage facilities, which would not occur near or affect any known historic sites (listed, eligible, or otherwise).

1.3.6 Magnuson-Stevens Fishery Conservation and Management Act

Section 305 of the Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. § 1855(b)(2), requires federal agencies to consult with NMFS on all actions that may adversely affect Essential Fish Habitat (EFH). EFH for Atlantic salmon has been defined as, "all waters currently or historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut."

The project area constitutes EFH for Atlantic salmon because it is located in Maine and on Cobbosseecontee Stream, which was historically accessible to Atlantic salmon. Our analysis of project effects on Atlantic salmon EFH is presented in section 3.3.3.2, *Environmental Effects, Atlantic Salmon*. We conclude that relicensing the project as proposed and with the staff-recommended measures would not adversely affect Atlantic salmon EFH. KEI Power proposes and staff recommends operating the project in run-of-river mode and releasing year-round minimum flows to the bypassed reach and additional seasonal flow releases for downstream fish passage. Operating the project in run-of-river mode would provide nearly natural flows and maintain water temperatures to support habitat. Run-of-river operation also reduces project-related water level fluctuations in the downstream reach that could otherwise dewater spawning habitat. Therefore, over the term of the license, Atlantic salmon EFH would be enhanced under

the applicant's proposal, and the additional staff modifications and measures discussed in section 5.1, *Comprehensive Development and Recommended Alternative*, which are supported in section 3.3.1.2, *Aquatic Resources*, would further support EFH. Based on this information, we conclude that relicensing the American Tissue Project with the measures considered in this EA would not adversely affect Atlantic salmon EFH habitat.

1.4 PUBLIC REVIEW AND COMMENT

The Commission's regulations (18 CFR § 16.8) require applicants to consult with appropriate resource agencies, tribes, and other entities before filing an application for a license. This consultation is the first step in complying with the Fish and Wildlife Coordination Act (16 U.S.C. § 661 *et seq*.), ESA, NHPA, and other federal statutes. Pre-filing consultation must be completed and documented according to the Commission's regulations.

1.4.1 Scoping

Before preparing this EA, staff conducted scoping to determine what issues and alternatives should be addressed. A scoping document was distributed to interested agencies and others on August 8, 2017. The scoping document was noticed in the *Federal Register* on August 14, 2017. NMFS filed comments on the scoping document on August 31, 2017 and FWS filed comments on September 7, 2017.

1.4.2 Interventions

On September 28, 2017, the Commission issued a notice accepting the application and setting November 27, 2017 as the deadline for filing motions to intervene and protests. The notice was published in the *Federal Register* on October 4, 2017. In response to the notice, the following entities filed notices of intervention (none opposed issuance of a license):

Intervenor	**Date Filed**
Maine Department of Inland Fisheries and Wildlife	October 4, 2017
NMFS	November 27, 2017

1.4.3 Comments on the Application

On September 28, 2017, the Commission issued a notice setting November 27, 2017 as the deadline for filing comments, recommendations, terms and conditions, and prescriptions. The following entities responded:

Commenting Entity	Date Filed
Maine Department of Marine Resources	November 22, 2017
NMFS[4]	November 27, 2017
Interior[5]	November 27, 2017

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 baseline environmental conditions for comparison with other alternatives.

2.1.1 Existing Project Facilities

The American Tissue Project is located on Cobbosseecontee Stream in the Town of Gardiner, Maine, approximately 1.0 river mile upstream of the confluence of Cobbosseecontee Stream and the Kennebec River. The project facilities are shown in Figure 2.

The dam is a 256-foot-long concrete and stone masonry structure that includes: (1) a 61-foot-long, 26-foot-high west abutment section with 2-foot-high flashboards; (2) a 100-foot-long, 19- to 23-foot-high spillway section with 12-inch-high flashboards and a crest elevation of 122.3 feet mean sea level (msl); and (3) a 95-foot-long, 27-foot-high east abutment section with: (a) a 34-foot-wide, 19-foot-high concrete intake structure that includes a manually-operated headgate and a 17-foot-wide, 25.5-foot-high trashrack with

[4] NMFS's November 27, 2017 filing included its section 18 preliminary fishway prescriptions. On November 29 and November 30, 2017, NMFS filed the administrative record for its section 18 preliminary fishway prescriptions.

[5] Interior's November 27, 2017 filing included its section 18 preliminary fishway prescriptions. On November 28, 2017, Interior filed the administrative record for its section 18 preliminary fishway prescriptions.

2-inch clear spacing; and (b) three 4.67-foot-diameter discharge pipes[6] with steel slide gates located at the base of the dam at an elevation of 100.8 feet msl.

The dam impounds approximately 5.5 surface acres at a normal maximum water surface elevation of 123.3 feet msl. From the impoundment, water enters a 280-foot-long, 7-foot-diameter underground steel penstock through the intake structure. Water flows from the penstock to the 1-MW Kaplan turbine-generator unit located in the 37-foot-long, 34-foot-wide concrete and wooden powerhouse, and then back into the mainstem of Cobbosseecontee Stream. The project creates a 345-foot-long bypassed reach of Cobbosseecontee Stream.

The project generator connects to a 4/12 kilovolt (kV) step-up transformer, then to a 250-foot-long, 12-kv underground transmission line that connects to the regional electric grid.

Downstream passage for adult American eels is provided through a discharge pipe located at the base of the east abutment section of the dam. Downstream passage for alewives is provided through an opening in the flashboards on top of the spillway, and a 15-foot-long, 3-foot-wide, 4-foot-high steel, and plywood plunge pool located on the downstream side of the spillway (collectively referred to as the "downstream fish passage facility"). There are no upstream fish passage facilities at the project.

The project includes no formal recreation facilities.

2.1.2 Existing Project Boundary

The current project boundary for the American Tissue Project as established in the Commission's May 9, 1979 license order encompasses 7.1 acres, including the impoundment up to a contour elevation of 125.3 feet msl, the bypassed reach, and land associated with the dam, powerhouse, transmission line, and appurtenant facilities.

[6] For descriptive purposes, we use the term "discharge pipes" in this EA instead of the term "deep gates" that is used by KEI Power in the April 28, 2017 license application.

Figure 2. American Tissue Project facilities (Source: U.S. Geological Survey, 2017, as modified by staff).

2.1.3 Project Safety

The American Tissue Project has been operating for more than 34 years under its existing license. During this time, Commission staff has conducted operational inspections focusing on the continued safety of the structures, identification of unauthorized modifications, efficiency, and safety of operations, compliance with the terms of the license, and proper maintenance.

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

2.1.4 Current Project Operation

KEI Power operates the American Tissue Project as a run-of-river facility. The existing license requires a continuous minimum flow of 52 cubic feet per second (cfs) (or inflow to the impoundment, whichever is less) to be released from the project. When the project is generating, the minimum flow requirement is met by conveying water through the project penstock and the project turbine, where it then exits the project powerhouse and re-enters Cobbosseecontee Stream. When the generator is offline, the minimum flow of 52 cfs is released over the crest of the dam or via the discharge pipe located at the base of the dam.

When river flow is less than or greater than the hydraulic capacity of the turbine at the American Tissue Project (*i.e.*, 100 cfs and 360 cfs, respectively), water is spilled over the dam into the bypassed reach. However, there is currently no required minimum instream flow for the 345-foot bypassed reach.

According to an October 16, 2003 Commission order, the licensee is required to facilitate passage of American eels from September 1 through November 15 of each year by: (1) opening a discharge pipe at the base of the dam by at least 8 inches at night to provide safe passage for eels;[7] and (2) installing 30-inch-tall blinding plates[8] at the base of the trashrack to block eel entrainment.[9] Of the three discharge pipes located at the base of the American Tissue Dam, KEI Power uses the discharge pipe located furthest from the intake structure to provide downstream passage for eels.[10] The licensee also

[7] In Exhibit A of the license application, KEI Power states that 40 cfs is released through the discharge pipe.

[8] A blinding plate is a rectangular solid steel plate that covers the bottom of the intake screen to prevent entrainment.

[9] *See Ridgewood Maine Hydro Partners, L.P.*, 105 FERC ¶ 62,030 (2003) (October 16, 2003 Order).

[10] Maine DMR stated in its section 10(j) comment letter that the discharge pipe nearest the intake is opened at night to facilitate downstream passage of eels and that the license application mistakenly stated that the discharge pipe furthest from the intake is opened to provide downstream eel passage. The October 16, 2003 Order requires KEI Power to open the discharge pipe furthest from the intake to facilitate downstream passage of eels. There is no evidence on the record indicating that KEI Power opens any other gate than the gate furthest from the intake to facilitate eel passage.

installs a partial trashrack overlay with 7/8-inch clear spacing on a seasonal basis to protect eels from being entrained.

The October 16, 2003 Order requires the licensee to facilitate downstream passage of juvenile alewife on a seasonal basis. No later than September 1 of each year, the licensee must maintain a surface-level egress for alewives by removing a 1-foot by 3-foot section of the flashboards and maintaining a 15-foot-long, 3-foot-wide, 4-foot-high steel and plywood plunge pool at the base of the dam (collectively referred to as the "downstream fish passage facility"). The licensee must maintain these downstream fish passage facilities until November 15, depending on available inflow to the project.[11] In the license application, KEI Power states that it currently releases flows to the bypassed reach for downstream fish passage from June 1 to November 15.

The October 16, 2003 Order requires the licensee to monitor the stream reach downstream of the project at least once a day from September 1 to November 15 for evidence of eel and alewife injury and mortality. If injured or killed alewives or eels are observed downstream of the project, generation must be reduced immediately to protect the fisheries. If any eel entrainment occurs during the eel migration season, the licensee is required to cease project operation each night for the duration of the season.

The project is automated and can be monitored remotely, though KEI Power states that plant operators visit the site daily. Electric water level sensors are used to monitor water levels at the tailrace and upstream and downstream of the trashracks, and are used to control the headpond and turbine.

2.2 APPLICANT'S PROPOSAL

2.2.1 Proposed Project Facilities

KEI Power proposes to remove approximately 0.7 acre of land and water from the project bypassed reach.

2.2.2 Proposed Operation and Environmental Measures

KEI Power proposes to:

- Continue to operate the project in a run-of-river mode to protect aquatic resources;

[11] In Exhibit A of the license application, KEI Power states that 10 cfs is released through the notch in the flashboards for downstream fish passage.

- Continue to provide a continuous minimum flow of 52 cfs or inflow, whichever is less, downstream of the powerhouse to protect aquatic resources;

- Provide a continuous minimum flow of 10 cfs, or inflow if less, to the bypassed reach from November 16 to May 31 to protect aquatic habitat, and a continuous minimum flow of 29 cfs, or inflow if less, to the bypassed reach from June 1 through November 15 to protect aquatic habitat and facilitate downstream fish passage;[12]

- Install a new downstream fish passage facility to replace the existing downstream fish passage facility for alewives, in order to provide a continuous minimum flow of 29 cfs or inflow, whichever is less, to the bypassed reach from June 1 to November 15, and improve the structural integrity and reliability of the plunge pool to provide safe and reliable passage for juvenile and adult alewives downstream of the project;

- Continue monitoring the downstream reach for injured or dead alewives during the downstream passage season, and reducing or ceasing generation if injured or dead alewives are observed;

- Continue to operate and maintain the existing downstream fish passage facility for alewives from June 1 to November 15 of each year by releasing a flow of 10 cfs to the bypassed reach until the new downstream fish passage facility becomes operational;

- Continue to provide downstream eel passage from September 1 to November 15 of each year by: (1) installing blinding plates at the base of the trashrack and a partial trashrack overlay with 7/8-inch clear spacing to protect eels from being entrained; (2) releasing 40 cfs from the discharge pipe at night to provide a passage route for eels; (3) reducing generation at night if any dead or injured adult eel are observed during passage season; and (4) ceasing generation at night for the remainder of the eel passage season if any entrained eels are observed; and

[12] The 10-cfs flow release for fish habitat protection would also contribute to flows for downstream fish passage from June 1 to November 15 of each year.

- Install an upstream eel passage facility on the west end[13] of the project spillway to facilitate upstream passage of American eel over the dam.

2.3 MODIFICATIONS TO APPLICANT'S PROPOSAL – MANDATORY CONDITIONS

The following mandatory conditions have been provided and are summarized below.

Section 18 Prescriptions

Interior's preliminary section 18 prescription would require KEI Power to provide upstream and downstream passage for alosines (alewife, blueback herring, and American shad) and upstream and downstream passage for American eels. Specifically, Interior's prescription would require KEI Power to:

- Continue to operate and maintain the existing downstream fish passage facility from June 1 to November 30 each year until a new downstream fish passage facility is operational;

- Construct a downstream fish passage facility for alosines prior to the second migratory season after issuance of a subsequent license, and operate and maintain the facility annually from June 1 to November 30, with the following design specifications: (1) a minimum 2-foot deep by three-foot wide surface weir that produces gradually accelerating discharge; (2) a minimum flow of 29 cfs to attract and convey migrants over the surface weir without contacting the concrete surface; and (3) the flow through the surface weir must fall into an adequately-sized plunge pool at the toe of the spillway, that then discharges to the bypassed reach;

- Install a 3/4-inch full-length trashrack overlay from June 1 to November 30 each year to protect alosines from entering the penstock intake;

- Two years after upstream passage for alosines is operational at the next downstream dam (Gardiner Paperboard dam), install an upstream fish passage

[13] The April 28, 2017 license application refers to the "river right" and the "river left" when describing features in the vicinity of the project. For descriptive purposes, this EA uses cardinal directions. *See* Figure 2 above for reference.

facility for alosines that is designed to pass a maximum of approximately 3.1 million alosines from May 1 to July 31 each year;[14]

- Operate the existing downstream fish passage facility for eels from August 15 to November 15 each year by installing a trashrack overlay[15] and opening the discharge pipe at the base of the dam to release 40 cfs to the bypassed reach;

- Construct a new downstream fish passage facility for eels if the existing downstream eel passage facility does not pass eels in a safe, timely, and effective manner;

- Construct an upstream fish passage facility for American eel prior to the second migratory season after issuing any subsequent license, and operate and maintain the facility annually from June 1 to September 15;

- Modify fishway operating schedules during the term of the license based on new information;

- Develop a Fishway Operation and Maintenance Plan (Fishway Plan) within 12 months of license issuance that includes provisions for operating and maintaining upstream and downstream fish passage facilities at the project for alosines and eels; update the Fishway Plan upon request of the FWS, and on an annual basis to reflect changes in fishway operation and maintenance; and obtain approval from FWS for any requested modification to the Fishway Plan;

[14] Interior refers to an upstream passage facility for alosines capable of passing "river herring." Commission staff assumes Interior is using "alosines" and "river herring" interchangeably in this requirement.

[15] Interior's preliminary fishway prescription does not clearly specify the bar spacing size that it would require for the trashrack overlay or whether blinding plates would be required to protect eels migrating downstream. Interior states that the licensee "shall continue to use the existing downstream facility (installing the blinding plates and the 7/8-inch punchplate overlay and opening the deep gate at the required time) until further notice," but then states that the licensee "shall continue to install the 3/4-inch, full-length punchplate during the American eel downstream migration period unless a new downstream eel passage facility makes them obsolete." Based on this conflict, staff cannot describe which bar spacing size would be required by Interior for downstream eel passage.

- Provide information on fish passage operations and project generating operations that may affect fish passage to FWS upon written request from resource agencies;

- Design eel and alosine fishways in a manner that is consistent with the FWS's 2017 Fish Passage Engineering Design Criteria Manual (FWS, 2017a) and submit design plans to the resource agencies for review and approval, and then to the Commission for approval;

- File final as-built drawings for new fishways with resource agencies after construction is complete;

- Develop effectiveness testing and evaluation plans within three months of providing the conceptual design for the respective fish passage facility to the FWS, and conduct effectiveness testing and quantitative monitoring at each fish passage facility for a minimum of two years after the facility is operational to evaluate passage success, diagnose problems, and determine if modifications to the facilities are needed;

- Meet annually with FWS and other resource agencies in the late fall to report on fish passage maintenance, operation, and monitoring results, and to review the Fishway Plan;

- Complete any fish passage facility maintenance and modification 30 days prior to the start of the next migratory season; and

- Provide FWS personnel and FWS-designated representatives access to the project site and to pertinent project records for the purpose of inspecting the fish passage facilities and determining compliance with the fishway prescription.

In addition to the specific fish passage measures listed above, Interior reserves authority to prescribe fishways at the project under section 18 of the FPA during the term of any subsequent license.

Commerce's preliminary section 18 prescription would require KEI Power to provide downstream passage for diadromous fish and upstream and downstream passage for American eels. Specifically, Commerce's preliminary fishway prescription would require KEI Power to:

- Continue to operate and maintain the existing downstream fish passage facility for diadromous fish from June 1 to November 30 each year until a new downstream fish passage facility is operational;

- Construct a new downstream fish passage facility for diadromous fish prior to the second migratory season after issuance of any subsequent license, and operate and maintain the new downstream facility from June 1 to November 30, with the following design specifications: (1) a minimum 2-foot deep by 3-foot wide surface weir that produces gradually accelerating discharge; (2) a minimum flow of 25 cfs to attract and convey migrants over the surface weir without impacting the concrete surface; (3) the surface weir flow must fall into an adequately-sized plunge pool at the toe of the spillway that then discharges into the bypassed reach; and (4) seasonal installation of a 7/8-inch full-depth trashrack overlay with blinding plates at the base of the penstock intake;

- Operate a downstream fish passage facility for American eel from August 15 to November 15 each year;

- Construct an upstream fish passage facility that provides safe, timely, and effective upstream passage for American eel on the west side of the dam prior to the second migratory season after issuing a subsequent license; operate the facility annually from June 1 to September 15; and complete maintenance on the facility prior to the eel migration season;

- Submit design plans for eel and alosine fishways to the resource agencies for review and approval, and then submit the design plans to the Commission for approval;

- File final as-built drawings for any new fishways with NMFS after construction is complete;

- Conduct quantitative monitoring of each fish passage facility for a minimum of 2 years after the facility is operational to evaluate whether or not the facility meets performance standards for safe, timely, and effective fish passage;

- Improve fishways that do not meet performance standards; and

- Develop a fish passage operation and maintenance plan that includes measures for operating and maintaining upstream and downstream passage facilities for alosines and eels.

In addition to the specific fish passage measures listed above, Commerce reserves authority to prescribe fishways at the project under section 18 of the FPA during the term of any subsequent license.

2.4 STAFF ALTERNATIVE

Under the staff alternative, the project would be operated as proposed by KEI Power except for: four proposed measures, five of the fishway prescriptions filed by Commerce (Appendix A), and nine of the fishway prescriptions filed by Interior (Appendix B) with some modifications and additional staff-recommended measures described below.

The staff alternative for the project includes modifications of and additions to KEI Power's proposed measures as follows:

- Modify the proposed mode of operation to eliminate a 52-cfs minimum flow requirement;

- Develop an operation compliance monitoring plan to document compliance with run-of-river operation and minimum flow releases that may be required in any subsequent license;

- Modify the proposed dates for releasing flows to the bypassed reach for downstream fish passage, so that flows are released from June 1 to November 30 of each year, instead of June 1 to November 15;

- Construct and operate the new downstream fish passage facility before the second migratory season after issuance of any subsequent license;

- Operate and maintain the existing downstream fish passage facility for safe, timely, and effective passage of alosines from June 1 to November 30 of each year until a new downstream fish passage facility is operational, by: (1) conveying a continuous minimum flow of 10 cfs or inflow, whichever is less, from the impoundment to the bypassed reach; (2) providing a plunge pool at the base of the dam; and (3) installing a partial trashrack overlay with 7/8-inch clear spacing and blinding plates at the base of the trashrack to protect alosines from being entrained;

- Modify the proposed operation of the existing downstream eel passage facility by eliminating the flow release of 40 cfs at night from the discharge pipe at the base of the dam, to protect eels that are migrating downstream;

- Provide downstream eel passage from August 15 to November 15 of each year through: (1) the existing downstream fish passage facility for alosines until the new downstream fish passage facility for alosines is constructed and operational; and (2) the new downstream fish passage facility for alosines once the facility is constructed and operational;

- Protect alewife and American eel during the downstream passage season from June 1 to November 30 of each year (instead of September 1 to November 15 as proposed by KEI Power), by: (1) installing blinding plates at the base of the trashrack and a partial trashrack overlay with 7/8-inch clear spacing over the upper trashrack intake to protect alewives and eels from being entrained; and (2) monitoring the downstream reach for injured/dead alewives during the downstream passage season, and reducing or ceasing generation if injured/dead alewives or eels are observed;

- Operate the new upstream eel passage facility on the west end of the spillway from June 1 to September 15 of each year to facilitate upstream passage of American eel over the dam;

- Construct and operate the new upstream eel passage facility before the second migratory season after the issuance of any subsequent license;

- Design new eel and alosine fishways in a manner that is consistent with the FWS's 2017 Fish Passage Engineering Design Criteria Manual, and submit design plans to the resource agencies for review and approval, and then to the Commission for approval;

- Develop a fish passage operation and maintenance plan to ensure proper operation and maintenance of all existing and newly-constructed fishways, and to ensure that project operation is adjusted if dead or injured alewives or eels are observed downstream of the project;

- Operate each newly-constructed or modified fishway for a one-season "shakedown" period to ensure that the fishways are generally operating as designed, and if not, to make adjustments;

- Complete any maintenance and changes to fish passage facilities at least 30 days prior to the start of the next migratory season;

- Provide FWS personnel and FWS-designated representatives access to the project site and to pertinent records in the performance of their official duties and with reasonable advanced notification;

- Perform an archaeological survey of the Gardiner Mill remains in consultation with the Maine SHPO during the next scheduled drawdown of the project

impoundment and determine the National Register eligibility of Gardiner Mill;[16]

- Consult with the Maine SHPO to establish protocols to be implemented prior to conducting maintenance activities in the vicinity of the project that could affect cultural resources; and

- If previously unidentified cultural resources are encountered during the course of constructing, maintaining, or developing project facilities, consult with the Maine SHPO to ensure the proper treatment of these resources and discontinue all exploratory or construction-related activities until the proper treatment of the resources is established.

Fishway Prescriptions Not Recommended

The staff alternative does not include Interior's preliminary fishway prescriptions to:

- Install a 3/4-inch full-length trashrack overlay from June 1 to November 30 of each year;

- Operate the existing downstream fish passage facility for eels by opening the discharge pipe at the base of the dam to release 40 cfs to the bypassed reach;

- Construct a new downstream fish passage facility for eels if the existing downstream eel passage facility does not pass eels in a safe, timely, and effective manner;

- Two years after upstream passage for alosines is operational at the next downstream dam (Gardiner Paperboard dam), install an upstream fish passage facility for alosines that is designed to pass a maximum of approximately 3.1 million alosines from May 1 to July 31 each year;

- Modify fishway operating schedules during the term of the license based on new information;

[16] If the Gardiner Mill remains are eligible for listing on the National Register, then KEI Power would develop specific measures to ensure the protection of the historic property in consultation with the Maine SHPO.

- Provide FWS information on fish passage operation and project generating operations that may affect fish passage;

- File final as-built drawings for new fishways with resource agencies after construction is complete;

- Develop effectiveness testing and evaluation plans within three months of providing the conceptual design for the respective fish passage facility to the FWS, and conduct effectiveness testing and quantitative monitoring at each fish passage facility for a minimum of two years after the facility is operational to evaluate passage success, diagnose problems, and determine if modifications to the facilities are needed; and

- Meet annually with FWS and other resource agencies in the late fall to report on fish passage maintenance, operation, and monitoring results, and to review the Fishway Plan.

The staff alternative does not include Commerce's preliminary fishway prescriptions to:

- Construct a new downstream fish passage facility for diadromous fish that releases a continuous minimum flow of 25 cfs into the bypassed reach from June 1 to November 30;

- Conduct quantitative monitoring of each fish passage facility for a minimum of 2 years after the facility is operational to evaluate whether or not the facility meets performance standards for safe, timely, and effective fish passage;

- Improve fishways that do not meet performance standards;

- Provide downstream passage for American eel from August 15 to November 15 each year by opening the discharge pipe at the base of the dam to release 40 cfs to the bypassed reach; and

- File final as-built drawings for any new fishways with NMFS after construction is complete.

Section 10(j) Measures Not Recommended[17]

The staff alternative does not include the following section 10(j) recommendations:

- Commerce's, Interior's, and Maine DMR's recommendation to provide a year-round downstream minimum flow of 52 cfs in the reach below the powerhouse;

- Maine DMR's recommendations regarding: (1) installing a 3/4-inch trashrack overlay with blinding plates from June 1 to November 30 to physically exclude diadromous fish and eels from the intake; (2) constructing and operating new upstream and downstream fish passage facilities within 2 years of license issuance; (3) designing and installing a new upstream fish passage facility for anadromous fish consistent with FWS's Design Criteria Manual, within two years after upstream passage becomes operational at the Gardiner Paperboard Dam; (4) developing an operation and maintenance plan for the upstream fish passage facility for anadromous fish; (5) releasing 40 cfs of flow from the deep discharge pipe to facilitate downstream eel passage; (6) testing an experimental airlift-assisted deep bypass for downstream eel passage; (7) testing the new downstream fish passage facility to assess whether it provides safe, timely, and effective passage for juvenile and adult alewife, blueback herring, and American eel; (8) terminating the 40-cfs flow release from the discharge pipe if the downstream fish passage facility or the airlift-assisted deep bypass prove to be effective at passing downstream migrating eels; (9) developing evaluation plans and conducting effectiveness testing for new fish passage facilities; (10) conducting biennial effectiveness studies for fishways that do not meet performance standards; (11) having a licensed engineer certify that fishways are constructed and operating as designed after a one-season "shakedown period;" (12) filing as-built fishway drawings; (13) sending copies of the fishway operating procedures and any revisions to resource agencies over the term of a license; and (14) modifying fishway operating schedules during the term of the license based on migration data and new information; and

- Interior's recommendation to release 40 cfs from September 1 to November 15 through the discharge pipe at the base of the dam and install a 1-inch

[17] See section 5.3, *Summary of Section 10(j) Recommendations*, for additional details on the recommendations. As discussed in section 5.3, some of the measures listed below are outside of the scope of section 10(j). Here, we account for all measures that were characterized as section 10(j) recommendations by the resource agencies, but are not being adopted by Commission staff.

punchplate (*i.e.* trashrack overlay) to facilitate downstream passage of American eel.

2.5 STAFF ALTERNATIVE WITH MANDATORY CONDITIONS

We recognize that the Commission is required to include all section 18 fishway prescriptions 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 the section 18 fishway prescriptions not included in the staff alternative, as discussed above in section 2.4, *Staff Alternative*.

2.6 ALTERNATIVES CONSIDERED BUT ELIMINATED FROM DETAILED ANALYSIS

Project decommissioning was considered as an alternative to the project, but has been eliminated from further analysis because it is not reasonable in the circumstances of this case. We discuss our justification for eliminating project decommissioning as an alternative below.

2.6.1 Project Decommissioning

As the Commission has previously held, decommissioning is not a reasonable alternative to relicensing a project in most cases, when appropriate protection, mitigation, and enhancement measures are available.[18] The Commission does not speculate about possible decommissioning measures at the time of relicensing, but rather waits until an applicant actually proposes to decommission a project, or there are serious resource concerns that cannot be addressed with appropriate license measures, making decommissioning a reasonable alternative to relicensing.[19] This is consistent with NEPA and the Commission's obligation under section 10(a) of the FPA to issue licenses that balance developmental and environmental interests.

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

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

Project retirement could be accomplished with or without dam removal.[20] Either alternative would involve denial of the license application and surrender or termination of the existing license with appropriate conditions.

No participant has recommended project retirement, there are no critical resource concerns, and we have no basis for recommending project retirement. The American Tissue Project is a source of clean, renewable energy. This source of power would be lost if the project was retired. There also could be significant costs associated with retiring the project's powerhouse and appurtenant facilities.

Project retirement without dam removal would involve retaining the dam and disabling or removing equipment used to generate power. Certain project works could remain in place and could be used for historic or other purposes. This approach would require the State of Maine to assume regulatory control and supervision of the remaining facilities. However, no participant has advocated for this alternative, and we do not have any basis for recommending it. Removing the dam would be more costly than retiring it in place, and removal could have substantial, negative environmental effects.

3.0 ENVIRONMENTAL ANALYSIS

This section includes: (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. Sections are organized by resource area (aquatic, recreation, *etc.*). Historic and current conditions are described under each resource area. 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 cumulative effects of the proposed action and alternatives. Staff conclusions and recommended measures are discussed in section 5.1, *Comprehensive Development and Recommended Alternative*.[21]

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[20] In the unlikely event that the Commission denies relicensing of a project or a licensee decides to surrender an existing project, the Commission must approve a surrender "upon such conditions with respect to the disposition of such works as may be determined by the Commission." 18 C.F.R. § 6.2 (2017). This can include simply shutting down the power operations, removing all or parts of the project (including the dam), or restoring the site to its pre-project condition.

[21] Unless otherwise indicated, our information is taken from the application for license filed by KEI Power on April 28, 2017, and KEI Power's September 19, 2017 response to staff's request for additional information.

3.1 GENERAL DESCRIPTION OF THE RIVER BASIN

The American Tissue Project is located at river mile 1.2 on Cobbosseecontee Stream, a tributary of the Kennebec River. The Kennebec River begins at the outlet to Moosehead Lake and flows south for approximately 145 river miles where it joins the Androscoggin River and several smaller rivers to form Merrymeeting Bay (Maine DACF, 2007). The Kennebec River has a total drainage of 5,870 square miles. There are 140 dams on the Kennebec River, some of which are used for hydropower generation. The major streams and tributaries of the Kennebec River include the Dead River, the Carrabassett River, the Sebasticook River, and Cobbosseecontee Stream.

Cobbosseecontee Stream has a total drainage area of approximately 217.2 square miles, and covers three counties in Maine: Kennebec, Androscoggin, and Sagadahoc. Cobbosseecontee Stream is approximately 11 miles long from its headwaters at Cobbosseecontee Lake to its confluence with the Kennebec River. The project is located approximately one mile upstream from the confluence of Cobbosseecontee Stream and the Kennebec River, and is the second-most upstream dam on Cobbosseecontee Stream.

The upper two-thirds of the Kennebec River basin is hilly and mountainous and the lower one-third of the basin has a gentle topography representative of a coastal drainage area. Climate varies by season, with warm to hot (and often humid) summers and cold (sometimes severely cold) winters. The average temperature is approximately 44.5°F (6.9°C). On average, the warmest month is July (68.7°F (20.4°C)) and the coolest month is January (18.7°F (-7.4°C)). Precipitation occurs year-round, with April generally being the wettest month and August being the driest month. Land in the project vicinity is predominantly wooded and lightly developed.

There are five dams on Cobbosseecontee Stream (Table 1). Only the American Tissue Dam is used for hydroelectric generation. The New Mills Dam was historically used to generate power as part of the New Mills Dam Project No. 5399, but the project owner surrendered its FERC exemption from licensing in 1996.[22] The American Tissue Dam and the Gardiner Paperboard Dam are privately owned, while the other three dams on Cobbosseecontee Stream are owned by local municipalities (Table 1).

[22] *Gardiner Water District*, 75 FERC ¶ 62,123 (1996).

Table 1. Dams on Cobbosseecontee Stream.

Dam	Owner	Impoundment Capacity (acre-feet)	Approximate River Mile
Cobbosseecontee Lake	Town of Manchester, Maine	67,000	11
Collins Mills	Town of West Gardiner, Maine	756	9
New Mills	Towns of Gardiner, Richmond, and Litchfield, Maine	4,650	1.4
American Tissue	KEI (Maine) Power Management (III) LLC.	108	1.2
Gardiner Paperboard	Private	Unknown	0.9

(Source: KEI Power, 2017, as modified by staff).

3.2 SCOPE OF CUMULATIVE EFFECTS ANALYSIS

According to the Council on Environmental Quality's regulations that implement the National Environmental Policy Act (40 C.F.R. § 1508.7), a cumulative effect is the impact on the environment that results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency or person undertakes such other 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 development activities.

Based on our review of the license application and agency and public comments, we have not identified any resources that could be cumulatively affected by continued operation of the American Tissue Project.

3.3 PROPOSED ACTION AND ACTION ALTERNATIVES

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

Only the resources that would be affected, or about which comments have been received, are addressed in detail in this EA. Based on this, we have determined that aquatic resources, terrestrial resources, threatened and endangered species, land use and recreation, and cultural resources may be affected by the proposed action and alternatives. We have not identified any substantive issues related to geology and soils, aesthetic resources, or socioeconomics associated with the proposed action; therefore, these resources are not addressed in the EA. We present our recommendations in section 5.1, *Comprehensive Development and Recommended Alternative*.

3.3.1 Aquatic Resources

3.3.1.1 Affected Environment

Water Quantity

The American Tissue Project receives water from Cobbosseecontee Stream, which has a drainage area of approximately 217.2 square miles. The drainage area of the project is approximately 216 square miles. Immediately upstream of the project, the New Mills Dam impounds the 746-acre Pleasant Pond and has a minimum flow requirement of 52 cfs to the project. The New Mills Dam is used to regulate Pleasant Pond at an elevation of 135.0 feet msl to provide flows to the downstream reach.

The 5.5-acre project impoundment is 0.22 river mile long, is generally shallow (maximum depth of 24 feet), and has minimal storage capacity (108-acre feet). KEI Power operates the project as a run-of-river facility, where outflow from the project approximates inflow to the impoundment. The existing license requires a continuous minimum flow of 52 cfs or inflow to the impoundment, whichever is less, to be released from the project.

Operation of the project results in the diversion of water from approximately 345 feet of riverine habitat, creating a bypassed reach between the project dam and powerhouse. There is no minimum flow requirement to the bypassed reach. However, water from Cobbosseecontee Stream is currently released to the bypassed reach through: (1) leakage at the dam; (2) spill over the dam or through the discharge pipe at the base of the dam when inflow to the impoundment is either below or above the 100-cfs minimum or 360-cfs maximum hydraulic capacity of the turbine, respectively; and (3) the downstream fish passage facilities for juvenile alewife and American eel. KEI Power estimates that there is approximately 5 cfs of leakage through the dam. Based on pro-rated daily average flows from 1975 to 2013, spill into the bypassed reach occurs approximately 59 percent of the time (*i.e.*, 215 days of the year) as a result of limitations to the hydraulic capacity of the turbine. From June 1 to November 15 of each year, KEI Power releases approximately 10 cfs to the bypassed reach to provide downstream passage for juvenile alewives, and from September 1 to November 15, KEI Power

releases 40 cfs at night to the bypassed reach to provide downstream passage for American eel.

Table 2 shows the monthly flow data from the United States Geological Survey (USGS) Gage No. 01049500, located 0.7 mile downstream of the project in Gardiner, Maine. The mean annual flow is 392 cfs, with monthly flows generally lowest from July to September and highest in April. The maximum peak flow recorded during the period of record was 3,940 cfs, which occurred in April 1987. The lowest peak flow recorded during the period of record was 8 cfs, which occurred in September 1987.

Table 2. Minimum, mean, and maximum flow from the American Tissue Project (January 1985 to December 2015).

Month	Minimum Daily Flow (cfs)	Mean Daily Flow (cfs)	Maximum Daily Flow (cfs)
January	14	388	1,770
February	28	359	2,360
March	39	561	2,260
April	42	860	3,940
May	24	441	2,760
June	14	312	2,660
July	11	171	1,890
August	9	127	1,810
September	8	168	1,390
October	19	367	1,820
November	14	451	1,710
December	28	502	1,960
Annual	8	392	3,940

(Source: KEI Power, 2017, as modified by staff).

Water Quality

The American Tissue Project is located on the lower reach of the Cobbosseecontee Stream, which is classified as a Class B waterway by the state of Maine (Maine DEP, 2016). Class B waters must be of such quality that they are suitable for the designated uses of drinking water supply after treatment, fishing, agriculture, recreation in and on the water, industrial processes, cooling water supply, hydroelectric power generation, navigation, and unimpaired habitat for fish and other aquatic life.[23] The dissolved oxygen content of Class B waters may not be less than 7 milligrams per liter (mg/L) or 75 percent of saturation, whichever is higher. Maine has not established water quality standards for temperature, although dissolved oxygen percent saturation is dependent on

[23] Maine Statute, Title 38, § 465(3) (2007).

temperature. Discharges to Class B waters may not cause adverse impact to aquatic life, such that the receiving waters must be of sufficient quality to support all aquatic species indigenous to the receiving water without detrimental changes in the resident biological community.

Water Quality Monitoring

KEI Power conducted water quality monitoring in the impoundment for dissolved oxygen, temperature, and nutrients (total phosphorus, chlorophyll a,[24] and secchi disk transparency[25]) twice a month from June to October 2015. The results for all sampled parameters met Class B water criteria and the impoundment was characterized as mesotrophic[26] based on Maine's lake trophic status guidelines (Maine DEP, 2014). Water temperature in the impoundment ranged from a low of 10.8°C in October to over 25.5°C in July and September. Dissolved oxygen concentration in the impoundment ranged from a low of 7.1 mg/L in August to a high of 11.2 mg/L in late October. Average dissolved oxygen during the peak summer period of July through September ranged from 7.4 to 8.7 mg/L. Water quality monitoring also demonstrated that the impoundment did not thermally stratify and exhibited a slight decrease in temperature from the surface to the bottom of the impoundment (ranging from 0.7 to 1.6^{0}C during the months of June, July, and August).[27]

KEI Power monitored dissolved oxygen and water temperature downstream of the powerhouse and in the bypassed reach on an hourly basis from July to September 2015. Monitoring demonstrated that water temperatures in the bypassed reach and the downstream reach were similar, with an average of 25.0°C each. Dissolved oxygen

[24] Chlorophyll a is a pigment in plants that is central to photosynthesis and can serve as a measure of the abundance of phytoplankton and a reflection of the biological productivity of the water body.

[25] Secchi depth is a measure of water transparency. To measure Secchi depth, an 8-inch disk with a black and white pattern is lowered into the water column until it is no longer visible from the surface and then the disk is raised until it is visible again. The depths at which the disk disappears and reappears are averaged and reported as the Secchi depth.

[26] A mestrophic body of water (lake, river, or stream) is one that has a moderate amount of dissolved nutrients.

[27] Stratification is a natural phenomenon that occurs when water bodies form distinct thermal layers, including a warm surface layer (epilimnion), a layer with an abrupt change in temperature (thermocline), and a cool dense lower layer (hypolimnion).

levels in the bypassed reach exceeded the standard for Class B water and ranged from 7.2 to 8.8 mg/L, with an average of 8.3 mg/L. In the tailrace, dissolved oxygen levels ranged from 6.6 to 8.5 mg/L, with an average of 7.9 mg/L. There was one 24-hour period in September when dissolved oxygen levels in the downstream reach dropped below the Class B water quality standard of 7 mg/L to a minimum of 6.6 mg/L. In a March 31, 2017 letter, Maine DEP confirmed that the American Tissue Project meets applicable Class B dissolved oxygen criteria downstream of the dam.

At the request of Maine DEP, KEI Power also collected water temperature and dissolved oxygen profiles from the impoundment of the New Mills Dam to characterize the influence, if any, of the American Tissue Project on water quality in Cobbosseecontee Stream.[28] The data collected from the sampling effort showed that water temperature is consistent between the New Mills and American Tissue impoundments, and dissolved oxygen concentrations are lower in the New Mills impoundment than in the American Tissue impoundment.

Tailwater Macroinvertebrates

In the late summer of 2015, KEI Power sampled the benthic macroinvertebrate community in the bypassed reach and downstream of the powerhouse to assess stream health.[29] The monitoring results demonstrated that the benthic macroinvertebrate community downstream of the American Tissue Dam was abundant, but not very rich in taxa. The community was dominated by filter feeders, flatworms, and organisms that have adapted to a wide variety of water quality conditions. As a result, the macroinvertebrate community did not attain Class B aquatic life standards. KEI Power discussed the study results with Maine DEP, who noted that nutrient enrichment in the watershed could be influencing the macroinvertebrate community. According to KEI Power, Maine DEP stated that the American Tissue Project is not likely causing or contributing to the nutrient enrichment issue in the watershed or to changes in the benthic macroinvertebrate community structure.

[28] The sample site in the New Mills impoundment was approximately 155 feet upstream of the New Mills Dam and approximately 1,375 feet upstream of the American Tissue Dam.

[29] The benthic macroinvertebrate community can be used as an indicators of overall stream health. In general, an unpolluted waterbody has a higher percentage of taxa from the orders Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies); whereas, pollution tolerant taxa (*e.g.*, midge flies) dominate the community in poor-quality waters.

Aquatic Habitat

Impoundment Habitat

The American Tissue Project impoundment is relatively narrow and shallow, with depths less than 24 feet and a total volume of approximately 108 acre-feet at full pond. The shoreline immediately surrounding the project impoundment is moderately forested to the north with some commercial and developed areas to the south. Slopes along the shoreline are moderately steep with mixed vegetation. The substrate within the project boundary consists primarily of fine sandy loam soils that have low to moderate susceptibility to erosion.

Bypassed reach

The American Tissue Project creates a 345-foot-long bypassed reach of riverine habitat between the dam and the powerhouse. The bypassed reach is a moderate-to-low gradient, incised channel that runs over bedrock and is armored on both banks by boulders, cobblestone, and other rock material. There is no year-round minimum flow requirement for the bypassed reach. Aquatic habitat is generally limited in the bypassed reach, but some habitat stability is provided from June 1 to November 15 when increased flows are being released from the dam for downstream fish migration. When the generator is offline, the minimum flow of 52 cfs is also released over the crest of the dam or via the discharge pipes at the base of the dam to the bypassed reach. Flows are also spilled over the dam into the bypassed reach when inflow to the project is below/above the minimum/maximum hydraulic capacities of the turbine (100 cfs/360 cfs, respectively). Intermittent pools in the bypassed reach provide refuge for resident fish species and macroinvertebrates when flows are not being released to the bypassed reach.

Water released from the dam into the bypassed reach generally flows toward the eastern bank of the stream through a series of step pools,[30] and then flows towards the western bank of the stream through a deep channel before connecting to the outflow from the powerhouse. The bypassed reach contains the following four distinct habitat units, from upstream to downstream: (1) a set of bedrock cascades/falls immediately below the dam, (2) a large pool immediately downstream of the falls, (3) a moderate gradient riffle, and (4) a section of run habitat (Table 3). The banks on both sides of the bypassed reach are relatively steep, and have been modified from their natural composition. The eastern bank of the stream is armored with rip-rap and concrete support walls for the dam. The western bank of the stream includes medium- to large-sized boulders and bedrock. Protective cover for fish and aquatic organisms is provided in certain sections of the

[30] In a river a step-pool is a regular series of steps in the bed of a river, similar to a staircase formed by bedrock or woody debris that create a series of interconnected pools.

bypassed reach by water depth, boulders and other rocky substrates, and a vegetative canopy that shades the streambanks. The reach also contains a variety of substrates (cobble, gravel, and sand) that promote the macroinvertebrate community.

Table 3. Riverine habitat units in the bypassed reach downstream of the American Tissue Dam.

Habitat Unit No.	Habitat Type	Predominant Substrates	Length (feet)	Channel Width (feet)	Maximum Depth[a] (feet)
1	Cascades/Falls	Bedrock	120	45-80	3.4
2	Pool	Large and small boulder	60	50	6 to 10[b]
3	Moderate Gradient Riffle	Large and small boulder	125	35-60	2.8
4	Run	Large and small boulder	38	45	4.0

(Source: KEI Power, 2017, as modified by staff).
[a] As measured at the time of the survey.
[b] The pool is at least 6 feet deep, and is estimated to be up to 10 feet deep.

KEI Power conducted an instream flow study in 2015 to evaluate whether a migratory corridor, or "zone of passage,"[31] would be maintained during minimum flow conditions. KEI Power also analyzed whether an increase in flow would create velocity barriers that prevent alewives that are migrating upstream from successfully navigating otherwise passable barriers. For this analysis, KEI Power compared the velocities measured in the instream flow study that it conducted in 2015 to the known cruising,

[31] Zone of passage refers to the contiguous area of sufficient lateral, longitudinal, and vertical extent in which adequate hydraulic and environmental conditions are maintained to provide a fish species a route of passage through a stream reach influenced by a dam (or stream barrier) (Hoar, 2018). KEI Power assumed that water must be sufficiently deep to cover two-thirds of the estimated body height of the largest-sized alewives and adult eels moving downstream of the project (Bovee, 1982). Using data from the Sebastiacook River, a representative tributary similar to Cobbosseecontee Stream, KEI Power estimated that two-thirds of the body height of the longest alewives and adult eels is 1.8 inches and 1.7 inches, respectively.

sustained, and burst speeds[32] of adult alewives, which are 0 to 2.5 fps, 2.5 to 5 fps, and 5 to 7 fps, respectively (Bell, 1991). The instream flow study evaluated physical habitat data (*i.e.*, water depth and velocity) at flows of 10, 25, 50, and 108 cfs.[33] KEI Power selected two transects in the bypassed reach that had stream bed features (*e.g.*, bedrock, boulders, and pools) representative of habitat throughout the bypassed reach. Transect 1 was located in the cascades/falls habitat and Transect 2 was located in the riffle habitat (Figure 3).

In the cascades/falls habitat, the average water depth ranged from 0.29 feet to 0.85 feet and the average water velocity ranged from 0.34 feet per second (fps) to 1.88 fps across the four test flows. In the riffle habitat, the average water depth ranged from 0.76 to 1.74 feet and the average water velocity ranged from 0.78 to 1.53 fps across the four test flows. Under all test flows, average water depths in the cascades/fall and the riffle habitats were sufficient to allow unimpeded fish passage for downstream migrating alewives and eels, and the measured velocities did not create zone of passage impediments for alewives or eels.

[32] Cruising speed is the swim speed a fish can maintain for a long period of time (*i.e.*, hours); sustained speed can be maintained for minutes; and burst speed can only be maintained for a short period of time (*i.e.*, seconds).

[33] The 108 cfs is equivalent to FWS's default aquatic baseflow recommendation in the absence of a site-specific study, which is calculated as 0.5 cfs for each square mile of drainage above the dam (FWS, 1999).

Figure 3. Riverine habitat and transcet locations in the American Tissue bypassed reach. (Source: KEI Power, 2017).

KEI Power also conducted the instream flow study to evaluate whether the project meets Maine DEP's guideline that 75 percent of the cross section of the river must be wet at all times. KEI Power measured the wetted stream width for the cascades/fall and riffle habitat units at the same test flows discussed above and compared the results to the

estimated width of the channel during bankfull conditions.[34] These flows provided 95.6 percent to 100 percent of the bankfull wetted cross-sectional width in the cascades/falls habitat and 77.9 percent to 82.2 percent of the bankfull wetted width in the riffle habitat (Table 4). KEI Power concluded that all four test flows satisfied Maine DEP's guidelines for maintaining suitable aquatic habitat.

Table 4. Wetted bed width and percent of bankfull wetted width in the cascades/falls and the riffle habitat units of the bypassed reach.

Flow Release	**Cascades/Falls Habitat**		**Riffle Habitat**	
	Wetted Bed Width (ft.)	Percent of Bankfull Wetted Width	Wetted Bed Width (ft.)	Percent of Bankfull Wetted Width
10 cfs	80.3	95.6	41.7	77.9
25 cfs	80.8	96.1	44.0	82.2
50 cfs	82.0	97.6	44.0	82.2
108 cfs	84.0	100.0	44.0	82.2

(Source: KEI Power, 2017).

Fishery Resources

Cobbosseecontee Stream historically supported runs of diadromous fish, including striped bass, river herring,[35] rainbow smelt, American shad, Atlantic salmon, and American eel. However, access to Cobbosseecontee Stream for migratory fish species has been restricted since the first dams were constructed in the late 1700s. By the mid-1800s, there were eight dams within one mile upstream of confluence of Cobbosseecontee Stream with the Kennebec River. Gardiner Paperboard Dam, the first dam on Cobbosseecontee Stream today, was originally created in 1761 to form an impoundment for municipal water purposes.

There are only 2 native migratory species currently found at the project: alewife and American eel. Five native migratory fish species (blueback herring, striped bass, American shad, rainbow smelt, and alewife) are reported to use habitat downstream of the Gardiner Paperboard Dam in Cobbosseecontee Stream. In addition to diadromous

[34] The bankfull channel width is the distance between the top of each river bank.

[35] Blueback herring and alewife are difficult to distinguish visually and are therefore often collectively referred to as river herring.

species, Cobbosseecontee Stream contains a variety of resident riverine fish species that offer high quality sport fishing. Such species include a stocked fishery of brook trout and brown trout, striped bass, white perch, and yellow perch, as well as non-native largemouth bass, smallmouth bass, and northern pike.

Cobbosseecontee Stream and Kennebec River Fisheries Management

Management of alewife, blueback herring, and shad is guided by the Atlantic States Marine Fishery Commission's[36] management plan for river herring and shad. The management plan calls for improving habitat accessibility for river herring and shad by providing fish passage at dams, improving water quality to support habitat needs, and preventing mortality at water withdrawal facilities. The management plan also calls for stocking programs to enhance depressed stocks of fish in historic habitat (ASMFC, 1985). Separately, Maine DMR's 2002 Draft Fisheries Management Plan for Cobbosseecontee Stream outlines restoration goals for fishery resources that historically resided in the Cobbosseecontee Stream above Gardiner Paperboard Dam. The draft plan calls for upstream and downstream passage measures for diadromous fish at dams on Cobbosseecontee Stream to further populations of these migratory species (Maine DMR, 2002).

Since 1997, Maine DMR has stocked adult alewives in Pleasant Pond[37] on an annual basis.[38] Maine DMR's stocking program was initiated because alewives are an important source of food for many species of fish and wildlife, and Maine DMR anticipated that a run of alewives would attract sportfish to the mouth of Cobbosseecontee Stream and could provide a sustainable commercial harvest of alewives.

Consistent with the Atlantic States Marine Fishery Commission's and Maine DMR's management plans, KEI Power operates the project in run-of-river mode to

[36] The Atlantic States Marine Fisheries Commission is a deliberative body of Atlantic coastal states that coordinate the conservation and management of 27 fish species. Its mission is to promote better utilization of the Atlantic seaboard fisheries the development of a joint program for the promotion and protection of such fisheries, and by the prevention of physical waste of the fisheries. The Atlantic States Marine Fisheries Commission collaborates with NMFS and FWS to accomplish their mission.

[37] Pleasant Pond is a 746-acre pond located in the towns of Gardiner, Litchfield, West Gardiner, Richmond, Sagadahoc, Maine.

[38] In its November 22, 2017 comments, Maine DMR states that it has also stocked blueback herring in addition to alewives (collectively known as "river herring") in Pleasant Pond on an annual basis since 1997.

protect aquatic resources, operates and maintains fish passage facilities for alewives that are migrating downstream through the project, and installs a partial trashrack overlay with 7/8-inch clear bar spacing to protect alewives that are migrating downstream through the project.

The Atlantic States Marine Fishery Commission's American Eel Fishery Management Plan guides the management of eels in the territorial seas and inland waters along the Atlantic coast from Maine to Florida. Relevant goals of the plan are to protect and enhance American eel abundance in all watersheds where eel now occur; restore American eel to waters where they had historically occurred; and contribute to the viability of American eel spawning populations. KEI Power releases water from a discharge pipe at the base of the dam to facilitate downstream eel passage and installs a partial 7/8-inch trashrack overlay on the upper turbine intake and blinding plates over the lower intake during migration season to protect eels from injury and mortality.

Anadromous Fish

Alewife is the only anadromous fish species currently found at the project.[39] Maine DMR traps adult alewives at the Brunswick Hydroelectric Project No. 2284[40] in mid-May and subsequently stocks alewives and blueback herring [41] upstream of the project on an annual basis. Between 1997 and 2015, Maine DMR stocked 115,705 alewives in Pleasant Pond and Horseshoe Pond, which are approximately 4 and 8 river miles upstream of the project, respectively. Adult alewives migrate downstream from Pleasant Pond and Horseshoe Pond shortly after spawning, and would be expected to begin arriving at the project as early as June 1 of each year. Maine DMR's Draft Fisheries Management Plan for Cobbosseecontee Stream calls for providing downstream fish passage for alewife at the American Tissue Dam between June 1 and November 30 of each year (MDMR, 2002).

Downstream of the project, the Gardiner Paperboard Dam blocks passage for other anadromous species migrating upstream. There are five species of anadromous fish that utilize the 0.9 mile reach of Cobbosseecontee Stream between the Gardiner Paperboard

[39] An anadromous fish, born in fresh water, spends most of its life in the sea and returns to fresh water to spawn.

[40] The Brunswick Hydroelectric Project No. 2284 is located on the Adroscoggin River in Brunswick Maine, approximately 26 miles south of the project.

[41] In its section 10(j) recommendation, Maine DMR states that it also stocks blueback herring in addition to alewives (collectively known as "river herring").

Dam and the confluence of the stream with the Kennebec River: American shad, blueback herring, rainbow smelt, alewives, and striped bass.

American shad, blueback herring, and alewife (collectively, alosines)[42] spend most of their lives at sea, but return to their natal (home) rivers along the eastern seaboard of North America to reproduce (Melvin *et al*., 1986; Greene *et al*., 2009). Spawning runs of alewife occur earlier (May through June in Maine) than those of blueback herring and American shad (June through July) (Loesch, 1987; Saunders *et al*., 2006). In New England, blueback herring and American shad primarily spawn in lotic (mainstem river) habitats, whereas alewife generally spawns in lentic (lake or pond) habitats within a river basin (Loesch, 1987). Upstream of the American Tissue Dam, the Cobbosseecontee Stream watershed has a mix of lotic and lentic habitats where blueback herring, American shad, and alewife historically spawned.

In northern latitudes (including the New England region), alosines often survive spawning, unlike in southern regions (*e.g.*, areas south of Cape Hatteras, North Carolina) where most fish die after spawning (Leggett and Corscadden, 1987). Post-spawn adult fish migrate downstream shortly after spawning. Fish produced from spawning events generally remain in river habitats for a few months before out-migrating to the sea as juveniles during late summer and early fall. Juveniles generally spend three to five years at sea, where they mature, and subsequently return to their natal rivers in the spring to spawn (Saunders *et al*. 2006; Greene *et al*., 2009). Alewife is an important food source for striped bass and in the summer and fall, striped bass congregate near the confluence of Cobbosseecontee to feed on downstream migrants.

The October 16, 2003 Order requires KEI Power to operate and maintain a downstream fish passage facility for juvenile alewives on a seasonal basis from September 1 to November 15 by removing a 1-foot by 3-foot section of the flashboards and maintaining a plunge pool at the base of the dam.[43] In its license application, KEI Power states that it currently operates the downstream fish passage facility from June 1 to November 15. KEI Power also installs blinding plates at the base of the trashrack and a partial trashrack overlay with 7/8-inch clear spacing on the upper trashrack on a seasonal basis to protect fish from being entrained. KEI Power visually monitors the tailwaters and bypassed reach daily and reduces generation if injured or dead juvenile alewives are observed. The licensee has not observed any juvenile alewife mortalities since initiating these downstream passage measures in 2003.

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[42] Alosine refer to fish in the Genus *Alosa*, such as American shad, alewife, and blueback herring.

[43] In Exhibit A of the license application, KEI Power states that 10 cfs is released through the notch in the flashboards.

Atlantic salmon historically migrated upstream from the Kennebec River to Cobbosseecontee Stream, but do not currently occur in Cobbosseecontee Stream. Atlantic salmon (*Salmo salar*) in the Kennebec River are listed as endangered under the ESA and are part of the Gulf of Maine Distinct Population Segment. In 2009, NMFS designated critical habitat for Atlantic salmon in the Kennebec River, but no critical habitat was identified on Cobbosseecontee Stream, including within the project boundary.

Catadromous Fish

American eel is the only catadromous fish species that occurs at the project.[44] The American eel spends most of its life in fresh or brackish water before migrating to the Sargasso Sea to spawn. It occurs throughout warm and cold waters of the Atlantic Ocean and Atlantic coastal drainages in North America (Boschung and Mayden, 2004). Within its range, it is most abundant throughout the Atlantic coastal states (ASMFC, 1999).

Spawning likely occurs from February through April in the Sargasso Sea, although the act of spawning has never been observed (Boschung and Mayden, 2004). Fertilized eggs and larvae, known as the planktonic phase, drift with the Gulf Stream currents along the east coast of the United States (Jenkins and Burkhead, 1993). Following this phase, the planktonic leptocephali, ribbon-like eel larvae, metamorphose (or transform) into what is termed a "glass" eel as it approaches coastal waters. Glass eels are completely transparent and make their way into brackish waters by the use of flood tides. Once skin pigments develop in glass eels, they are considered "elvers."[45]

As eels mature, elvers become juvenile, or "yellow" eel. The majority of eels collected in freshwater rivers are typically yellow eel, which is considered the primary growth phase of its life cycle (Ross *et al*., 2001). Yellow eel are typically sedentary during the day, often burying in mud or silt, and becoming active at night to feed (Jenkins and Burkhead, 1993). They associate with pools or backwater habitats, and often have relatively small home ranges (Gunning and Shoop, 1962). The juvenile stage can last from five to 40 years before finally maturing into the silver eel and out-migrating in the fall and mid-winter months to spawning grounds (*i.e.*, Sargasso Sea) (Boschung and

[44] A catadromous fish spends most of its life in freshwater and migrates to saltwater to breed.

[45] Elvers often serve as important forage fish for striped bass and other large piscivores.

Mayden, 2004).[46] Adult eels are presumed to die after spawning (Boschung and Mayden, 2004; Jenkins and Burkhead, 1993).

Juvenile and adult eels are known to occur in Cobbosseecontee Stream, upstream and downstream of the American Tissue Project. Following a fish kill incident at the project in early October 2001, the Commission required the licensee to facilitate downstream eel passage from September 1 through November 15 at the project.[47] KEI Power provides downstream passage and protection measures for American eel by: (1) installing blinding plates at the base of the trashrack and a partial trashrack overlay with 7/8-inch clear spacing over the upper intake to protect eels from being entrained; (2) releasing 40 cfs from the discharge pipe at the base of the dam at night from September 1 and November 15 to provide a passage route for eels; (3) reducing generation at night if any dead or injured adult eel are observed during passage season; and (4) ceasing generation at night for the remainder of the eel passage season if any entrained eels are observed. The licensee has not observed any adult eel mortalities since initiating these downstream passage measures in 2003.

According to Maine DMR, preliminary information from a study it conducted in the fall of 2017 indicates that the existing downstream eel passage facility at the base of the dam might not provide effective passage for adult eels at the project. As part of the study, Maine DMR monitored the discharge pipe at the base of the dam to estimate the number of eels that are using the discharge pipe to migrate downstream from the project's impoundment to the bypassed reach. Maine DMR states that eels were visible in the vicinity of the discharge pipe at night between September 21 and October 2, 2017, but the velocity of flow through the eel passage facility (estimated at 23 fps) elicited an avoidance response in adult migrating eels. Maine DMR states that none of the eels in the vicinity of the discharge pipe exited the impoundment through the discharge pipe.

Between June and August 2015, KEI Power conducted a juvenile American eel passage study. The goals of the study were to identify presence, abundance, and distribution of American eel at the project; identify areas where eels congregate or attempt to ascend wetted structures; and identify potential areas for an upstream eel passage system. Approximately 1,050 juvenile eel were observed in Cobbosseecontee Stream during the monitoring period in three primary locations: (1) in bedrock pools on

[46] Juvenile eels that reside in estuaries reach maturity and migrate earlier than juveniles found in freshwaters. These eels can reach full maturity without migrating to freshwater (FWS, 2007).

[47] *Ridgewood Maine Hydro Partners, L.P.*, 105 FERC ¶ 62,030 (2003).

the east side of river, (2) on the dam abutment[48] on the west side of the river, and (3) in bedrock pools and rock crevices on west side of the river (Table 5, Figure 4). The majority of eels (84 percent of the total) were observed during the surveys on the west side of the river within small pools and rock crevices.

Table 5. Summary of American eel counts at the American Tissue Project in 2015.

	Number of Eels				
Date	**East Side of the River (Pools)**	**West Side of the River (Abutment)**	**West Side of the River (Pools and Rock Crevices)**	**Total**	**Length (mm)**
June 9	0	0	12	12	75-100
June 11	11	6	30	47	75-100
June 16	7	25	25	57	75-125
June 18	3	17	11	31	75-100
June 23	13	27	9	49	75-125
June 25	25	22	21	68	75-125
June 30	8	75	13	96	75-125
July 2[a]	-[b]	200	-[b]	205	-[b]
July 16	65	200	35	300	75-150
July 23	15	-[b]	-[b]	15	-[b]
July 29	20	100	45	165	75-150
Aug 19	0	0	4	4	100-150
Total	**167**	**672**	**205**	**1,049**	

(Source: KEI Power, 2017, as modified by staff).
[a] KEI Power reported 5 juvenile eel were observed in the impoundment near dam.
[b] KEI Power did not provide numeric data for this sampling event.

[48] KEI Power refers to this location as "rock/concrete wall" in the Juvenile American Eel Study Report. This feature is the dam abutment on the west side of the river, which is composed of concrete and rock.

Figure 4. Locations (within red circles) of observed juvenile eels at American Tissue dam in 2015. (Source: KEI Power, 2017).

Resident Fish

Cobbosseecontee Stream and the Kennebec River support a community of cool water and warm water riverine fish. Maine Department of Inland Fisheries and Wildlife (Maine DIFW) annually stocks brook trout in Cobbosseecontee Stream upstream of the American Tissue Project (1,000 fish annually) and also stocks Cobbosseecontee Lake with brown trout (2,500 fish annually). In the summer of 2002, the Midwest Biodiversity Institute electrofished the Kennebec River. While Cobbosseecontee Stream was not sampled, eight sites upstream and downstream of the confluence of Cobbosseecontee Stream with the Kennebec River were sampled in the study. A total of 21 fish species were found during sampling, with spottail shiner, eastern banded killifish, mummichog, and American eel representing over two-thirds of the fish caught (Table 6).

Table 6. Summary of Midwest Biodiversity Institute 2002 Kennebec River Electrofishing Survey.

Species	Number Collected	Relative Percentage
Spottail shiner	701	25.4
Eastern banded killifish	432	15.6
Mummichog	429	15.5
American eel	299	10.8
White sucker	211	7.6
Redbreast sunfish	177	6.4
White perch	146	5.3
American shad	100	3.6
Smallmouth bass	88	3.2
Largemouth bass	43	1.6
Common carp	42	1.5
Yellow perch	32	1.2
Alewife	25	0.9
Pumpkinseed sunfish	16	0.6
White catfish	12	0.4
Blueback herring	5	0.2
Sea lamprey	3	0.1
Rainbow smelt	1	<0.1
Creek chub	1	<0.1
Northern silverside	1	<0.1
Total Catch	**2,765**	**100**

(Source: KEI Power, 2017).

3.3.1.2 Environmental Effects

Impoundment Levels

KEI Power proposes to continue operating the project in run-of-river mode using electric water level sensors to ensure project outflow approximates inflow. KEI Power also proposes to draw down the project impoundment for short periods of time to conduct maintenance or for emergency operations.

Interior, Commerce, and Maine DMR all recommend under section 10(j) of the FPA that KEI Power operate the project in an instantaneous run-of-river mode in which outflow from the project is equal to inflow. In addition to operating in a run-of-river mode, Commerce and Maine DMR recommend that fluctuations of the impoundment be kept to a minimum. Commerce recommends that fluctuations be kept to within 1 foot of

the top of the flashboards or 6 inches of the permanent crest of the spillway when replacing flashboards.

Our Analysis

The American Tissue Project is currently operated in a run-of-river mode where outflow approximates inflow. Operating the project in a run-of-river mode minimizes project effects on streamflow in Cobbosseecontee Stream. KEI Power currently uses electric water levels sensors to control and monitor the turbine and water level in the impoundment. Continuing to operate the American Tissue Project in a run-of-river mode as proposed by KEI Power and recommended by Commerce, Interior, and Maine DMR would minimize unnatural fluctuations in the project impoundment and alteration to the natural flow regime of the Cobbosseecontee Stream downstream of the powerhouse. Operating the project in a run-of-river mode would reduce disruption to any near-shore spawning habitat and passage for migratory fish in the reach downstream of the project. In addition, operating the project in run-of-river mode would help to maintain relatively stable impoundment levels, which would continue to benefit shoreline habitat, as well as fish and other aquatic organisms that rely on near-shore habitat for spawning, foraging, and cover.

Commerce and Maine DMR recommend that KEI Power minimize fluctuations of the impoundment. KEI Power currently uses electric water level sensors to monitor the impoundment elevation and make adjustments to project operation to maintain stable impoundment elevations. These measures would ensure that the project continues to operate in an instantaneous run-of-river mode with minimal unnatural fluctuation of the project impoundment. There would be times over the course of a license when KEI Power would need to draw down the impoundment to make repairs or address emergencies. The effects of a maintenance or emergency drawdown on fish and aquatic organisms inhabiting the impoundment would be expected to be short-term and temporary.

Minimum Flows

Minimum Flow Downstream of the Powerhouse

The current license requires the licensee to discharge a continuous minimum flow of 52 cfs or inflow, whichever is less, from the project for the purpose of protecting the aquatic habitat of Cobbosseecontee Stream. Flows may be temporarily modified if required by operating emergencies and for fishery management purposes. KEI Power proposes to provide a continuous minimum flow of 52 cfs or inflow, whichever is less,

downstream of the powerhouse. Commerce, Interior,[49] and Maine DMR provide recommendations under section 10(j) of the FPA that are consistent with KEI Power's proposed minimum flow.

Our Analysis

The existing 52-cfs minimum flow requirement was developed in consultation with resource agencies and approved in a September 18, 1980 order amending the license. The 52-cfs minimum flow represented the 7Q10[50] for Cobbosseecontee Stream and was determined to be representative of "normal" conditions during the summer. The 52-cfs minimum flow also was determined to maintain water quality and habitat for resident and migratory fish in the reach of Cobbosseecontee Stream downstream of the project.

KEI Power proposes to release a minimum flow of 52 cfs (or inflow if less) from the powerhouse. However, the project is not actually capable of releasing flows as low as 52 cfs from the powerhouse because the minimum hydraulic capacity of the project is 100 cfs. Flows less than 100 cfs are released by other means to meet the 52-cfs minimum flow requirement, including through the discharge pipe at the base of the dam, as spillage over the dam, and/or as a conveyance flow for downstream fish passage through a notch in the flashboards at the top of the dam.

KEI Power is already proposing to continue to operate the facility in run-of-river mode with outflow approximating inflow, as discussed above. The effects of project operation on water quantity in the downstream reach would already be minimized to the greatest extent possible by operating the project in run-of-river mode and no additional benefit would be expected from operating the project with a minimum flow release of 52 cfs or inflow, whichever is less.

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[49] Interior's recommendation does not specifically account for instances when inflow to the impoundment drops below 52 cfs, but we assume that Interior's recommendation is consistent with KEI Power's proposal and Commerce's and Maine DMR's recommendations, *i.e.*, that Interior is recommending a flow of 52 cfs or inflow, whichever is less, from the powerhouse. The impoundment is relatively small in size (with a total storage capacity of only 108 acre-feet) and withdrawing a continuous flow of 52 cfs from the impoundment when inflows are less than 52 cfs could substantially lower impoundment elevation levels and dewater aquatic habitat in the impoundment, which could adversely affect aquatic life, including fish and benthic macroinvertebrates.

[50] The 7Q10 is the lowest 7-day average flow that occurs on average once every 10 years.

Minimum Flow in the Bypassed Reach

KEI Power proposes to release a continuous year-round minimum flow of 10 cfs or inflow, whichever is less to the bypassed reach and to release conveyance flows through the downstream fishways into the bypassed reach according to the following schedule:[51]

1. From January 1 to May 31, release 10 cfs plus leakage from the dam;

2. From June 1 to November 15, release 29 cfs plus leakage through the downstream fish passage facility;

3. From September 1 to November 15, release 40 cfs plus leakage at night through a discharge pipe at the base of the dam for downstream eel passage;

4. From November 16 to December 31 release 10 cfs plus leakage from the dam.

Interior's section 10(j) recommendation includes a continuous year-round minimum flow of 10 cfs (or inflow, whichever is less) to the bypassed reach, consistent with KEI Power's proposal. Maine DMR's section 10(j) recommendation includes a minimum flow of 10 cfs to the bypassed reach from January 1 to May 30 and December 1 to December 31 of each year.[52]

Interior's section 10(j) recommendation and preliminary section 18 prescription for downstream fish passage for alosines includes minimum flows that are consistent with KEI Power's proposed minimum flows, except that Interior would require a release of 29 cfs from June 1 to November 30 of each year, instead of June 1 to November 15.

[51] The 10 cfs flow release would contribute to the conveyance flows for downstream fish passage.

[52] Maine DMR's recommendation does not specifically account for instances when inflow to the impoundment drops below 10 cfs, but we assume that Maine DMR's recommendation is consistent with KEI Power's proposal and Interior's recommendations, *i.e.*, that Maine DMR is recommending a flow of 10 cfs or inflow, whichever is less. The impoundment is relatively small in size (with a total storage capacity of only 108 acre-feet) and withdrawing a continuous flow of 10 cfs from the impoundment when inflows are less than 10 cfs could substantially lower impoundment elevation levels and dewater aquatic habitat in the impoundment, which could adversely affect aquatic life, including fish and benthic macroinvertebrates.

Commerce's preliminary section 18 prescription and Maine DMR's section 10(j) recommendation would require a minimum flow release of 25 cfs from June 1 to November 30 of each year for downstream fish passage.[53]

Interior's preliminary section 18 prescriptions for downstream eel passage includes minimum flows that are consistent with KEI Power's proposed minimum flows, except that Interior would require a release of 40 cfs beginning on August 15 to November 15 of each year,[54] instead of September 1 to November 15. Maine DMR's section 10(j) recommendation also includes a minimum flow release of 40 cfs from August 15 to November 15 for downstream eel passage.[55]

Our Analysis

To analyze the effects of the proposed flows on aquatic habitat availability, we evaluate the wetted stream width in the bypassed reach for the proposed and recommended flows. We also analyze the magnitude of flow in the bypassed reach that is needed to provide an adequate zone of passage for migratory species occurring at the project (i.e., alewife and American eel).

Analysis of 10 CFS Minimum Flow

Aquatic Habitat

A minimum flow of 10 cfs waters 95.6 percent of the bankfull cross-sectional width in the cascades/falls habitat located immediately below the dam, and 77.9 percent of the bankfull cross-sectional width in the riffle habitat located over 180 feet downstream from the dam. Relative to existing conditions where leakage might be the only source of water for the bypassed reach during certain times of the year, a minimum flow of 10 cfs would continually water the majority of the bypassed reach and expand

[53] Commerce's preliminary section 18 prescription for downstream fish passage for alosines is not consistent with its recommendation under section 10(j) because Commerce recommends a release of 29 cfs under section 10(j), consistent with to KEI Power's proposal.

[54] Interior's preliminary section 18 prescription for downstream eel passage is not consistent with its section 10(j) recommendation because Interior recommends a release of 40 cfs beginning on September 1 of each year, consistent with KEI Power's proposal.

[55] Maine DMR also lists the migration season for American eel as June 1 to November 30 in its section 10(j) recommendation. We assume that the reference to a June 1 to November 30 migration season was a typographical error, and that Maine DMR is actually recommending downstream eel passage from August 15 to November 15.

habitat for fish and aquatic resources. A continuous minimum flow of 10 cfs would also provide greater stability to the riverine habitat in the bypassed reach for resident fish during times of the year when river flow fluctuates between the minimum and maximum hydraulic capacity of the turbine or when there is no flow from the fishways.

Zone of Passage

At a flow release of 10 cfs from the dam, average water depth is 0.29 feet (3.48 inches) in the cascades/falls habitat and 0.76 feet (9.12 inches) in the riffle habitat of the bypassed reach. When compared to two thirds of the body height of the longest alewives (1.8 inches) and the longest adult American eels (1.7 inches), water depth at 10 cfs would not constrict the zone of passage for downstream movements of alewives and adult eels.

Analysis of 25/29 CFS Minimum Flow

Aquatic habitat

A minimum flow of 25 cfs from June 1 to November 30, as recommended by Maine DMR and required by Commerce's preliminary section 18 prescription, would water 96.1 percent of the bankfull cross-sectional width in the cascades/falls habitat located immediately below the dam, and 82.2 percent of the bankfull cross-sectional width in the riffle habitat located over 180 feet downstream from the dam. Relative to existing conditions in the bypassed reach, where leakage might be the only source of water during the June 1 to August 31 timeframe, a minimum flow of 25 cfs would continually water the majority of the bypassed reach and expand habitat for fish and aquatic resources.

A minimum flow of 25 cfs would also increase the available aquatic habitat in the bypassed reach relative to the amount of habitat that would be available at 10 cfs (77.9 to 95.6 percent wetted bed width), including habitat in the late spring when certain resident fish species are spawning. A flow release of 25 cfs would provide additional water cover for fish and aquatic species, thereby potentially decreasing predation on fish and other aquatic species. Additional aquatic habitat availability during the summer could also enhance populations of macroinvertebrates, a valuable food source for fish. Winged adults would have more wetted area to lay eggs that will eventually hatch to become aquatic macroinvertebrates. In the fall, the added wetted habitat could also benefit macroinvertebrates by allowing them greater access to seasonal food sources (*e.g.*, deciduous leaves) that are not available at other times of the year.

KEI Power did not directly measure aquatic habitat availability at its proposed minimum flow release of 29 cfs. Increasing flows by an additional 4 cfs (from 25 cfs to 29 cfs) could result in marginal increases to the amount of watered area in the bypassed reach. However, according to the test flows administered by KEI Power, increasing the

flow from 25 cfs to 50 cfs does not change the percent of wetted stream width in the riffle habitat (82.2 percent for both flow releases) and only results in a slight increase for the cascades/falls habitat (an increase from 96.1 to 97.6 percent).

With regard to timing of the release, KEI Power's proposal to release 29 cfs from June 1 to November 15, as opposed to November 30, would decrease flow releases to the bypassed reach by 19 cfs (*i.e.*, from 29 cfs to 10 cfs) for a 15-day period in late fall, relative to the flow release schedule recommended by Commerce, Interior, and Maine DMR. Reducing the available habitat by 15 days in the fall would decrease the percent of wetted stream width in the riffle habitat from 82.2 to 77.9 percent, thereby decreasing the amount of aquatic habitat available for food and cover for aquatic species. Specifically, a November 15 schedule would decrease the availability of food sources for resident fish, such as macroinvertebrates, at a time of active feeding prior to winter when food sources are scarce. Loss of access to food sources prior to winter could reduce survivability of resident fish.

Zone of Passage

At a flow release of 25 cfs from the dam, average water depth is 0.49 feet (5.88 inches) in the cascades/falls habitat and 1.05 feet (12.60 inches) in the riffle habitat of the bypassed reach. When compared to two-thirds of the body height of the longest alewives (1.8 inches) and the longest adult American eels (1.7 inches), water depth at 25 cfs would not constrict zone of passage for downstream movements of alewives and adult eels. A flow release of 25 cfs would also provide greater water depths for downstream passage, including an approximately 70 percent increase in water depth in the cascades/falls habitat and an approximately 40 percent increase in water depth in the riffle habitat.

Although KEI Power did not measure water depth in the bypassed reach at 29 cfs, increasing flows by an additional 4 cfs (from 25 cfs to 29 cfs) would be expected to increase water depth in the bypassed reach. The next highest test flow studied by KEI Power is 50 cfs. When compared to 25 cfs, a release of 50 cfs results in an increase in the average water depth from 0.49 to 0.68 feet in the cascades/falls habitat and from 1.05 to 1.42 feet in the riffle habitat. Therefore, an increase in flows from 25 to 29 cfs would not be expected to increase water depth by more than 0.4 feet in the bypassed reach. Similar to a flow release of 25 cfs, a release of 29 cfs would not constrict the zone of passage for downstream movements of alewives and adult eels.

With regard to timing of the release, KEI Power's proposal to release 29 cfs from June 1 to November 15 would reduce the amount of flow being used to pass alosines from the project impoundment to the bypassed reach for the last 15 days of November. Flows for alosines through the fish passage facility would be reduced to 10 cfs, and the depth and velocity of water flowing in the bypassed reach would decrease to the levels reported above for a flow release of 10 cfs.

Analysis of 40 CFS Minimum Flow

Aquatic habitat

In the instream flow study, KEI Power did not evaluate the amount of available habitat at 40 cfs, but did evaluate the amount of available habitat at 50 cfs. Results of the instream flow study showed that doubling the flow (from 25 cfs to 50 cfs) did not provide a significant increase in available habitat. At 50 cfs, the amount of available habitat in the bypassed reach (82.2 to 97.6 percent wetted) was similar to the available habitat at 25 cfs (82.2 to 96.1 percent wetted). Therefore, a 40-cfs flow to the bypassed reach would be expected to produce a similar amount of habitat as a 50 cfs flow release. In addition, the marginal increase in available habitat from a 40-cfs minimum flow would occur only at night; therefore, reducing the potential benefit of the increased flows to fish and aquatic macroinvertebrates in the bypassed reach.

Zone of Passage

Under the current license, a nightly flow release of approximately 40 cfs is required from September 1 through November 15 to facilitate downstream passage of American eel.

As seen in the results of the instream flow study, water depth does not substantially increase as flow increases from 25 cfs to 50 cfs in the bypassed reach. At 25 cfs, average water depth ranged from 0.49 feet to 1.05 feet. At 50, cfs, water depth ranged from 0.68 feet to 1.42 feet and was not substantially different despite increasing the volume of flow by two-fold. Although a 40-cfs flow release was not selected as a test flow for the instream flow study, a 40-cfs minimum flow would likely provide sufficient depth to allow unimpeded downstream passage for alewives and adult eels. As discussed above, flows significantly less than 40 cfs (10 cfs and 25 cfs) would provide adequate depth to allow unimpeded passage for both alewife and adult American eel.

Although a nightly 40 cfs minimum flow is intended for eel passage, migrating alewives could also could benefit from the 40-cfs eel passage conveyance flow during the late summer and fall seasons. In New England, alewife migration begins approximately mid-June and peaks around mid-October (Richkus, 1975). Alewives display diel behavior patterns, moving to deeper parts of the water column during the day and shallower areas at night (Loesch, 1987). Daytime use of the downstream fish passageway could be reduced because migrating alewives may prefer a deeper location in the water column, and may not readily utilize the downstream fish passage facility located higher in the water column at the crest of the dam. At night, alewives move higher in the water column and would be expected to use the downstream fish passageway over the dam in greater numbers. Alewives utilizing the downstream fish passageway through an opening in the flashboards at night between September and

November would be conveyed to the bypassed reach where they would encounter the additional 40-cfs flow for eel passageway that is being released from the base of the dam. This increased flow in the bypassed reach (69 cfs, as proposed by KEI Power) would move alewives downstream at a faster rate and therefore increase passage efficiency.

Water Quality

KEI Power proposes to continue to operate the project in run-of-river mode, with outflow from the project approximating inflow to the impoundment. Interior, Commerce and Maine DMR support KEI Power's proposed operation in their section 10(j) recommendations. KEI Power also proposes to release to the bypassed reach: (1) a flow of 10 cfs or inflow, whichever is less, from June 1 to May 31; (2) a flow of 29 cfs or inflow, whichever is less from June 1 to August 31; (3) a flow of 29 cfs during the day, and a flow of 69 cfs at night or inflow, whichever is less from September 1 to November 15, and (4) a flow of 10 cfs or inflow, whichever is less from November 16 to December 31. As discussed above in the minimum flow analysis, Interior, Commerce, and Maine DMR submitted various alternative schedules and flow releases for the bypassed reach.

Dissolved Oxygen

Our Analysis

Dissolved oxygen is an important indicator of water quality and is required at an adequate concentration to sustain aquatic resources. Dissolved oxygen concentrations at the project have been consistent with state standards (generally exceeding 7.0 mg/L), and are relatively uniform throughout the water column of the impoundment and in the bypassed reach. Continuing to operate the project in run-of-river mode and release seasonal flows for downstream fish passage will help to maintain adequate dissolved oxygen concentrations in the project impoundment, bypassed reach, and downstream of the project.

KEI Power proposes to increase flow in the bypassed reach to 29 cfs or inflow, whichever is less, from June 1 to November 15 of each year. Interior recommends releasing 29 cfs from June 1 to November 30 of each year, and Commerce and Maine DMR propose to release 25 cfs from June 1 to November 30 of each year. Releasing either 25 or 29 cfs from June to November could increase dissolved oxygen levels in the bypassed reach relative to the existing 10-cfs release. The 25/29 cfs would be released as a conveyance flow from the downstream fish passage facility and would increase water turbulence over rocks in the bypassed reach, which helps to aerate water. As a result, the additional flow could enhance dissolved oxygen during the warm, dry summer months and reduce the occurrence of lower dissolved oxygen concentrations (*i.e.*, below 7.0 mg/L) in the bypassed reach.

KEI Power currently releases an additional 40 cfs at night from September 1 to November 15, and proposes to continue releasing the 40 cfs at night. Pursuant to section 18 of the FPA, Commerce and Interior prescribe that downstream eel passage be provided from August 15 to November 15.[56] Releasing 40 cfs to the bypassed reach for an additional 17 days in August would not likely adversely affect the dissolved oxygen concentration in the bypassed reach, even though the 40 cfs of flow would be released from a discharge pipe at the bottom of the dam. The dissolved oxygen concentration is relatively stable throughout the vertical column of the impoundment, and is generally similar to dissolved oxygen concentrations in the bypassed reach. For instance, during the summer monitoring period in 2015, the dissolved oxygen concentration ranged from 7.18 to 8.77 mg/L in the bypassed reach and ranged from 7.10 to 8.26 mg/L in the impoundment at a depth of 5 meters.

Temperature

Our Analysis

Operating a dam on a riverine system has the potential to affect water temperature, including by increasing the residence time of water in an impoundment and openly exposing water at the surface to the heat of the sun, without cover from the streambank. High temperatures are associated with lower dissolved oxygen and shifts in water chemistry that can be harmful to fish and other aquatic organisms. Changes in temperature are most evident during low flow periods when residence time is already longer because of the reduced volume of water reaching the impoundment.

Data collected on water temperatures in the impoundment, bypassed reach, and downstream of the powerhouse indicate that there is little temperature deviation between the three sites and the impoundment does not thermally stratify during the summer period. Continuing to operate the project in a run-of-river-mode, as proposed by KEI Power, would minimize project effects on the water temperature of Cobbosseecontee Stream. Because of the similarity in temperatures between the impoundment and the downstream reach, and the lack of thermal stratification in the impoundment, water temperature would not likely be affected by the proposed minimum flow releases from the powerhouse, discharge pipe at the base of the dam, or spill over the dam.

[56] Maine DMR recommends under section 10(j) that KEI Power maintain the existing downstream passage measures for American eel, but only for an interim period until additional mitigation measures are implemented and tests are performed regarding the effectiveness of alternative measures.

Macroinvertebrates

Our Analysis

Continuing to operate the project in a run-of-river mode, as proposed by KEI Power, would minimize project effects on the timing and magnitude of flow downstream of the powerhouse. Flows released from the project would reflect the natural hydrograph, which allows the physical habitat to be maintained and biological productivity to be sustained. Therefore, operating the project in a run-of-river mode would minimize project effects on the aquatic macroinvertebrate community in the downstream reach.

The proposed and recommended minimum flows for the bypassed reach would increase the amount of available habitat for macroinvertebrate communities relative to existing conditions. A year-round continuous minimum flow of 10 cfs or inflow, whichever is less, and a downstream fishway conveyance flow of 25/29 cfs or inflow, whichever is less from June to November, would increase the extent of the wetted width of the bypassed reach and provide additional habitat for macroinvertebrates.

Commerce, Interior, and Maine DMR recommend providing downstream fish passageway conveyance flows of 25/29 cfs from June 1 to November 30; whereas, KEI Power proposes to release a conveyance flow of 29 cfs from June 1 to November 15. The resource agencies' recommendation to provide an extra 15 days of flow in the bypassed reach could marginally benefit macroinvertebrates in the bypassed reach that are utilizing aquatic habitat made available by the additional conveyance flows.

Interior and Maine DMR recommend that KEI Power provide a 40-cfs conveyance flow for downstream eel passage at night from August 15 to November 15; whereas, KEI Power proposes to release a 40-cfs conveyance flow at night from September 1 November 15. Releasing 40 cfs to the bypassed reach for an additional 17 days, as proposed by the resource agencies, would not likely provide significant benefit to aquatic macroinvertebrates because the additional flow would be short-term, and would only increase the wetted width of the streambank at night.

Operation Compliance Monitoring Plan

KEI Power proposes to operate the project in run-of-river mode with a minimum downstream flow of 52 cfs or inflow to the impoundment, whichever is less. KEI Power also proposes to release a continuous, year-round 10-cfs minimum flow, and flow of 29 cfs for downstream fish passage from June 1 to November 15, and a flow of 40 cfs from September 1 to November 15 at night for downstream eel passage.

Operation of the American Tissue Project is automated and the project can be monitored remotely. KEI Power uses sensors to monitor water levels at the project and to control the impoundment and discharges from the powerhouse to the downstream reach.

KEI Power proposes no changes to its use of water level sensors to monitor and operate the project.

In a June 27, 2017 letter, Maine DEP states that KEI Power should consider development of an "operations and monitoring plan" that specifies the methods that will be used at the project to monitor and maintain minimum flows and pond levels within licensed limits. Maine DEP states that such a plan can be expected to provide both KEI Power and regulatory agencies the tools to evaluate the ongoing operations through the license period.

Our Analysis

Although compliance measures do not directly affect environmental resources, they do allow the Commission to ensure that a licensee complies with the environmental requirements of a license. Therefore, operation compliance monitoring and reporting are typical requirements in Commission-issued licenses.

While KEI Power states that it uses sensors to monitor water levels in the impoundment and flows discharged from the powerhouse, KEI Power does not currently have formalized monitoring protocols or reporting requirements to verify compliance with run-of-river operation and minimum flow releases. As recommended by Maine DEP, formalizing KEI Power's existing monitoring protocol in an operation compliance monitoring plan would help KEI Power document its compliance with the operational provisions of any subsequent license, provide a mechanism for reporting operational data and deviations, facilitate administration of the license, ensure the protection of resources that are sensitive to impoundment fluctuations, and ensure that fish passage facilities are conveying minimum flows to the bypassed reach.

Upstream Fish Passage

The project does not currently provide upstream fish passage, and KEI Power does not propose any upstream fish passage facilities. Interior's preliminary section 18 prescription and Maine DMR's section 10(j) recommendation would require KEI Power to design and install in consultation with resource agencies an upstream passage facility to provide safe, timely, and effective passage of alosines two years after upstream passage for alosines[57] becomes operational at the Gardiner Paperboard Dam downstream of the project. Commerce reserved authority under section 18 to prescribe upstream fish

[57] Maine DMR's recommendation applies more generally to upstream passage for anadromous fish, but requires that the facility be designed to pass a maximum of approximately 3.2 million river herring. Interior states that the facility must be designed to pass a maximum of approximately 3.1 million river herring.

passage at the project in the future if upstream passage for diadromous fish becomes operational at the Gardiner Paperboard Dam, or if the downstream dam is removed.

Our Analysis

Anadromous fish attempting to migrate upstream from the Kennebec River to spawn do not have access to the Cobbosseecontee Stream upstream of the Gardiner Paperboard Dam. The Gardiner Paperboard Dam is located 0.3 mile downstream of the American Tissue Dam and blocks passage upstream because it does not have any installed upstream fish passage facilities. The Gardiner Paperboard Dam is privately owned and there are no known plans for the installation of fish passage facilities or for removing the dam. Although Interior and Maine DMR state that Cobbosseecontee Stream once supported runs of diadromous fish and that the lakes and ponds in the drainage could support a population of over 3 million adult alewives, there would be no benefit to requiring installation of upstream passage facilities at the project until an upstream fish passage facility for diadromous fish is operational at the Gardiner Paperboard Dam or the dam is removed.

Downstream Fish Passage

KEI Power proposes to upgrade the existing downstream fish passage facility in consultation with NMFS, FWS, and Maine DMR, to release a flow of 29 cfs to the bypassed reach for downstream passage of juvenile and adult alewives, and to modify the design of the plunge pool to improve the structural integrity and reliability of the downstream passage system for alewives. KEI Power proposes to operate the downstream fish passage facility from June 1 to November 15. In addition, KEI Power proposes to continue providing certain protection measures for eels and alewives that are migrating downstream, including: (1) monitoring the downstream reach for injured or dead eels and alewives during the downstream passage season, and reducing or ceasing generation if injured or dead alewives or eels are observed; and (2) installing blinding plates at the base of the penstock intake and a partial trashrack overlay with 7/8-inch clear spacing on the upper intake trashrack from September 1 to November 15 of each year to protect eels and alewives from being entrained.

Commerce's preliminary section 18 fishway prescription would require KEI Power to construct, operate, and maintain a new downstream fish passage facility for the safe, timely, and effective downstream passage of diadromous fish species, including juvenile and adult alosines (alewife, shad, and blueback herring). Commerce's fishway prescription would require KEI Power to construct and operate the downstream fish passage facility before the second migratory season after issuance of a new license, with the following features:

1. a minimum 2-foot-deep by 3-foot-wide surface weir that produces a gradually accelerating discharge;
2. a minimum flow of *25* cfs to attract and convey migrants over the dam;[58]
3. an adequately-sized plunge pool at the base of the dam that discharges to flowing water in the bypassed reach; and
4. a 7/8-inch, full-depth trashrack overlay with blinding plates at the intake.

Commerce's preliminary fishway prescription would require KEI Power to operate the improved downstream fish passage facility annually from June 1 to November 30. Commerce would require KEI Power to keep the downstream fish passage facility in proper order and remove debris that could hinder flow and passage. Commerce would also require KEI Power to operate the existing downstream fish passage facility until the new downstream fish passage facility is operational.

Interior's preliminary fishway prescription would require the same measures as Commerce's preliminary fishway prescription, except that Interior would require KEI Power to: (1) design, operate, and maintain the new downstream fish passage facility to be consistent with FWS's 2017 Fish Passage Engineering Design Criteria Manual (Design Criteria Manual); (2) release a flow of approximately *29 cfs* over the surface weir; and (3) install a 3/4-inch full length trashrack overlay.

Maine DMR's section 10(j) recommendation would require the same measures as Commerce's preliminary fishway prescription, except that Maine DMR recommends that KEI Power: (1) design, operate, and maintain the new downstream fish passage facility to be consistent with FWS's Design Criteria Manual; (2) install a 3/4-inch trashrack overlay with blinding plates at the base of the penstock intake; and (3) construct and operate the facilities within two years of issuance of a new license (instead of the second migratory season after issuance of a new license).

Our Analysis

Schedule for Downstream Fish Passage Operation

Juvenile and adult alewives are known to migrate downstream through the project impoundment and bypassed reach from June 1 to November 30 of each year (MDMR, 2002). However, the October 16, 2003 Order only requires KEI Power to operate the downstream fish passage facility for juvenile alewives from September 1 to November 15 of each year. Under the terms of the October 16, 2003 Order, safe access to the bypassed

[58] Commerce's preliminary section 18 prescription is not consistent with its recommendation under section 10(j) because Commerce recommends a release of 29 cfs under section 10(j), consistent with KEI Power's proposal.

reach (including through the 10-cfs conveyance flows over the spillway and the plunge pool at the base of the dam) is not available until September 1, such that adult alewives would have to seek other means of passage (including over the spillway during high flows or through the turbine), where they could be injured or killed. The risk of turbine passage is also higher between June 1 and September 1, prior to installation of the partial 7/8-inch trashrack overlay from September 1 to November 15 of each year. Migrating adult alewives could also be stranded and delayed from passing downstream of the project until September 1, when KEI Power is required to operate the downstream fish passage facility. Delaying downstream passage can also increase predation as fish become more concentrated at the dam.

KEI Power's proposal to begin operating the downstream passage facility on June 1 of each year, including the surface-level egress and plunge pool, would provide a downstream passage route for alosines that would reduce the risk of entrainment relative to current project operation, consistent with Commerce's and Interior's preliminary fishway prescriptions, and Maine DMR's section 10(j) recommendation. However, KEI Power's proposal to wait until September 1 of each year to install the 7/8-inch partial trashrack overlay and blinding plates at the base of the track increases the risk of entrainment for alewives that are migrating downstream between June 1 and September 1.

KEI Power proposes to continue to operate the downstream fish passageway and install the partial 7/8-inch trashrack overlay with blinding plates until November 15 of each year, which is 15 days before the November 30th date required by Interior's and Commerce's preliminary fishway prescriptions and recommended by Maine DMR pursuant to section 10(j). In Maine, juvenile alewives migrate from mid-July through the end of November (Maine DMR, 2018; Saunders *et al.*, 2006). Ceasing to provide surface-level passage and protection measures before the end of the downstream migration season could harm juvenile alewives by stranding individuals in the impoundment for prolonged periods, and then exposing them to increased risk of entrainment, which is known to kill and injure alewives at the project. In addition, after November 15, the plunge pool would not be operating to provide a catchment basin for alewives, such that alewives being spilled over the dam during high flow would be subject to injury or mortality from impact on the concrete at the toe of the dam. Therefore, because the migration season for alewives ends November 30, providing downstream fish passage and protection measures for alewives that are migrating downstream until November 30 would reduce injury or death from turbine passage or passage over the spillway.

Conveyance Flows

KEI Power proposes to upgrade the existing downstream fish passage facility in consultation with Interior, Commerce, and Maine DMR to release a flow of 29 cfs to the

bypassed reach. The existing downstream fish passage facility is a 1-foot by 3-foot opening in the flashboards that provides approximately 10 cfs to the bypassed reach for downstream fish passage. As discussed above, 10 cfs provides sufficient water depth in the bypassed reach to pass alewives and adult eels downstream of the project, and does not constrict the zone of passage for downstream movements of alewives and adult eels. However, the existing 10 cfs conveyance flow may not provide an adequate flow to attract fish to the entrance of the downstream fish passageway when the project is generating and may not be sufficient to prevent downstream migrants from striking the downstream side of the spillway, which could injure or kill migrating alewives.

FWS's Design Criteria Manual provides guidance for proper conveyance flows for downstream fish passage. According to the Design Criteria Manual, a conveyance flow of five percent of the station's hydraulic capacity (equal to 18 cfs at the project) or a minimum of 25 cfs, is adequate to attract fish to the entrance of the fishway (FWS, 2017a). KEI Power proposes and Interior requires a flow of 29 cfs; whereas, Commerce requires and Maine DMR recommends a flow of 25 cfs.[59] At the same time, Interior, Commerce, and Maine DMR all recommend increasing the size of the downstream passageway to 2-foot-deep by 3-foot-wide. From the record, it appears that the 2-foot-deep by 3-foot-wide surface weir recommended by the resource agencies is sized to provide a minimum flow of at least 25 cfs, but could provide a minimum flow as high as 29 cfs, depending on the final design. A conveyance flow of 25 cfs meets the standard provided in FWS's Design Criteria Manual. In addition, as discussed in the minimum flow analysis above, a flow of 25 cfs would be sufficient to provide a zone of passage for alewives and adult eels. A conveyance flow of 29 cfs would also meet these criteria, and would result in a marginal increase to the amount of watered area in the bypassed reach.

Plunge Pool Design

Since its installation in 2003, the plunge pool has been subject to damage from episodic high flow events, which have compromised proper operation during fish migration season.[60] Interior's and Commerce's section 18 preliminary fishway prescription, and Maine DMR's section 10(j) recommendation include provisions for constructing an adequately-sized plunge pool at the base of the spillway. In its section 18 preliminary fishway prescription, Interior explains that the plunge pool does not meet FWS's standards. FWS's Design Criteria Manual suggests that the depth of the plunge pool be 25 percent of the fall height. The American Tissue Dam has a maximum height

[59] Under section 10(j), however, Commerce recommends a release of 29 cfs.

[60] *See* December 4, 2013 compliance letter from Mr. Steve Hocking of Commission staff to Mr. Lewis Loon of KEI Power.

of 23 feet. Therefore, according to the Design Criteria Manual, the recommended depth of the plunge pool should be increased from 4 feet to 5.75 feet. Modifying the design of the plunge pool to resolve the structural issues that occur during high flows, and increasing the size of the plunge pool would improve the reliability of the downstream passage facility and reduce possible injury and mortality to migrants.

Potential for Impingement and Entrainment at the Project

As evidenced by a fish kill in 2001, turbine passage is unsafe for alewives that are migrating downstream through the project. Since 2003, KEI Power has been installing blinding plates at the base of the trashrack and a partial trashrack overlay with 7/8-inch clear spacing over the upper trashrack on a seasonal basis to protect fish from being entrained. The licensee has not observed any juvenile alewife mortalities since initiating these downstream passage measures in 2003. KEI Power proposes to continue installing the partial trashrack overlay with 7/8-inch clear spacing and blinding plates during fish passage season. Commerce would require the seasonal installation of a trashrack overlay with 7/8-inch clear spacing and blinding plates to protect fish from being entrained. Interior would require, and Maine DMR recommends that KEI Power install a 3/4-inch trashrack overlay with blinding plates to protect alosines from entrainment. For the purposes of this analysis Commission staff analyzes the protective value of a 7/8-inch trashrack overlay with regard to clear spacing, in comparison to a trashrack overlay with 3/4 inch clear spacing for the species of fish found at the project.

To better understand the potential effects of existing project operation on impingement and entrainment, Commission staff calculated the velocity at the maximum hydraulic capacity of the turbines. When the existing partial 7/8-inch trashrack overlay and blinding plates are installed, the velocity through the open spaces of the overlay would be approximately 1.4 fps.[61] This "through velocity" could be overcome by adult alewife, which have a reported burst speed of 5.0 to 7.0 fps (Bell, 1991).

[61] To estimate the flow velocity through the trashrack overlay, Commission staff calculated the effective area in which flow could pass through the trashrack overlay at the project. Specifically, staff accounted for the following parameters: (1) the effective intake width (11.9 feet), as calculated from (a) the clear spacing of the overlay (0.875 inch) and (b) the number of bars necessary to span the 17-footwide trashrack (163 bars at a standard bar thickness of 0.375 inches); and (2) the effective intake height (22.2 feet), as calculated from a 23-foot intake opening (a 25.5-foot-tall trashrack, as reduced by the 30-inch blinding plates) that is assumed to be installed at a standard angle of 15 degrees. Staff calculated the velocity through the clear spaces of the trashrack overlay by dividing the maximum hydraulic capacity of the turbine (360 cfs) by the effective area of the trashrack overlay (264 ft^2).

The 7/8-inch (0.875-inch) clear bar spacing of the existing partial trashrack overlay and blinding plates would exclude most adult alewives from entrainment. An adult alewife has an average width of 0.87 inch (Castro-Santos 2005; Lawler *et al.*, 1991; Bigelow and Schroeder, 1953), which is approximately equal to the size of the 7/8-inch clear spacing on the existing trashrack overlay. While a full-depth trashrack overlay with 3/4-inch clear spacing would decrease the clear spacing size by an additional 0.125 inch (from 0.875 inch to 0.75 inch), there have not been any reported injuries and mortalities of adult alewife at the project since installation of the downstream fish passage measures in 2003 and Interior, Commerce, and Maine DMR have not offered any information indicating that entrainment is currently an issue at the project.

Because the 7/8-inch spacing on the existing trashrack overlay at the project is approximately the same size as the average width of an adult alewife, and an adult alewife has a reported burst speed that is greater than the intake velocity at the trashrack and behavioral tendencies that would allow it to avoid the project intake, the 7/8-inch partial trashrack overlay appears to minimize the risk of injury and mortality associated with entrainment at the project. Most adult alewife would likely be able to avoid entrainment at the project and pass safely through the downstream passage facilities at the dam with the installation of a 7/8-inch trashrack overlay.

With regard to the potential for entrainment of young-of-year alewives at the project, the clear spacing of both the existing trashrack overlay (7/8 inch) and the proposed trashrack overlay (3/4 inch) would not likely physically exclude young-of-year alewives from the intake and they would be vulnerable to entrainment. A juvenile young-of-year alewife has a reported total length of 2.5-3.5 inches (Bell, 1991) and an average width of 0.12 inches (Lawler, 1991), which is less than the 3/4-inch and 7/8-inch clear spacing sizes. Although the project has potential to entrain juvenile alewives based on body size, there is still a low potential for entrainment of juvenile alewives based on their swimming capabilities and the availability of downstream fish passage at the project. Juvenile alewives have a reported burst speed of 0.5 to 3.0 fps (Bell 1991) which partially overlaps the 1.4-fps maximum through velocity when the 7/8-inch partial trashrack overlay is installed. Accordingly, some juvenile alewife could be entrained at the project, but most juveniles would likely be able to avoid entrainment.

Schedule for Completion

With regard to the schedule for constructing and operating the new downstream fish passage facility, Commerce's and Interior's preliminary fishway prescriptions would require the new facility to be operational before the second migration season following issuance of a subsequent license and Maine DMR recommends that the new downstream passage facility be operational within 2 years of license issuance. Adjusting the completion timing for the new downstream fish passage facility around migration seasons, as required in Commerce's and Interior's fishway prescriptions, would ensure

that construction activities were completed outside of the alewife migration period, which would minimize the effects of construction on migrating fish.

Fishway Design Criteria

Interior's section 18 preliminary fishway prescription would require KEI Power to design, operate, and maintain the new downstream fish passage facility in accordance with FWS's Design Criteria Manual. The Design Criteria Manual provides guidance on design, operation, and maintenance of fishways throughout the northeastern United States. The Design Criteria Manual provides guidance for the geometry and conveyance flows for surface-oriented downstream fish passage facilities. Specifically, the Design Criteria Manual recommends a surface-oriented downstream fish passage that is a minimum of 2-foot-deep by 3-foot-wide that produces a gradually accelerating flow that discharges into a plunge pool with a depth of at least 25 percent of the equivalent fall height of the weir or 4 feet, whichever is greater (*i.e.*, equal to a depth of approximately 5.75 feet for the project). The Design Criteria Manual also specifies conveyance flows that are 5 percent of station hydraulic capacity (equal to 18 cfs at the project) or a minimum of 25 cfs. Designing the surface weir and plunge pool consistent with FWS's Design Criteria Manual would ensure that the modified downstream fish passage facility provides safe, timely, and effective movement of fish through the project.

Interim Passage Measures

Operating the existing downstream fish passage facility from June 1 to November 30 of each year until improvements to the existing downstream passage facility are completed, as required by Commerce and Interior and recommended by Maine DMR, would ensure that alewives have a means of passage through the project in the interim period before construction is complete on the modified facility. Conveying a continuous minimum flow of 10 cfs or inflow, whichever is less, from the impoundment to the bypassed reach; providing a plunge pool at the base of the dam that conveys flows to the bypassed reach; and installing a partial trashrack overlay with 7/8-inch clear spacing to protect alosines from being entrained would facilitate safe downstream passage of alewife during the interim period until the new downstream fish passage facility is operational.

Upstream Eel Passage

There are no existing upstream fishways for juvenile eels at the American Tissue Project. KEI Power proposes to design and install an upstream eel passage facility in consultation with Commerce, Interior, and Maine DMR on the west side of the river to facilitate the upstream passage of juvenile eels over the American Tissue Dam.

Interior's and Commerce's preliminary fishway prescriptions would require KEI Power to construct, operate, and maintain an upstream eel passage facility on the west end of the American Tissue Dam before the second migration season after a subsequent license is issued. Interior and Commerce would require KEI Power to operate the upstream eel passage facility from June 1 to September 15 of each year. Interior would require the facility to be designed in accordance with FWS's Design Criteria Manual. Commerce's fishway prescription also requires KEI Power to keep the upstream eel passage facility in proper order and to remove debris that could hinder flow and passage. Maine DMR's section 10(j) recommendation includes an upstream passage facility for eel on the west end of the dam consistent with Interior's and Commerce's preliminary fishway prescriptions, except that Maine DMR recommends that the facility be operational within two years of license issuance.

Our Analysis

There are no existing upstream fish passage facilities at the project for American eel. However, migrating juveniles can reach the project by scaling the Gardiner Paperboard Dam. Thus, upstream migrating juveniles can reach the project and be affected by project facilities and operation.

To migrate upstream past the project, juvenile eels must climb over or around the project dam. In August 2006, KEI Power installed a temporary eel fishway near the rock wall on the west end of the dam, which facilitated passage of over 1,800 eels. During the juvenile American eel study conducted between June 9 and August 19, 2015, KEI Power observed a total of 1,056 juvenile eels searching for passage over the project dam. The majority of eels (84 percent) were observed on the west side of Cobbosseecontee Stream, within pools and rock crevices, and along the rock wall just below the dam. Adult eels are also present upstream of the project, which confirms that eels do ascend the dam; however, there is no estimate of the number of individuals that successfully pass upstream on an annual basis.

Climbing over or around dams is a well-documented behavior for juvenile eels (GMCME, 2007). Juvenile eels that are migrating upstream in Cobbosseecontee Stream must first scale the 12-foot-high Gardiner Paperboard Dam and then in 0.3 mile, the juvenile eels must scale the taller, 19- to 23-foot high American Tissue Dam. The American Tissue Project could delay and potentially block juvenile eels from moving further upstream. A dedicated upstream eel passage facility at the project would increase upstream passage effectiveness and improve access to upstream habitat. Operating the facility from June 1 to September 15 is consistent with the juvenile eels upstream migration season.

KEI Power proposes to install the upstream eel passage facility on the west side of the dam. Using evidence from the upstream passage temporarily installed in 2006 and

the study conducted in 2015, the west side of the American Tissue Dam is likely the most effective location to install an eel ladder to pass juvenile eels upstream. Installing the upstream eel passage facility in this location would likely provide the most timely and effective upstream passage for juvenile eels. Operating the upstream eel passage facility from June 1 to September 15 as proposed by the resource agencies is consistent with the juvenile eel migration season in Maine. Therefore, construction and operation of an upstream eel passage facility from June 1 to September 15 of each year would reduce project effects on eels by providing eels with additional access to habitat upstream of the project.

As discussed above for the downstream fish passage facility for alosines, FWS's Design Criteria Manual could be used to guide the design, operation, and maintenance of the upstream eel passage facility, as required by Interior and recommended by Maine DMR, to ensure the safe, timely, and effective movement of eels passed the project. Specifically, the Design Criteria Manual recommends an upstream eel passage facility consisting of a covered metal or plastic volitional ramp that is lined with a wetted substrate and angled at a maximum slope of 45 degrees, with one-inch-deep resting pools that are sized to the width of the ramp and spaced every 10 feet along the length of the ramp. The Design Criteria Manual further recommends sizing the ramp width to accommodate a maximum capacity 5,000 eels/day (FWS, 2017a). Adjusting the construction of the new upstream eel passage facility around migration seasons, as required in Commerce's and Interior's fishway prescriptions, would minimize the effects of construction on migrating eels.

Downstream Eel Passage

KEI Power proposes to continue the following measures to facilitate the passage of eels downstream from September 1 to November 15 of each year: (1) installing blinding plates at the base of the turbine intake and a partial trashrack overlay with 7/8-inch clear spacing over the upper intake to protect eels from being entrained; (2) releasing 40 cfs from the discharge pipe at night to provide a passage route for eels; (3) reducing generation at night if any dead or injured adult eel are observed during passage season; and (4) ceasing generation at night for the remainder of the eel passage season if any entrained eels are observed.

Based on data collected in the fall of 2017 indicating that eels are not using the existing downstream eel passage facility at the base of the dam, Maine DMR recommends under section 10(j) that KEI Power maintain the existing downstream passage measures for American eel only for an interim period until additional mitigation measures are implemented and tests are performed regarding the effectiveness of alternative measures. First, Maine DMR states that downstream passage should be provided for eels from August 15 to November 15 and that within two years of license issuance, KEI Power should install a trashrack overlay with 3/4-inch clear spacing and

blinding plates at the base of the intake during the downstream migration season. Second, Maine DMR recommends testing the effectiveness of alternative means of downstream eel passage, including: (1) the downstream passage facility that conveys flows over the dam for alosines, with modifications to increase conveyance flows; and (2) an "experimental airlift-assisted deep bypass" at the project.[62] Maine DMR states that if either of these facilities prove to be effective, then the 40 cfs flow release through the discharge pipe at the base of the dam "may be terminated."

Interior's preliminary fishway prescription would require KEI Power to continue operating the existing downstream facility for eels from August 15 to November 15 each year, including: installing a trashrack overlay[63] and opening the discharge pipe at the base of the dam to release 40 cfs to the bypassed reach.[64] However, if the existing structure does not pass American eels in a safe, timely, and effective manner, as proposed by the Maine DMR study, then Interior would require the licensee to consult with FWS to design and construct a new downstream eel passage facility. The new facility would have to be designed in accordance with FWS's Design Criteria Manual.

Commerce's preliminary fishway prescription states generally that a fishway must be operational during the migration window of August 15 to November 15 of each year. Based on the study conducted by Maine DMR, Commerce states that there is a lack of clear data that eels are passing through the discharge pipe at the base of the dam in a safe, timely, and effective manner. Commerce states that the rapidly accelerating water in

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[62] An airlift-assisted deep bypass system is a submerged conduit that uses air to induce flow through the conduit to transport eels from a deep location to the surface, in order to provide passage over a dam.

[63] Interior's preliminary fishway prescription does not clearly specify the bar spacing size that it would require for the trashrack overlay or whether blinding plates would be required to protect eels migrating downstream. Interior states that the licensee "shall continue to use the existing downstream facility (installing the blinding plates and the 7/8-inch punchplate overlay and opening the deep gate at the required time) until further notice," but then states that the licensee "shall continue to install the 3/4-inch, full-length punchplate during the American eel downstream migration period unless a new downstream eel passage facility makes them obsolete." Based on this conflict, staff cannot describe which bar spacing size would be required by Interior for downstream eel passage.

[64] Interior's preliminary section 18 prescription for downstream eel passage is not consistent with its section 10(j) recommendation because Interior recommends a release of 40 cfs beginning on September 1 of each year, consistent with KEI Power's proposal. Interior also recommends installing a 1-inch punchplate (*i.e.*, trashrack overlay).

front of the deep gate can repulse eels. Based on the area of the gate opening and the head over the gate, Commerce estimates that the velocity through the deep gate is approximately 23 fps. Commerce states that this acceleration and velocity exceeds recommended guidelines for safe, timely, and effective downstream passage (Piper *et al*., 2015). In addition, Commerce states that if eels do eventually commit to the deep gate, the high velocity expulsion of the eel from the deep gate may injure the fish by impacting ledge or retaining walls immediately downstream. Based on the results of required monitoring studies, Commerce states that it may seek to implement improvements to downstream passage for American eel.

Our Analysis

In New England, adult eel out-migration typically occurs from mid-August to mid-November (Haro *et al*., 2003). Adult eels often move downstream in pulses with large numbers of eels moving downstream during short periods of activity (1-3 days) followed by longer periods of time (7-20 days) with relatively little downstream eel movement (EPRI, 2001). Peak movements often occur at night during periods of increasing river flow (Richkus and Whalen, 1999). Other environmental cues, such as local rain events and moon phase, may also encourage downstream movement of out-migrating eels (EPRI, 2001; Haro *et al*., 2003).

To facilitate downstream eel passage at the project and reduce project effects on American eel that are migrating downstream through the project, KEI Power currently installs 30-inch-tall blinding plates at the base of the turbine intake and a partial trashrack overlay with 7/8-inch clear spacing over the upper intake on a seasonal basis to reduce the potential for impingement and entrainment. Potential downstream routes for adult eels migrating through the project include: (1) passage through the existing downstream eel passage facility, which consists of a discharge pipe at the base of the dam that is opened at night from September 1 through November 15; (2) passage through the existing surface-level downstream fish passage facility for juvenile alewives; (3) passage over the dam when KEI Power releases flows over the crest of the dam during high flow events; and (4) passage through the project turbine. We analyze the safety, effectiveness, and timeliness of the potential downstream migration routes below.

Passage through the Discharge Pipe at the Base of the Dam

Releasing flows through a deep passage route can be a safe, timely, and effective means of passage for adult eels. Migrating eels are attracted to flow releases at lower impoundment depths, as evidenced by their attraction to hydropower turbine intakes (Brown *et al*., 2009). Until recently, no concerns had been raised about the safety, timeliness, and effectiveness of the downstream eel passage facility at the project, including the 40-cfs flow release through the discharge pipe at the base of the dam.

A study conducted in the fall of 2017 by Maine DMR, the results of which were submitted with Maine DMR's section 10(j) recommendation, indicates that eels might not use the existing downstream eel passage facility due to rapidly accelerating flow and high velocities at the gate of the discharge pipe (referred to as the "deep gate"). In its preliminary fishway prescription, Commerce estimates that the velocity at the deep gate is 23 fps, and suggests that the downstream eel passage facility might not be a safe, timely, and effective means of downstream passage. Using a standard orifice equation based on the depth of the discharge pipe at the project, staff calculates that the velocity at the deep gate is approximately 23 fps, as estimated by Commerce. Based on the results of a study conducted by Piper *et al*. (2015), which indicated that European eels avoid intakes at a median flow velocity of 1.87 fps, the 23-fps flow velocity would likely exceed suitable velocities for effective downstream eel passage by an order of magnitude.

The size of the intake opening at the deep gate might also create unsafe conditions for eel passing downstream through the project. FWS's Design Criteria Manual recommends that the intake opening at a low-level downstream eel passage facility be sized at approximately one-half of the maximum body length of an adult silver eel (*i.e.*, an opening of 18 inches or larger), in order to prevent injury associated with rapid flow acceleration at a pressurized deep intake. Although the discharge pipe has a diameter of approximately 56 inches, KEI Power only opens the deep gate by 8 inches for downstream eel passage, in accordance with the Commission's October 16, 2003 Order. Therefore, the 8-inch opening at the deep gate is smaller than the opening recommended in FWS's Design Criteria Manual, which indicates that the opening could be inadequate for safe and effective passage.

Altogether, the flow velocity at the deep gate and the size of the intake opening reduce the potential effectiveness of the existing downstream facility and could present a risk of injury to eels that attempt to pass through the relatively narrow opening. Staff concludes that the existing downstream passage facility located at the discharge pipe most likely does not provide a safe and effective means of passage for adult eels.

Passage through the Downstream Fish Passage Facilities

Based on the avoidance behavior observed at the deep gate of the project, the downstream passage facility for alewife could serve as the primary mode of downstream passage for eels at this time. Migrating eels are not strictly bottom-oriented during migration (Haro *et al*., 2000) and will utilize a surface-oriented downstream fish passage facility (Brown *et al*., 2009). KEI Power proposes to continue providing downstream fish passage for alewife through a surface-level egress from June 1 to November 15, which overlaps with the downstream migration period for eels of August 15 to November 15. KEI Power also proposes to modify the existing downstream passage facility by increasing the flow release over the dam and improving the structural integrity and reliability of the plunge pool. As discussed above, these measures would improve the

attraction flow for downstream migrants, improve the reliability of the downstream passage facility, and reduce possible injury and mortality to migrants. With these modifications, the downstream passage facility would continue to provide safe, timely, and effective eel passage.

Passage over the Dam during High Flow Events

Increasing spill into the bypassed reach over the project spillway can be an effective means of passing eels downstream (Brown *et al*., 2009). When there is spill at a hydropower facility, eels are attracted to water flowing over the spillway and will utilize spill as a route of passage (Haro *et al*., 2003). At the American Tissue Project, precipitation events increase flow in Cobbosseecontee Stream during eel downstream migration season. Flow in Cobbosseecontee Stream begins increasing from October to the end of the migration season in mid-November. Data collected at USGS gage number 01049500 (located directly downstream from the project) shows that elevated streamflow results in spill at the American Tissue Dam about 40 percent of the time in October and 49 percent of the time in November. Because spill occurs more frequently at the project during migration, eels could potentially utilize spill over the dam as a route for downstream migration during high flow events, rather than passage through the discharge pipe at the base of the dam. However, the spillway height ranges from 19 to 23 feet, and flows spilling over the dam fall onto a concrete and rock shelf at the base of the dam that could potentially injure or kill eels upon impact. Therefore, passage over the dam during high flow events at the project most likely does not provide a safe alternative means of passage for American eel.

Passage through the Turbines

As evidenced by a fish kill in 2001, turbine passage at the project is unsafe. KEI Power proposes to continue to install a partial trashrack overlay with 7/8-inch clear spacing over the upper intake and blinding plates at the base of the intake during the downstream eel migration season to protect adult eels from entrainment during migration. The licensee has monitored the tailrace area of the project on a daily basis from September 1 to November 15 each year since the October 16, 2003 Order was issued, and has not observed any eel mortalities since initiating these existing downstream passage measures in 2003. KEI Power proposes to continue monitoring for eel injury and mortality downstream of the project on a daily basis and to cease generation at night if entrained eels are observed in the downstream reach. These measures should continue to protect eels from downstream injury and mortality associated with turbine passage.

Maine DMR recommends installing a 3/4-inch trashrack overlay during the downstream migration period.[65] A trashrack overlay with 3/4-inch clear spacing would reduce the existing trashrack clear bar spacing by 1/8 inch, or 0.125 inch. While a narrower spacing size in the trashrack overlay could potentially provide additional protection for smaller eels, a smaller-sized clear spacing does not appear to be necessary because no injured or killed eels have been observed downstream of the project since the licensee began installing the blinding plates and the 7/8-inch partial trashrack overlay on a seasonal basis in 2003. These existing measures appear to have mitigated the risk of eel injury and mortality associated with turbine passage. Studies in New England have documented adult eels ranging in size from 24 to 30 inches long (ASMFC, 2000; Haro *et al*., 2000) and 0.9 to 1.1 inches wide (Great River Hydro, 2016). Based on this size range, the existing partial trashrack overlay with 7/8-inch (0.875 inch) clear spacing would protect most adult eels migrating downstream from entrainment. In addition, there is a low potential for impingement on the trashracks because American eels have a burst speed of over 4 fps (Bell, 1991) that is sufficient to overcome the maximum through velocity of 1.4 fps, when the trashrack overlay is installed.

Alternative Means of Downstream Eel Passage

Based on its study from the fall of 2017, Maine DMR recommends testing the effectiveness of alternative means of downstream eel passage, including: (1) the downstream passage facility that conveys flows over the dam for alosines, with modifications to increase conveyance flows; and (2) an "experimental airlift-assisted deep bypass" at the project. Maine DMR states that if either of these facilities prove to be effective, then the 40 cfs flow release through the discharge pipe at the base of the dam "may be terminated." If the existing downstream fish passage facility does not pass American eels in a safe, timely, and effective manner, then Interior would require the

[65] Interior's preliminary fishway prescription and section 10(j) recommendation would require a trashrack overlay with three different sizes of clear bar spacing to facilitate downstream eel passage. Interior's fishway prescription requires KEI Power to: "continue to use the existing downstream facility (installing the blinding plates and the 7/8-inch punchplate overlay and opening the deep gate at the required time)" and "continue to install the 3/4-inch, full-length punchplate during the American eel passage downstream migration period…." Interior's section 10(j) recommendation would require KEI Power to install a different overlay, with 1-inch clear spacing. It is unclear which trashrack overlay Interior is proposing. However, based on the size range of eels described above, a 1-inch trashrack overlay would provide less protection from entrainment than the 7/8-inch overlay that is currently installed at the project on a seasonal basis.

licensee to consult with FWS to design and construct a new downstream eel passage facility.

As discussed above, the discharge pipe at the base of the dam does not appear to provide safe and effective downstream passage, and could result in injury to eels based on the high flow velocity at the deep gate and the relatively small opening at the discharge pipe. Therefore, there is no basis for continuing to release 40 cfs at night through the discharge pipe during the downstream migration season.

Maine DMR does not provide any specific performance standards for testing the effectiveness of the downstream fish passage facility for eels or testing an experimental airlift-assisted deep bypass" at the project. Without specific performance standards to evaluate, there is no information to analyze and no information to determine whether effectiveness testing would or would not provide benefits to alosines and American eels.

There is no evidence that the effectiveness of the downstream surface-level passage needs to be tested at the project. Based on Maine DMR's and Commerce's analyses indicating that the 40-cfs flow release at the base of the dam is ineffective and unsafe, the surface-level downstream passage facility for alewife is the most probable means of downstream eel passage at the project at the current time.[66] Eels are not strictly bottom-oriented during downstream migration (Haro *et al.*, 2000) and will utilize a surface-oriented downstream fish passage facility (Brown *et al.*, 2009). In addition, no dead or injured eels have been observed in the downstream reach of the project since implementation of downstream passage protection measures in 2003, and there is no evidence that eels are otherwise adversely affected by the project. Since 2003, KEI Power has: (1) installed a partial trashrack overlay with 7/8-inch clear spacing and blinding plates at the base of the trashrack during the downstream eel migration season to protect adult eels from entrainment; and (2) monitored for eel injury and mortality downstream of the project on a daily basis and ceasing generation at night if entrained eels are observed in the downstream reach. KEI Power proposes to continue implementing the existing protection measures for eels at the project, and proposes to construct a new surface-level downstream fish passage facility that would provide a greater attraction flow for downstream migrants and improve the structural integrity and

[66] Based on the fact that no injured or dead eels have been observed downstream of the project since the downstream passage and protection measures were implemented in 2003, it is unlikely that eels are using turbine passage or spill over the dam during high flows as a primary means of passage. Turbine passage is known to cause injury and mortality at the project, and passage through spill would increase the risk of injury and mortality from impact on the concrete and rock surface at the base of the dam during high flows.

reliability of the plunge pool. Therefore, the downstream surface-level passage should continue to be a safe and effective means of passage for eels.

Schedule for Operating Downstream Eel Passage Facilities

KEI Power proposes to continue to operate the downstream eel passage facility annually from September 1 to November 15. Interior's section 10(j) recommendation is consistent with KEI Power's proposal. In New England, the downstream migration period for American eel generally begins in mid-August. Waiting until September 1 to implement downstream measures could delay, harm, or kill eels that begin migrating downstream in mid-August, depending on the passage routes available to eels between August 15 and September 1. Interior's and Commerce's preliminary fishway prescriptions would require implementing downstream eel passage measures at the beginning of the migration period (*i.e.*, August 15), which would reduce the potential for delay, injury, and mortality relative to a September 1 start date for operating a downstream eel passage facility.

Fish Passage Design, Operation, and Maintenance

KEI Power proposes to consult with resource agencies on the proposed modifications to the existing downstream fish passage facility and the new upstream eel passage facility. KEI Power does not propose to develop an operations or maintenance plan for the existing and proposed fishways.

Commerce's and Interior's preliminary fishway prescription would require KEI Power to submit design plans for the new eel and alosine fishways to the respective agency for review and approval according to the following schedule: (1) submit the conceptual design plans within 15 months of construction; (2) submit the 30 percent design plan within one year of construction; (3) submit the 60 percent design plan within 9 months of construction; and (4) submit the 90 percent design plan within three months of construction. Commerce and Interior would also require KEI Power to submit the final design plan to the Commission for approval prior to the commencement of fishway construction activities and to file as-built drawings with the respective agency after construction of the fishway is complete. Interior's fishway prescription further requires KEI Power to design fishways consistent with FWS's Design Criteria Manual.

Interior's prescription also requires a fishway operation and maintenance plan (Fishway Plan) within 12 months of license issuance that includes measures for operating and maintaining the upstream and downstream fish passage facilities that are in operation at the time. Interior would require KEI Power to submit the Fishway Plan to the FWS for review and approval prior to submitting it to the Commission for its approval, and to update the Fishway Plan annually to reflect any changes in operation and maintenance planned for the year. In addition, if FWS requests a modification to the Fishway Plan, KEI Power must amend the plan within 30 days and must receive the approval of FWS

prior to implementing any other modifications to the plan. KEI Power would also be required to provide FWS with information on fish passage operation and any project operating conditions that may affect fish passage within 10 days of any such request from FWS. Interior also states that the schedule for operating the fishways may change based on new information, improved access at the lower dam, and agency consultation.

Commerce's preliminary fishway prescription includes specific provisions for maintaining the upstream and downstream fishways, including: (1) the licensee must keep the downstream passage facilities in proper order and clear of trash, logs, and material that would hinder flow and passage; and (2) anticipated maintenance must be performed in sufficient time before a migratory period such that fishways can be tested and inspected and will operate effectively prior to the migratory periods.

Maine DMR's section 10(j) recommendation includes provisions for fish passage operation and maintenance, including:

1. KEI Power must operate each fish passage facility for a one season "shakedown" period to ensure that it is generally operating as designed and to make minor adjustment to the facilities and operation. At the end of the "shakedown" period, KEI Power must have a licensed engineer certify that the facility is constructed and operating as designed in all material respects. Further, KEI Power must provide Maine DMR, FWS, and NMFS with a copy of the as-built fishway drawings as submitted to the Commission, along with the licensed engineer's letter of certification.

2. KEI Power must keep the fishways in proper working order and maintain fishway areas clear of trash, logs, and material that would hinder passage. KEI Power must perform routine maintenance sufficiently before a migratory period such that fishways can be tested and inspected, and will be operational during the migratory periods.

3. KEI Power must draft, in consultation with Maine DMR, Interior, and NMFS, and maintain written fishway operating procedures for the American Tissue Project. These operating procedures would include: (1) general schedules of routine maintenance; (2) procedures for routine operation, monitoring, and reporting on the operation of each fish passage facility or measure; (3) schedules for procedures for annual start-up and shutdown; and (4) procedures for emergencies and project outages significantly affecting fishway operations.

4. KEI Power must maintain and operate permanent fishways during the upstream and downstream migration periods for Atlantic salmon, American shad, blueback herring, alewife, and eel (see Table 7). Maine DMR's recommendation includes provisions for modifying the schedule for

fishway operation based on new information regarding the timing of migration, river conditions, maintenance requirements, or annual variability in fish migration patterns, in consultation with Maine DMR, Interior, and NMFS.

Table 7. Migration periods for alosines and American eel at the project.

Species	**Upstream Migration Period**	**Downstream Migration Period**
Alewife, blueback herring, and American shad	May 1-July 31	June 1-November 30
American eel	June 1-September 15	August 15-November 15

(Source: Maine DMR section 10(j) recommendation comment letter, filed November 22, 2017).

Our Analysis

Fish Passage Facility Design

KEI Power is proposing to install an upstream fish passage facility for American eel and improve the existing downstream fish passage facilities for juvenile and adult alewives to provide safe, effective, and timely passage at the project. The April 28, 2017 license application does not contain design drawings or a description of the structural modifications to the existing downstream fish passage facility that would be needed to increase the conveyance flow for downstream passage and improve the integrity and reliability of the plunge pool. In addition, KEI Power has not proposed an eel passage facility design.

Submitting the conceptual, 30, 60, and 90 percent design drawings to Commerce, Interior, and Maine DMR would provide the resource agencies with a way to review and comment on design issues and provide KEI Power with an opportunity to adjust the design of any fish passage facility based on comments from the resource agencies to ensure that fishways are constructed to operate efficiently. Submitting the design drawings in this manner would also ensure that fish passage facilities are constructed in a timely manner. However, because it is the responsibility of the Commission to approve and ensure the proper design of fishways, there would be no benefit to providing certified as-built drawings to the resource agencies. As-built drawings could be accessed by the agencies, through the Commission.

Shakedown Period

Maine DMR recommends operating each new or modified fishway for a one-season "shakedown" period to ensure that the fishways are generally operating as designed, and if not, to make adjustments. Ensuring that new and modified facilities are operating as designed would increase the likelihood of safe, timely, and effective passage. To prevent interference with operation of the fish passage facilities during the migration season, any necessary adjustments could be timed so that they are completed prior to the relevant fish passage season.

Fishway Operation and Maintenance Plan

To maintain the effectiveness downstream fish passage facilities, fishways need to be properly operated and maintained. Most fishways require routine maintenance to ensure the fishways operate effectively. An operation and maintenance plan would ensure that routine cleaning and maintenance, including debris removal, are performed so that the fishways operate as intended. In addition, the plan would ensure that any fishways constructed at the project would be operated during the appropriate times of the day and year, and with an appropriate conveyance flow. A fishway operation and maintenance plan that includes Maine DMR's recommendations and Interior's and Commerce's requirements for operating and maintaining the fish passage facilities would provide KEI Power with procedures necessary to ensure that the project fishways are maintained in proper working order before and during the migratory fish season. A fishway operation and maintenance plan would also provide resource agencies a way to review the maintenance and operation history for all fishways at the project and adjust procedures as appropriate.

Separately, KEI Power proposes to continue monitoring the downstream reach during the downstream alewife and eel passage seasons, and reduce or cease generation if injured/dead alewives or eels are observed downstream of the project. KEI Power also proposes to cease generation at night if eels are entrained at the project intake. However, KEI Power does not discuss standard procedures that it would implement in the event dead/injured alewives and eels are observed in the tailrace during the downstream passage season, including the timing and magnitude of generation reductions and shutdowns. An operation and maintenance plan could include standard procedures for reducing and ceasing generation if dead/injured alewives or eels are observed downstream of the project.

Regarding Maine DMR's recommendation that KEI Power file copies of the fishway operating procedures to resource agencies, copies of these plans would already be filed with the Commission and would be accessible to the public, so there would be no benefit to providing copies to the agencies.

As to Maine DMR's recommendation that KEI Power file copies of the fishway operating procedures to resource agencies, copies of these plans would already be filed with the Commission and would be accessible to the public. Also, Interior's and Maine DMR's provision for modifying fishway operating schedules during the term of the license based on new information does not include limits regarding the number of days that the fishways would operate beyond the proposed schedules. In the absence of recommended or prescribed limits on operating schedule modifications, we have no information to analyze, and therefore no information to determine whether a particular schedule modification would or would not provide benefits to alosines and American eel.

Fishway Effectiveness Testing

Interior's preliminary fishway prescription would require KEI Power to test the effectiveness of new upstream and downstream eel and alosine passage facilities. Interior's fishway prescription specifically requires KEI Power to: (1) develop fishway effectiveness testing and evaluation plans within three months of submitting conceptual design plans for fishways; (2) submit the effectiveness testing and monitoring plan to FWS for review and approval; (3) implement the measures in the plan at the start of the first migratory season after a fishway is operational; (4) conduct effectiveness testing and evaluation for a minimum of two years; (5) meet with FWS and other resource agencies in the late fall to review fishway maintenance, operation, monitoring results, and to review the fishway operation and maintenance plan; and (6) implement changes and planned maintenance 30 days prior to the start of the next migratory season. Interior also prescribes that KEI Power provide FWS personnel, and its designated representatives, access to the project site and to pertinent project records for the purpose of inspecting the fish passage facilities and to determine compliance with its prescription.

Commerce's preliminary fishway prescription would require KEI Power to: (1) develop a quantitative fish passage monitoring plan with performance standards for all existing and any new fishways constructed at the project; (2) conduct quantitative monitoring for a period of two years, beginning at the start of the second migratory season after the fishway is operational; (3) measure the safety, timeliness, and effectiveness of passage based on performance standards to be developed by Commerce during the development of monitoring plans; (4) continue monitoring biennially if performance standards are not met; and (5) improve fishways that do not meet performance standards.

Maine DMR recommends that KEI Power develop and conduct a quantitative monitoring study for each new or modified fish passage facility or measure in consultation with the resource agencies. The monitoring study would include performance measures and would begin at the start of the second migration season after the fishway is operational. If the facility does not meet performance measures for safe,

timely, and effective passage, the studies will be conducted biennially until achievement of performance standards.

KEI Power does not propose to conduct effectiveness testing.

Our Analysis

Fishway efficiency evaluations may take many forms, including video observation, sample collection, hydro-acoustics, telemetry, or passive integrated transponder studies. A passage effectiveness study typically evaluates factors such as attraction flows, attraction efficiency, passage efficiency, passage delay, and survival rates. As stated in the FWS Design Criteria Manual, efficiency testing is typically evaluated quantitatively through a site-specific framework and performance standards are generally informed by state and federal agencies with expertise in the life history requirements of the region's fish populations. Factors to consider include the impact of all barriers within the watershed and the minimum number of fish required to sustain a population's long-term health and achieve identified management plan objectives and goals.

Commerce, Interior, and Maine DMR have not included any specific performance standards that would be used to test the effectiveness of the fish passage facilities. Instead, they would require the development of plans and performance standards post-licensing, in consultation with resource agencies. Without specific performance standards to analyze, there is no basis for assessing the benefits of effectiveness testing for fish passage and determining whether effectiveness testing would or would not provide benefits to alosines and American eels.

Interior's preliminary fishway prescription would require new fish passage facilities to be designed in accordance with proven, species-specific design criteria from the FWS's Design Criteria Manual, and that the facilities be operated and maintained in accordance with a fish passage operation and maintenance plan that is developed in consultation with the resource agencies and approved by the Commission. Since the facilities would be designed, operated, and maintained in accordance with proven fish passage standards and operating procedures, there is no apparent benefit to conducting effectiveness studies. As discussed above, however, Maine DMR's recommendation to operate each new or modified fishway for a one-season "shakedown" period to ensure that the fishways are generally operating as designed, and if not, to make adjustments would increase the likelihood of safe, timely, and effective passage.

Interior's preliminary fishway prescription would require KEI Power to meet with FWS and other resource agencies in the late fall to report on fish passage maintenance and operation, report on monitoring results, and to review the operation and maintenance plan. Interior does not identify a specific need or benefit of meeting annually or reviewing fish passage operational data and monitoring results. Further, KEI Power

would operate and maintain all fishways by following specific operation and maintenance plans that are developed in consultation with the resource agencies, and approved by the Commission. With proper operation and maintenance, there is no reason to believe that the fishways would not perform as designed. Thus, there would be no benefit to meeting annually. For the same reasons, there would also be no benefit to Interior's fishway prescription that would require KEI Power to provide information on fish passage operation and project generation to FWS upon written request.

3.3.2 Terrestrial Resources

3.3.2.1 Affected Environment

The project is located in the Acadian Plains and Hills ecoregion (Griffith *et al*., 2009), which is characterized by rolling plains and low hills. The project vicinity is predominately forested upland and developed land. Wetlands in the project vicinity are limited to deepwater habitats and fringe areas within the littoral zone. However, no wetlands are located within the project boundary.

Limited areas of upland are located within the project boundary. Approximately 0.8 acre of deciduous and mixed forest occurs primarily along the shoreline of the project. Deciduous forests in this area are composed of red maple, red oak, white ash, sugar maple, American beech, and paper birch. Mixed forests of deciduous and coniferous trees contain similar species, but may also include white pine, hemlock, and balsam fir.

The remaining 1.2 acres of land located within the project boundary is composed of commercial and residential areas, primarily along the shoreline of the impoundment. Current vegetation management within the project boundary is limited to mechanical vegetation removal techniques (*e.g.*, mowing and string trimming) to maintain mowed grass areas, the access road, and the parking lot.

Invasive Species

Several invasive plant species including Japanese knotweed, honeysuckle, purple loosestrife, and variable leaf-milfoil are known to occur within the Cobbosseecontee Stream watershed and could be present at the project. However, KEI Power is not proposing to conduct any significant ground-disturbing activities such as road construction or land-clearing that would facilitate the spread of invasive plant species within the project boundary.

Wildlife

The project vicinity supports various wildlife habitats, including those associated with wooded upland and urban/suburban areas. Mammals common to the project vicinity include white-tailed deer, red fox, raccoon, skunk, eastern chipmunk, squirrels, eastern red bat, long-tailed shrew, white-footed mouse, muskrat, and beaver. Numerous birds use the forested areas buffering the project including mourning dove, wild turkey, ruffled grouse, and barred owl. The Cobbosseecontee Stream watershed also supports a variety of waterfowl, including great blue heron, double-crested cormorant, gulls, mergansers, and ducks. Raptor species found in central Maine include bald eagle, osprey, and red-tailed hawk.

3.3.2.2 Environmental Effects

KEI Power does not propose any specific measures for the protection of terrestrial resources at the project. No agencies filed recommendations for botanical or wildlife resources; and no comments were received regarding invasive plant species.

Operating the project in a run-of-river mode would continue to maintain stable impoundment levels and minimize effects on habitat along the shoreline of the impoundment and downstream reach. Invasive plant species are not currently known to be a problem at the project and no significant ground-disturbing activities are proposed. Therefore, continued project operation and maintenance activities are not expected to facilitate the spread of these plants.

3.3.3 Threatened and Endangered Species

3.3.3.1 Affected Environment

The federally endangered Gulf of Maine Distinct Population Segment (GOM DPS) of anadromous Atlantic salmon (*Salmo salar*) currently occupies the Kennebec River. In addition, the federally listed threatened northern long-eared bat (*Myotis septentrionalis*) could occur in Kennebec County, Maine.

Atlantic Salmon

Anadromous Atlantic salmon (*Salmo salar*) in the Kennebec River are listed as endangered under the ESA and are part of the GOM DPS (Figure 5). While currently absent from the project area, anadromous Atlantic salmon historically migrated upstream on the Kennebec River as far as the Kennebec River Gorge in Indian Stream Township (NMFS, 2009), which is approximately 70 river miles upstream of the confluence of the Kennebec River and Cobbosseecontee Stream. In 2009, NMFS designated critical habitat for Atlantic salmon in the Kennebec River, but none was identified within the project boundary (NMFS, 2009). In addition, the Cobbosseecontee Stream is not

classified as critical habitat (*i.e.*, critical to the recovery of the species). No known spawning or rearing habitat occurs within the American Tissue project area, nor is there any known Atlantic salmon migration upstream or downstream through the project waters.

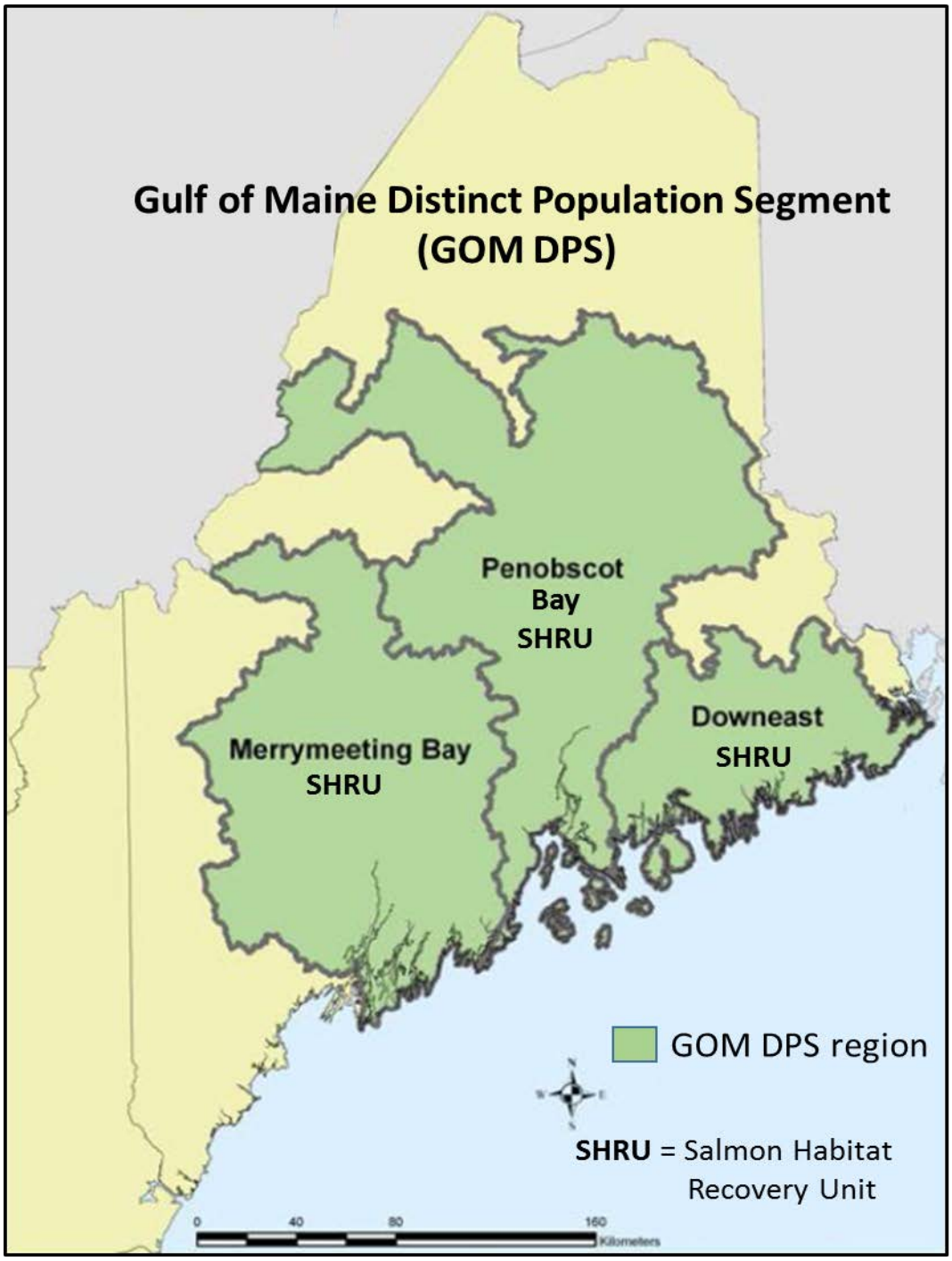

Figure 5. The freshwater population range of the Gulf of Maine Distinct Population Segment (GOM DPS) of endangered Atlantic salmon. (Source: NMFS, 2016a, as modified by staff).

Life History

Anadromous Atlantic salmon typically spend 2 to 3 years in the ocean before returning to their natal rivers to spawn. Approximately 86 percent of adults return after 2 years, about 10 percent (primarily males) return after 1 year, and the remaining 4 percent are repeat spawners or spend 3 years at sea (NMFS, 2009). Most adult Atlantic salmon enter Maine rivers during the spring and early summer (May-July), but upstream migrations can occur from April to early November (Baum, 1997). In the project area, the downstream Gardiner Paperboard Dam blocks movements of Atlantic salmon further upstream and no Atlantic salmon have been found in the project area. Historically, Atlantic salmon migrated up Cobbosseecontee Stream.

Recovery Plans

The 2005 Final Recovery Plan for the Gulf of Maine Distinct Population Segment of Atlantic Salmon for the originally-listed GOM DPS (NMFS and FWS, 2005) presented a strategy for recovering Atlantic salmon listed as endangered under ESA in 2000. An updated draft recovery plan comment addresses recovery within the expanded range of the GOM DPS of Atlantic salmon described in the 2009 listing rule (NMFS and FWS, 2016a).

The 2016 draft recovery plan for the GOM DPS of Atlantic Salmon reflects a new recovery planning approach (termed the Recovery Enhancement Vision) that focuses on the three statutory requirements in the ESA, including: site-specific recovery actions; objective, measurable criteria for delisting; and time and cost estimates to achieve recovery and intermediate steps. The draft recovery plan is based on two premises: first, that recovery must focus on rivers and estuaries located in the GOM DPS until threats in the marine environment are better understood; and second, that survival of Atlantic salmon in the GOM DPS depends on conservation hatcheries through much of the recovery process (NMFS and FWS, 2016a). The main objective of the draft recovery plan is to maintain self-sustaining, wild populations with access to sufficient suitable habitat in each salmon habitat recovery unit (SHRU), and ensure that necessary management options for marine survival are in place. In addition, the plan seeks to reduce or eliminate all threats that either individually or in combination might endanger the GOM DPS (NMFS and FWS, 2016a).

Essential Fish Habitat

Essential fish habitat (EFH) refers to those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity and covers a species' full life cycle.[67] EFH for Atlantic salmon has been defined as, "all waters currently or

[67] 50 C.F.R. § 600.10 (2017).

historically accessible to Atlantic salmon within the streams, rivers, lakes, ponds, wetlands, and other water bodies of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island and Connecticut," which includes the project area. A description of EFH for each Atlantic salmon life stage can be found in the New England Fishery Management Council (NEFMC) Essential Fish Habitat Amendment 2 (NEFMC, 2016) as follows:

- Eggs: Bottom habitats with a gravel or cobble riffle above or below a pool of rivers. Generally, the following conditions exist in the egg pits (redds): water temperatures below 10°C, and clean, well-oxygenated fresh water. Atlantic salmon eggs are most frequently observed between October and April.
- Larvae: Bottom habitats with a gravel or cobble riffle (redd) above or below a pool of rivers. Generally, the following conditions exist where Atlantic salmon larvae, or alevins/fry, are found: water temperatures below 10°C, and clean, well-oxygenated fresh water. Atlantic salmon alevins/fry are most frequently observed between March and June.
- Juveniles: Bottom habitats of shallow gravel/cobble riffles interspersed with deeper riffles and pools in rivers and estuaries. Generally, the following conditions exist where Atlantic salmon parr are found: clean, well-oxygenated fresh water, water temperatures below 25°C, water depths between 10 centimeters (cm) and 61 cm, and water velocities between 30 and 92 cm per second. As they grow, parr transform into smolts. Atlantic salmon smolts require access downstream to make their way to the ocean. Upon entering the sea, "post-smolts" become pelagic and range from Long Island Sound north to the Labrador Sea.
- Adults: For adult Atlantic salmon returning to spawn, habitats with resting and holding pools in rivers and estuaries. Returning Atlantic salmon require access to their natal streams and access to the spawning grounds. Generally, the following conditions exist where returning Atlantic salmon adults are found migrating to the spawning grounds: water temperatures below 22.8°C, and dissolved oxygen above 5 parts per million (ppm). Oceanic adult Atlantic salmon are primarily pelagic and range from the waters of the continental shelf off southern New England north throughout the Gulf of Maine.
- Spawning Adults: Bottom habitats with a gravel or cobble riffle (redd) above or below a pool of rivers. Generally, the following conditions exist where spawning Atlantic salmon adults are found: water temperatures below 10°C, water depths between 30 cm and 61 cm, water velocities around 61 cm per second, and clean, well-oxygenated fresh water. Spawning Atlantic salmon adults are most frequently observed during October and November.

Atlantic salmon EFH includes all aquatic habitats in the watersheds of the identified rivers, including all tributaries, to the extent that they are currently or were historically accessible for salmon migration. Atlantic salmon EFH excludes areas upstream of

longstanding naturally impassable barriers (*i.e.*, natural waterfalls in existence for at least several hundred years).

Northern Long-eared Bat

The northern long-eared bat (NLEB) was listed as a federally threatened species under the ESA on May 4, 2015 and is also a species of special concern in Maine. Traditional ranges for the NLEB 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 areas. The NLEB, whose habitat includes large tracts of mature, upland forests, 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 areas around them and can be used for fall-swarming[68] and spring-staging.[69] No critical habitat has been designated for this species.

The project is located within the white-nose syndrome buffer zone for the NLEB.[70] Although there are no known occurrences of NLEB at the project, the project vicinity is largely forested and could supply suitable habitat for NLEB summer roosting and foraging activities.

3.3.3.2 Environmental Effects

Atlantic Salmon

As discussed previously, KEI Power proposes to continue to operate the project in a run-of-river mode with minimum flows to the bypassed reach and downstream of the

[68] Fall-swarming fills the time between summer and winter hibernation. The purpose of swarming behavior may include: introduction of juveniles to potential hibernacula; copulation; and gathering at stop-over sites on migratory pathways between summer and winter regions.

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

[70] The white-nose syndrome buffer zone encompasses counties within 150 miles of a U.S. county or Canadian district in which white-nose syndrome or the fungus that causes white-nose syndrome is known to have infected bat hibernacula. A hibernaculum is where a bat hibernates over the winter, such as in a cave. White-nose syndrome is a fungal infection that agitates hibernating bats, causing them to rouse prematurely and burn fat supplies. Mortality results from starvation or, in some cases, exposure.

powerhouse, as discussed in in section 3.3.1.2, *Aquatic Resources, Environmental Effects*. Interior, Commerce, and Maine DMR recommend KEI Power's proposal to operate the project in run-of-river mode and release 52 cfs downstream of the powerhouse. The resource agencies also recommend various alternative schedules and flow releases for the bypassed reach.

Our Analysis

Atlantic salmon historically migrated up Cobbosseecontee Stream, but the downstream Gardiner Paperboard Dam blocks movements of Atlantic salmon further upstream. No Atlantic salmon are known to occur in the project area, and there is no known spawning or rearing habitat in Cobbosseecontee Stream in the vicinity of the project. The Cobbosseecontee Stream is also not classified as critical habitat for Atlantic salmon. Based on this information, we conclude that relicensing the American Tissue Project with any of the measures considered in this EA would have no adverse effect on Atlantic salmon. However, the project area constitutes EFH for Atlantic salmon because Cobbosseecontee Stream was historically accessible to Atlantic salmon.

As discussed in section 2.1.3, *Existing Project Operation*, KEI Power operates the project in run-of-river mode with outflow from the project approximating inflow. This mode of operation, which KEI Power proposes to continue under a subsequent license, prevents rapid fluctuations in the impoundment, and helps to maintain aquatic vegetation along shallow water areas of the impoundment, which can serve as temporary holding and resting areas during the upstream migration of adult salmon. The continuation of run-of-river operation would maintain suitable conditions for Atlantic salmon EFH consistently during the course of any new license.

As discussed in section 3.3.1.1, *Water Quality*, the water quality study conducted by KEI Power demonstrates that water quality in the project vicinity generally meets Maine's water quality levels specified for Class B waters. The study also indicates that the impoundment does not stratify and that water temperature and dissolved oxygen are relatively uniform throughout the water column. These environmental conditions would be maintained under KEI Power's proposed operations.

The proposed modifications to the downstream fish passage facility would result in a net benefit to water quality in the bypassed reach and would enhance EFH for Atlantic salmon. The proposed modifications to the downstream fish passage facility would increase the conveyance flow from 10 cfs to 29 cfs to the bypassed reach from June 1 to November 15 each year. The additional flow in the bypassed reach could enhance dissolved oxygen during the warm dry summer months and reduce the occurrence of lower dissolved oxygen concentrations (*i.e.*, below 7.0 mg/L). Staff's recommended modifications to the downstream passage facility include increasing the conveyance flow to the bypassed reach to 29 cfs and operating the downstream fish

passage facility through November 30 of each year. These measures would increase the availability of aquatic habitat in the bypassed reach and could enhance dissolved oxygen in the bypassed reach relative to existing conditions.

Therefore, over the term of the license, aquatic habitat and EFH for Atlantic salmon would be enhanced under the applicant's proposal, and the additional staff modifications and measures discussed in section 5.1, *Comprehensive Development and Recommended Alternative*, which are supported in section 3.3.1.2, *Aquatic Resources*, would further support EFH. Based on this information, we conclude that relicensing the American Tissue Project as proposed and with staff-recommended measures would not likely adversely affect Atlantic salmon EFH habitat.

Northern Long-Eared Bat

KEI Power does not propose any measures for the protection of the NLEB, and no agency recommendations were received regarding the NLEB.

Our Analysis

Project operation and maintenance would not affect NLEB, or its habitat and food availability, because the applicant does not propose, and none of the action alternatives include any tree clearing activities as part of relicensing. Vegetation maintenance associated with the project is limited due to the industrial/residential setting of the project, and the fact that the project transmission line is located underground. Therefore, we conclude that relicensing the American Tissue Project with any of the measures considered in this EA would have no effect on the NLEB.

3.3.4 Land Use and Recreation

3.3.4.1 Affected Environment

Land Use

Kennebec County is primarily forested, with 57 percent of the land use being tree cover. Another 14 percent of the land is covered in wetlands, and 10 percent of the land in the county is used for agriculture. Only six percent of the county is developed land. The Kennebec River basin has higher percentages of land dedicated to agriculture and development than the rest of Kennebec County. Land use in the project vicinity consists mainly of former industrial sites, residential areas, and some forested areas, including a small city-owned park (city park). The heavily-trafficked Maine State Routes 9 and 126 run immediately adjacent to the south side of the project.

The current project boundary for the American Tissue Project as established by the Commission's May 9, 1979 license order encompasses 7.1 acres, including the

impoundment up to a contour elevation of 125.3 feet msl, the bypassed reach, and land associated with the dam, powerhouse, transmission line, and appurtenant facilities. Use of project land is light, with recreational activities, project operation, and project maintenance being the primary activities that occur on project land. No federal land exists within or adjacent to the project boundary.

No land in the immediate vicinity of the project are included in the national trails system, nor are there any designated wilderness land. The Cobbosseecontee Stream is not on the list of wild and scenic rivers.

Statewide Recreation Plan

The 2014-2019 Maine State Comprehensive Outdoor Recreation Plan (SCORP) identifies outdoor recreation as central to the state's economic, environmental, and community values. The SCORP identifies broad goals of using outdoor recreation to improve health and drive economic development in Maine. The SCORP identifies strong future growth in water-based activity, both nationally and regionally. The SCORP recommends expanding identification, signage, and promotion of resources, like water trails, as a way of connecting both local users and tourists to the state's many existing resources for water-based recreation (Maine DACF, 2015).

Regional Recreation Opportunities

The Lower Kennebec River Basin contains many opportunities for recreation, including fishing, hunting, boating, camping, hiking, snowmobiling, and picnicking. Numerous lakes surround the region, and the Gulf of Maine coast and its many inlets are approximately 30 miles to the south. The 6.5-mile Kennebec River Rail Trail runs from Gardiner north to Augusta. Pleasant Pond, a 746-acre lake located just upstream of the project on Cobbosseecontee Stream, is popular for swimming, boating, and fishing.

The City of Gardiner is currently pursuing a "Cobbossee Corridor Master Plan" that aims to revitalize the Cobbosseecontee Stream shoreline through the development of trails, open space recreation areas, housing, and new commercial development. The plan was approved by the city on March 10, 2005, but has no implementation schedule. Part of this master plan includes plans to extend the city park located near the project, such that it would encompass land from Pleasant Pond to downtown Gardiner and connect to the Kennebec River Rail Trail (City of Gardiner, 2017).

Recreation at the Project

KEI Power permits public use of the land and water surrounding the project for recreation. However, there are no formal project recreation facilities, and access is generally restricted due to industrial/commercial use on the south bank and steep wooded

terrain on the north bank. The city park with picnic tables and a 5-car parking area is adjacent to the north bank of the impoundment. A dirt ramp adjacent to the city park provides informal recreational access to the north shore of the project impoundment. The ramp is located just upstream of the seasonal boat barrier in the impoundment, and is connected to a trail that is owned and maintained by the City of Gardiner. The approximately 1000-foot-long trail runs along the north bank of the project (Figure 6), and parallels Cobbosseecontee Stream. As indicated in KEI Power's September 19, 2017 response to Commission staff's additional information request, the trail provides an informal canoe portage route between the project impoundment and a canoe put-in/take-out area near the downstream Gardiner Paperboard Dam. Recreational access to the tailrace and downstream of the project is possible through informal access over project land.

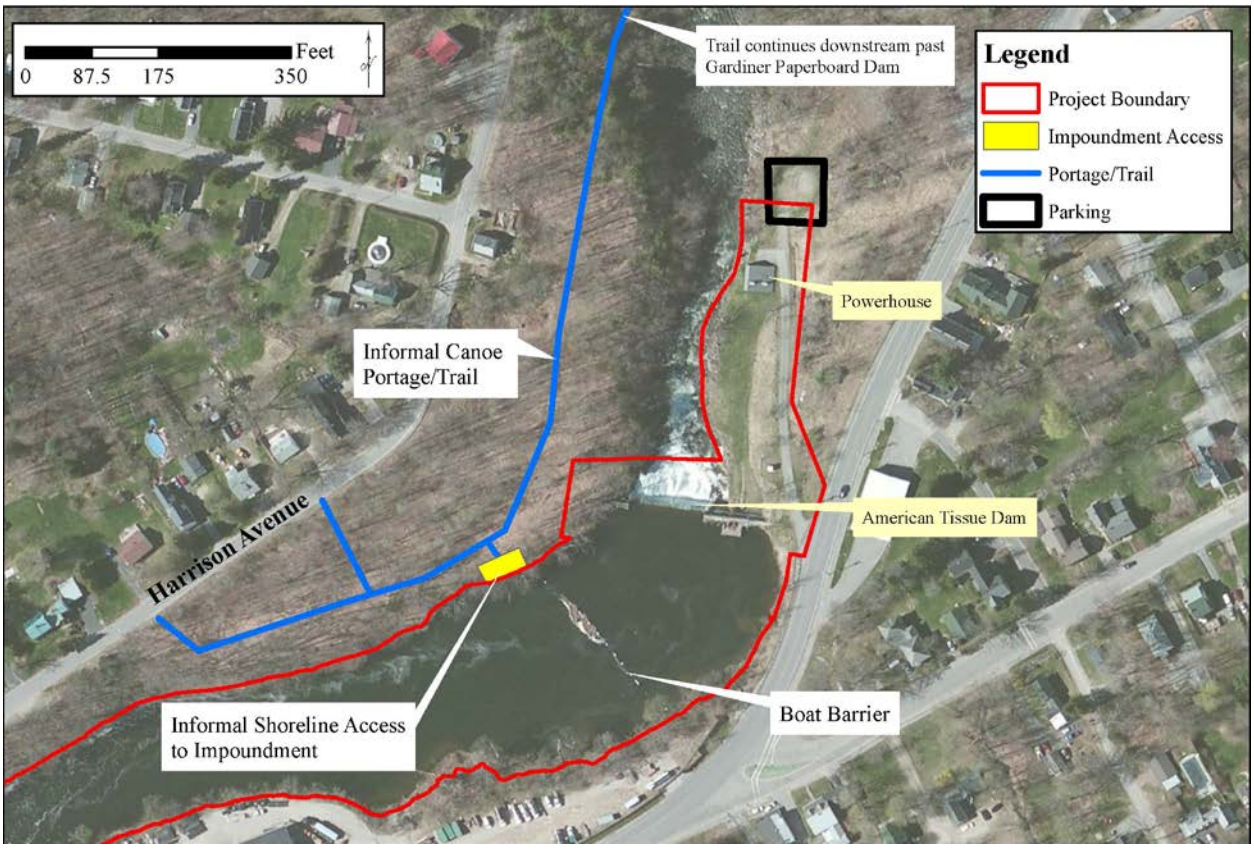

Figure 6. Diagram showing the City of Gardiner's trail and informal recreation access point (Source: KEI Power's September 19, 2017 response to additional information request).

Recreational Use

The project was exempted from FERC Form 80 recreational reporting requirements on April 4, 1996 because information available to Commission staff at the

time indicated that no potential for recreation existed at the project.[71] Based on staff observations made of the project area, and anecdotal evidence from the dirt ramp to the impoundment that is adjacent to the city park, the project likely sees light recreational use through swimming, hand-carry boating, and fishing.

3.3.4.2 Environmental Effects

KEI Power proposes to remove approximately 0.7 acre of land and water from the project bypassed reach. KEI Power states this land and water is not necessary for project operation and maintenance or the protection of environmental resources.

KEI Power is not proposing to add formal project recreation facilities, or improve public access to the project. In a letter filed on April 14, 2017, the City of Gardiner stated that recreation has been occurring at the project for at least 80 years and requested that the applicant be required to submit a recreation plan that includes provisions for evaluating potential adverse effects of the dam on recreation opportunities for area residents, measures to mitigate any adverse effects, and measures to support recreation opportunities at the project, including swimming, fishing, boating, walking, and bird and nature viewing.

Our Analysis

Recreation

There is no formal recreational access at the project. However, informal public recreational access to the American Tissue impoundment is available through the city park, and is likely to continue as long as the city maintains the facilities. Informal access is also available to the downstream reach over project land. Recreational use has occurred at the project for decades, but information on past usage rates is not available.

Development of land in the project vicinity for recreational use, as part of the Cobbossee Corridor Master Plan, could substantially change recreation at the project through increased access, revitalization of project surroundings, and promotion to the public. However, it is not possible to determine exactly what changes to the project surrounding will be made as part of the master plan, nor when they would be made, because this plan does not provide details on specific measures to enhance recreation, nor does it have a set schedule. In addition, given the industrial character of much of the project area and its vicinity, the relatively small size of the project impoundment, and its

[71] *See* April 4, 1996 letter from FERC's Division of Project Compliance and Administration to CHI Operations, Inc. regarding recreation reporting requirements at the American Tissue Project No. 2809.

location immediately downstream from the much larger Pleasant Pond, the project would likely continue to only receive light and informal recreation use, regardless of nearby revitalization.

The project does not appear to be diminishing the recreational value of the area or restricting recreation opportunities. The City of Gardiner did not provide specific examples of any negative effects in its comments, and no other party has submitted comments indicating that the project is adversely affecting recreational resources. The project creates a small 5.5-acre impoundment, and operates in run-of-river mode, so there are no impoundment fluctuations that could affect recreation. Although KEI Power does not provide formal recreational access, the impoundment is open to the public and accessible through the city park. Downstream access is also provided over project land. In addition, an informal canoe portage route is available from the impoundment to a hand-carry boat launch downstream of Gardiner Paperboard Dam. There is no indication that the City of Gardiner intends to restrict access to, or discontinue management of, the city park and the canoe portage trail. At this time, there appears to be no basis for the development of a recreation plan, as suggested by the City of Gardiner.

Project Boundary

KEI Power's proposal would remove approximately nine percent of the existing project land and water from the project boundary. The 0.7-acre of land and water is located entirely within the 345-foot bypassed reach, and is not used for project operation and maintenance, or the protection of environmental resources. Removal of this land would create a new project boundary that would cover the area needed for project operation and maintenance, and would eliminate land and water that are not needed for project purposes.

3.3.5 Cultural Resources

3.3.5.1 Affected Environment

Area of Potential Effect

Under section 106 of the NHPA of 1966, as amended, the Commission must take into account whether any historic properties within the proposed project's APE could be affected by the issuance of a license for the project. The Advisory Council on Historic Preservation (ACHP) 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 (36 C.F.R. 800.16(d)).

The APE for the project includes all land enclosed by the project boundary.

Cultural History Overview

Pre-contact Period

The earliest inhabitants of the region and throughout North America were the Paleoindian people, who rapidly colonized the continent in pursuit of large game (Martin, 1973). The hallmark of the Paleoindian tradition is the fluted spear point, which was presumably used to hunt large game. In Maine, the Paleoindian period dates from approximately 9,500 to 7,500 B.C., when much of the landscape was still tundra and/or woodlands. Paleoindian people living in the region are characterized as highly mobile hunters and gatherers reliant mainly on the caribou that were abundant at that time. They crafted their tools out of fine-grained, colorful rocks obtained from a limited number of sources in the region, and they camped in locations typically removed from present day water bodies (Spiess, *et al.*, 1998).

The Archaic period (ca. 7,500 - 1,000 B.C.) represents the longest cultural period in the region. This timeframe is indicative of persistent cultural adaptations over several millennia. This period is subdivided into the Early, Middle, and Late Archaic period. Although Early and Middle Archaic people probably continued a nomadic hunter and gatherer lifestyle, their subsistence and settlement patterns were different from those of the Paleoindian people. This distinction is suggested by the location of most Early and Middle Archaic sites along present-day water bodies and the presence of food remains of aquatic species, particularly beaver, muskrat, and fish (Robinson, 1992).

The close of the Late Archaic period is characterized by a transition to the Susquehanna Tradition, which is widespread in Maine and New England (Sanger, 1979; Bourque, 1995). The people of the Susquehanna Tradition appear to have been more focused on a terrestrial economy than a marine economy.

The introduction of pottery manufacturing and use in Maine defines the onset of what Maine archaeologists call the Ceramic period, but is known more widely as the Woodland period in other parts of the Northeast. Ceramics first appear in the archaeological record of Maine around 3,000 years ago, and they persist until contact with Europeans when clay pots were replaced in favor of iron and copper kettles that were traded for beaver pelts and other animal furs. Ceramic period sites are abundant in Maine, along the coast and in the Maine interior (Sanger, 1979). Sites in the interior are most common along waterways, especially rivers, ponds, and lakes. The presence and nature of artifact forms, and certain types of stone recovered from Ceramic period sites, indicate trade and communication with peoples far to the north, south, and west. By the end of the period, historical and archaeological evidence suggests horticulture was practiced in southern Maine. The Ceramic period ends with European contact around 450 years ago. At this time, most of the artifacts attributable to Pre-contact inhabitants of Maine disappear from the archaeological record.

Post-contact Period

At the time of European contact, a number of tribal groups were living in the region of Maine and the maritime Canadian provinces. Collectively, these groups identified as the Wabanaki, meaning "people of the land of the dawn." The term generally applies to the Passamaquoddy, Penobscot, Maliseet, and Abenaki, although there is no consensus on use of the term Wabanaki and the peoples who identify as Wabanaki (American Friends Service Committee, 1989).

Throughout the 16th Century, European fishing vessels frequently made contact with the Wabanaki, but it was not until the first years of the 17th Century that Europeans permanently began to settle in Wabanaki territory and provide written records of these societies. In 1600, the population of Wabanaki in Maine and maritime Canada is estimated to have been 32,000 people. Villages ranged in size from a half-dozen houses to over 100 and they were built at the coast, along the estuaries of rivers, and near lakes, rivers, and streams. As European settlement increased, the native populations experienced sudden and catastrophic population change due to disease epidemics. In the span of a few years, the native population in the region was reduced by as much as 75 percent (American Friends Service Committee, 1989).

The Kennebec Band of the Abenaki Nation was dominant in the Kennebec River Valley at the time of European contact (Allen, 1849). Their principal village was Norridgewock, which was located about 50 river miles upstream of the site of the American Tissue Project in Gardiner. The Kennebec River corridor was an important travel and trade corridor for the Abenaki Nation as it formed part of the route between the Gulf of Maine and the St. Lawrence River. The confluence of the Kennebec River and Cobbosseecontee Stream, known to the Kennebec Band as "Cabbassa-contee," was an important fishing area. "Cabbassa" means "sturgeon" in the language of the Kennebec Band (Hanson, 1852).

During the colonial era, the Kennebec Valley was only sparsely settled by Europeans, with the French moving into the valley from the north and the British from the south. In 1669, pressure from disease and conflict from English settlements closer to the coast forced the Abenaki Nation to begin migrating north to Quebec to be closer to their French allies. The Abenaki Nation raided many English settlements in Maine during King Philip's War (1675-1678), and many settlers fled as a result. Conflicts between natives and settlers continued by means of local skirmishes that were often part of larger colonial wars between the English and French, including King William's War (1688-1697) and Queen Anne's War (1702-1713) (Maine Historical Society, 2010).

Norridgewock had been the location of a French Jesuit mission since 1646 (Brown, 1879). The leader of this mission, Father Sebastien Rale, incited the Kennebec Band against the encroaching English. This resulted in a series of raids against English

settlements along the Kennebec River, including the burning of Brunswick. The English responded by attacking Norridgewock in 1724 and killing Father Rale and dozens of people from the Kennebec Band. The surviving people of the Kennebec Band fled the area for the St. Lawrence River Valley, and French influence over the Kennebec Valley waned (Kidd, 2002). After the French and Indian War, England claimed the land in Maine and the Maritime Provinces. Treaties with both the British government and the state of Massachusetts further reduced the Native American's territories within the region (American Friends Service Committee, 1989).

The Penobscot Nation is the only Federally-recognized Abenaki tribe remaining in Maine, and they have indicated that they have an interest in cultural resources in the Kennebec Valley.

European settlement of the lower Kennebec Valley was light until the mid-18th Century. In 1754, Dr. Sylvester Gardiner of Boston acquired the rights to develop the confluence of the Kennebec River and Cobbosseecontee Stream. Gardiner recognized the energy potential in the 130-foot drop of the last mile of Cobbosseecontee Stream. The first dam was built at the head of tide in 1761, and this led to the establishment of several mills that took advantage of the water power, including two saw mills, a felting mill, and a grist mill. The Town of Gardiner thrived as a manufacturing and transportation hub as industry along Cobbosseecontee Stream grew and the Kennebec River provided easy transportation. The railroad arrived in 1851, and paper mills were built starting in the 1860s.

At one time, there were at least ten dams along the 1.5 miles of Cobbosseecontee Stream between Pleasant Pond and the Kennebec River. Only three of these dams remain: the New Mills Dam, the American Tissue Dam, and the Gardiner Paperboard Dam. The American Tissue Dam is the only dam with electricity generation. In 1969, the American Tissue Corporation purchased the dam and the nearby S.D. Warren papermill that was powered by the dam. The papermill was originally constructed in 1879, and burned down shortly after being purchased by the American Tissue Corporation, in 1970.

Cultural Resource Investigations

KEI Power conducted a Phase I History/Architecture survey to identify and evaluate the National Register eligibility of above-ground resources within the project APE. The area around the American Tissue Dam has been extensively disturbed in the past by industrial uses, and survey determined that none of the project structures within the APE are eligible for listing in the National Register. In a January 22, 2016 email, the SHPO concurred with the licensee's finding that the project structures are not eligible for listing on the National Register.

In a February 21, 2017 letter to KEI Power, the SHPO requested that a reconnaissance-level archeological survey be performed concurrent with the next scheduled impoundment drawdown, to identify historic archaeological resources within the APE. The SHPO stated that periodic drawdowns of the impoundment for maintenance and repair could result in the exposure of inundated historic archaeological resources associated with the Gardiner Mill, which is reportedly the site of the first paper mill in the Town of Gardiner. In an April 13, 2017 letter to the SHPO, the licensee provided photographs from a drawdown of the impoundment in 2004, and stated that the photographs give a proper presentation of the area of interest to the SHPO. The licensee stated that drawdowns of the project impoundment occur infrequently (several years apart) and are of short duration (a few days or less). In the April 13, 2017 letter, the licensee stated that it will coordinate with the SHPO on any drawdown for maintenance or inspection purposes that is sufficiently low to dewater the historic Gardiner Mill. Due to this outstanding information, KEI Power has not reached a conclusion with the Maine SHPO on the eligibility of the Gardiner Mill for listing in the National Register.

3.3.5.2 Environmental Effects

KEI Power and resource agencies have proposed modifications to project facilities and operation to improve fish passage. These fish passage plans are not finalized, but any construction-related disturbance for the fish passage improvements would be made to the top of the dam and the west side of the dam, which are both already highly disturbed. These activities and other maintenance activities associated with routine operation of the project have the potential to affect undiscovered resources eligible for listing on the National Register. In addition, maintenance of the impoundment and project structures during drawdown events has the potential to affect the Gardiner Mill at the bottom of the impoundment.

Our Analysis

Project-related effects on cultural resources within the APE could result from modifications to project facilities or project operations; project-related ground-disturbing activities; construction of project recreation facilities and use of such facilities by visitors in the future; project-induced shoreline erosion;[72] and vandalism. Relicensing the project is not likely to affect historic properties that are eligible for or listed on the National Register because the project would only involve new construction for fish passage

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

facilities, which would not occur near or affect any known historic sites (listed, eligible, or otherwise).

The only potential historic property within the APE are the remains of the Gardiner Mill that are beneath the project impoundment. These remains are exposed for only a few days during impoundment dewatering events that occur several years apart. Because the last documented drawdown was in 2004, KEI Power has not performed a reconnaissance survey of the remains, as requested by the SHPO. Therefore, little is known about the integrity of the Gardiner Mill remains. Access to the Gardiner Mill remains is restricted because the remains are underwater. Absent a drawdown, there is no imminent threat to the property. Conducting a reconnaissance survey and determining the National Register eligibility of the mill remains during the next dewatering of the impoundment would inform the need for protective measures should any future repairs at the project require the extended dewatering of the impoundment. Should the Gardiner Mill be eligible for listing on the National Register, consulting with the SHPO on protective measures and coordinating with the SHPO prior to any scheduled drawdowns that could expose any part of Gardiner Mill would help to protect the historic property.

During the term of any subsequent license, the applicant would occasionally need to conduct maintenance activities in the project area or on project facilities. These activities could include general landscaping and ground-disturbing yard maintenance within the project boundary. These activities would not require prior Commission approval; however, they could affect unidentified historic resources in the project area.

Consulting with the Maine SHPO on standard protocol to be implemented prior to conducting these activities would ensure that unidentified historic resources are not adversely affected.

During the license term, it is possible that unknown archaeological or historic resources may be discovered during project operation or other project-related activities that require ground disturbance. To ensure the proper treatment of any potential archaeological or cultural resources, KEI Power could notify the Commission and the Maine SHPO if previously unidentified archaeological or cultural artifacts are encountered. In the event of any such discovery, KEI Power could discontinue all exploratory or construction-related activities until the proper treatment of any potential cultural resources is established.

4.0 DEVELOPMENTAL ANALYSIS

In this section, we look at the project's use of the Cobbosseecontee Stream for hydropower purposes to see what effects various environmental measures would have on the project's costs and power generation. Under the Commission's approach to evaluating the economics of hydropower projects, as articulated in *Mead Corp.*,[73] 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 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.*, operation, maintenance, and environmental measures); and (4) the difference between the cost of alternative power and total project cost for the project. If the difference between the cost of alternative power and total project cost is positive, the project helps to produce power for less than the cost of alternative power. If the difference between the cost of alternative power and total project cost is negative, then the project helps to produce 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 8 summarizes the assumptions and economic information we use in our analysis for the project. This information was provided by KEI Power in its license application or estimated by staff. We find that the values provided by KEI Power are reasonable for the purposes of our analysis. Cost items common to all alternatives include: taxes and insurance costs, net investment, estimated future capital investment required to maintain and extend the life of facilities, relicensing costs, normal operation and maintenance cost, and Commission fees.

[73] *See Mead Corporation, 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 8. Parameters for economic analysis of the American Tissue Project.

Parameters	Values (2017 dollars)	Sources
Period of analysis	30 years	Staff
Term of financing	20 years	Staff
Escalation rate	0 percent	Staff
Alternative energy value	$37.75/MWh	KEI Power
Federal tax rate	35 percent	Staff
Local tax rate	8.93 percent	Staff
Interest rate	7 percent	Staff
Discount rate	7 percent[a]	Staff
Net remaining investment	$944,584[b]	KEI Power
Annual operation and maintenance cost	$207,700[c]	KEI Power

[a] Assumed by staff to be the same as the interest rate.
[b] Based on KEI Power's remaining undepreciated net investment and cost to develop the license application for the project.
[c] KEI Power's value for the project's operation and maintenance cost includes insurance, administrative cost, and general expenses.

4.2 COMPARISON OF ALTERNATIVES

Table 9 summarizes the installed capacity, annual generation, annual cost of alternative power, annual project cost, and difference between the cost of alternative power and project cost for each of the alternatives considered in this EA: no-action, KEI Power's proposal, the staff alternative, and staff alternative with mandatory conditions.

Table 9. Summary of the annual cost of alternative power and annual project cost for the four alternatives for the American Tissue Project.

	No Action	KEI Power's Proposal	Staff Alternative	Staff Alternative with Mandatory Conditions
Installed capacity (megawatts)	1.0	1.0	1.0	1.0
Annual generation (MWh)	5,430	5,220	5,202	5,163
Annual cost of alternative power ($ and $/MWh)	$204,983 37.75	$197,055 37.75	$196,376 37.75	$194,903 37.75
Annual project cost ($ and $/MWh)	$295,718 54.46	$ 324,527[a] 62.17	$328,818[a] 63.21	$799,852[a,b] 154.92
Difference between the cost of alternative power and project cost ($ and $/MWh)	($90,735)[c] (16.71)	($127,472)[c] (24.42)	($132,443)[c] (25.46)	($604,949)[c] (117.17)

[a] The loss of generation is reflected as a higher project cost, rather than a lower power value.

[b] The annual project cost under the staff alternative with mandatory conditions does not include the costs of conducting effectiveness studies of upstream and downstream fish passage facilities for alosines and eels because those measures lack the specificity needed to estimate their cost.

[c] Numbers in parenthesis are negative.

4.2.1 No-Action Alternative

Under the no-action alternative, the project would continue to operate as it does now. The project would have an installed capacity of 1.0 MW, and generate an average of 5,430 MWh of electricity annually. The average annual cost of alternative power would be $204,983, or about $37.75/MWh. The average annual project cost would be

$295,718, or about $54.46/MWh. Overall, the project would produce power at a cost that is $90,735, or $16.71/MWh, more than the cost of alternative power.

4.2.2 KEI Power's Proposal

Table 9 lists all environmental measures, and the estimated cost of each, considered for the American Tissue Project. Under KEI Power's proposal, the American Tissue Project would have an installed capacity of 1.0 MW, and generate an average of 5,220 MWh of electricity annually. The average annual cost of alternative power would be $197,055 or about $37.75/MWh. The average annual project cost would be $324,527, or about $62.17/MWh. Overall, the project would produce power at a cost that is $127,472, or $24.42/MWh, more than the cost of alternative power.

4.2.3 Staff Alternative

The staff alternative is based on KEI Power's proposal with staff modifications and additional measures. The staff alternative would have an installed capacity of 1.0 MW and an average annual generation of 5,202 MWh. The cost of alternative power would be $196,376 or about $37.75/MWh. The average annual project cost would be $328,818, or about $63.21/MWh. Overall, the project would produce power at a cost that is $132,443, or $25.46/MWh, more than the cost of alternative power.

4.2.4 Staff Alternative with Mandatory Conditions

Under the staff alternative with mandatory conditions the American Tissue Project would have an installed capacity of 1.0 MW and an average annual generation of 5,163 MWh. The cost of alternative power would be $194,903 or about $37.75/MWh. The average annual project cost would be $799,852, or about $154.92/MWh. Overall, the project would produce power at a cost that is $604,949, or $117.17/MWh, more than the cost of alternative power.

4.3 COST OF ENVIRONMENTAL MEASURES

Table 10. Cost of environmental mitigation and enhancement measures considered in assessing the effects of operating the American Tissue Project.

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
General				
Continue to operate in a run-of-river mode with minimal impoundment fluctuation.	KEI Power, Maine DMR,[c] Interior,[c] Commerce,[c] Staff	$0	$0	$0
Develop an operation compliance monitoring plan.	Staff	$5,000	$0	$470
Aquatic Resources				
Continue to provide a continuous year-round minimum flow of 52 cfs or inflow, whichever is less, downstream of the powerhouse to protect aquatic resources.	KEI Power, Maine DMR,[c] Commerce,[c] Interior[c]	$0	$0	$0

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Provide a continuous year-round minimum flow of 10 cfs or inflow, whichever is less, to the bypassed reach to protect aquatic habitat.[d]	KEI Power, Maine DMR,[c] Interior,[c] Staff	$0	$2,980 (79 MWh in lost generation)[d,e]	$2,980
Continue to operate and maintain the existing downstream fish passage facility for alosines from June 1 to November 30 until a new downstream fish passage facility is constructed and operational.	Maine DMR,[c] Interior,[f] Commerce,[f] Staff	$0	$0[g]	$0
Install a new downstream fish passage facility by: (1) increasing the conveyance flow from the impoundment; and (2) improving the structural integrity and reliability of the plunge pool to provide safe and reliable passage for juvenile and adult alewives downstream of the project.	KEI Power, Maine DMR,[c] Interior,[f] Commerce,[f] Staff	$200,000	$2,250	$20,300
Construct and operate the new downstream fish passage facility within two years of issuance of any subsequent license.	Maine DMR[c]	$0	$0	$0
Construct and operate the new downstream fish passage facility before the second migratory season after issuance of any subsequent license.	Interior,[f] Commerce,[f] Staff	$0	$0	$0

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Release a continuous minimum flow of 29 cfs from the new downstream fish passage facility from June 1 to November 15.	KEI Power	$0	$4,950 (131 MWh in lost generation)[e,h]	$4,950
Release a continuous minimum flow of 29 cfs from the new downstream fish passage facility from June 1 to November 30.	Commerce,[c] Interior,[c, f] Staff	$0	$5,630 (149 MWh in lost generation)	$5,630
Release a continuous minimum flow of 25 cfs from the new downstream fish passage facility from June 1 to November 30.	Maine DMR,[c] Commerce[f]	$0	$4,530 (120 MWh in lost generation)[i]	4,530
Develop an evaluation plan and conduct effectiveness testing and quantitative monitoring of the new downstream fish passage facility for alosines.	Maine DMR,[c] Interior,[f] Commerce[f]	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost
Continue monitoring the downstream reach for injured or dead alewives from June 1 to November 15, and reduce or cease generation if injured or dead alewives are observed.	KEI Power	$0	$0	$0
Monitor the downstream reach for injured or dead alewives from June 1 to November 30, and reduce or cease generation if injured or dead alewives are observed.	Staff	$0	$1,800	$1,170

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Install a partial 7/8-inch trashrack overlay with blinding plates from September 1 to November 15 of each year to protect downstream migrating alewives and eels from being entrained.	KEI Power	$0	$0	$0
Install a full-length 3/4-inch trashrack overlay from June 1 to November 30 to protect downstream migrating alosines from entrainment.	Interior[f]	$600,000	$0	$56,500
Install a 3/4-inch trashrack overlay in combination with blinding plates, over the full length of the trashrack, from June 1 to November 30 to protect downstream migrating alosines from entrainment.	Maine DMR[c]	$600,000	$0	$56,500
Install a 7/8-inch trashrack overlay in combination with blinding plates, over the full length of the trashrack, from June 1 to November 30, to protect downstream migrating alosines from entrainment.	Commerce,[f] Staff	$0	$0	$0

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Design and install an upstream fish passage facility for alosines in a manner that is consistent with FWS's 2017 Design Criteria Manual, within two years after upstream passage for alosines is operational at the next downstream dam (Gardiner Paperboard Dam), and develop a plan for operating and maintaining the upstream fish passage facility from May 1 to July 31 each year.	Maine DMR,[c] Interior[f]	$4,000,000	$60,000[j]	$415,670
Develop an evaluation plan and conduct effectiveness testing and quantitative monitoring of the new upstream fish passage facility for alosines.	Maine DMR,[c] Interior,[f] Commerce[f]	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Continue providing downstream eel passage from September 1 to November 15 of each year by: (1) installing blinding plates at the base of the trashrack and a trashrack overlay with 7/8-inch clear spacing to protect eels from being entrained; (2) releasing 40 cfs from the discharge pipe at night to provide a passage route for eels; (3) reducing generation at night if any dead or injured adult eel are observed during passage season; and (4) ceasing generation at night for the remainder of the eel passage season if any entrained eels are observed.	KEI Power	$0	$0	$0
Operate the existing downstream fish passage facility for eels as proposed by KEI Power by releasing 40 cfs from the discharge pipe at night, except provide passage from August 15 to November 15.	Interior,[f] Commerce,[f] Maine DMR[c]	$0	$1,470 (39 MWh in lost generation)[k]	$1,470
Provide downstream eel passage from August 15 to November 15 of each year through: (1) the existing downstream fish passage facility for alosines until the new downstream fish passage facility for alosines is constructed and operational; and (2) the new downstream fish passage facility for alosines once the facility is constructed and operational.	Staff	$0[l]	$0[l]	$0[l]

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Protect American eel that are migrating downstream through the project from August 15 to November 15 of each year by: (1) installing blinding plates at the base of the trashrack and a trashrack overlay with 7/8-inch clear spacing to protect eels from being entrained; (2) reducing generation at night if any dead or injured adult eel are observed during passage season; and (3) ceasing generation at night for the remainder of the eel passage season if any entrained eels are observed.	Staff	$0	$1,920	$1,250
Release 40 cfs from September 1 to November 15 through the discharge pipe at the base of the dam and install a 1-inch punchplate (*i.e.*, trashrack overlay) to facilitate downstream eel passage.	Interior[c]	$600,000	$0	$56,500
Install a 3/4-inch trashrack overlay with blinding plates at the base of the intake from June 1 to November 30 each year to physically exclude eels from the turbine intake, within two years after license issuance.	Maine DMR[c]	$600,000	$0	$56,500

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Design and construct a new downstream fish passage facility for eels if the existing downstream eel passage facility does not pass eels in a safe, timely, and effective manner.	Interior[f]	$0[m]	$0[m]	$0[m]
Test the new downstream fish passage facility to assess whether it provides safe, timely, and effective passage for juvenile and adult alewife, blueback herring, and American eel.	Maine DMR[c]	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost
Test an experimental airlift-assisted deep bypass for passing downstream migrating American eels.	Maine DMR[c]	$111,000[n]	$0	$10,450
Terminate the 40-cfs flow release from the discharge pipe if the downstream fish passage facility or the airlift-assisted deep bypass prove to be effective at passing downstream migrating eels.	Maine DMR[c]	$0	$0	$0
Install and maintain an upstream eel passage facility on the west end of the spillway to facilitate upstream passage of American eel over the dam.	KEI Power, Maine DMR,[c] Interior,[f] Commerce,[f] Staff	$75,000	$2,250	$8,530

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Operate and maintain the new upstream eel passage facility from June 1 to September 15 of each year.	Maine DMR,[c] Interior,[f] Commerce,[f] Staff	$0	$0[o]	$0
Operate the new upstream eel passage facility by two years after issuance of any subsequent license.	Maine DMR[c]	$0	$0	$0
Operate the new upstream eel passage facility before the second migratory season after issuance of any subsequent license.	Interior,[f] Commerce,[f] Staff	$0	$0	$0
Design eel and alosine fishways using the following provisions: (1) submit design plans to resource agencies for review and approval; and (2) submit the final design plan to the Commission for approval following resource agency approval.	Maine DMR,[c] Interior,[f] Commerce,[f] Staff	$0[p]	$0[p]	$0[p]
Design eel and alosine fishways using FWS's 2017 Design Criteria Manual.	Maine DMR,[c] Interior,[f] Staff	$0[p]	$0[p]	$0[p]

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
File final as-built drawings with resource agencies after construction is complete.	Maine DMR,[c] Interior,[f] Commerce[f]	$0[p]	$0[p]	$0[p]
Operate each newly constructed or modified fishway for a one-season "shakedown" period to ensure that it is generally operating as designed and to make minor adjustments to facilities and operations, as needed.	Maine DMR,[c] Staff	$0	$0	$0
At the end of each shakedown period, have a licensed engineer certify that the fishway is constructed and operating as designed in all material aspects.	Maine DMR[c]	$0	$0	$0
Develop an evaluation plan and conduct effectiveness testing and quantitative monitoring of the new upstream fish passage facilities for American eel.	Maine DMR,[c] Interior,[f] Commerce[f]	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost
Modify fishway operating schedules during the term of the license based on new information.	Interior,[f] Maine DMR[c]	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost	Unknown – recommendation lacks specificity needed to estimate a cost

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Develop a fish passage operation and maintenance plan that includes measures for operating and maintaining upstream and downstream fish passage facilities for alosines and eels.	Maine DMR,[c] Interior,[f] Commerce,[f] Staff	$5,000	$0	$470
Send copies of fishway operating procedures to resource agencies.	Maine DMR[c]	$0	$0	$0
Provide information on fish passage operation and project generating operations that may affect fish passage to FWS upon written request from resource agencies.	Interior[f]	$0	$0	$0
Meet annually with the FWS and the other resource agencies in the late fall to report on fish passage maintenance, operation, and monitoring, and to review the fishway operation and maintenance plan.	Interior[f]	$0	$0	$0
Complete any maintenance and changes to the fish passage facilities 30 days prior to the start of the next migratory season.	Interior,[f] Staff	$0	$0	$0
If fishways do not meet performance standards, conduct biennial effectiveness studies until fishways meet performance standards.	Commerce,[f] Maine DMR[c]	$0[q]	$0[q]	$0[q]

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
Provide FWS personnel and FWS-designated representatives access to the project site and to pertinent project records for the purpose of inspecting the fish passage facilities and determining compliance with the fishway prescription.	Interior,[f] Staff	$0	$0	$0
Recreation Resources				
Develop a recreation plan.	City of Gardiner	$5,000	$0	$470
Land Use				
Remove 0.7 acre of land and water from the project boundary that do not serve a project purpose.	KEI Power, Staff	$0	$0	$0
Cultural Resources				
Consult with the Maine SHPO to establish protocols to be implemented prior to conducting maintenance activities in the vicinity of the project that could affect cultural resources.	Staff	$0	$0	$0

Enhancement/Mitigation Measures	Entity	Capital cost	Annual cost[a]	Levelized annual cost[b]
If previously unidentified cultural resources are encountered during the course of constructing, maintaining, or developing project facilities, consult with the Maine SHPO to ensure the proper treatment of these resources and discontinue all exploratory or construction-related activities until the proper treatment of the resources is established.	Staff	$0	$0	$0
Perform an archaeological survey of the Gardiner Mill remains in consultation with the Maine SHPO during the next scheduled drawdown of the project impoundment and determine the National Register eligibility of the Gardiner Mill.[r]	Maine SHPO, Staff	$10,000	$0	$940

[a] Annual costs typically include operational and maintenance costs and any other costs that occur on a yearly basis.

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

[c] Section 10(j) recommendation.

[d] Includes the cost of KEI Power's estimated average annual energy loss for providing a continuous minimum flow of 10 cfs or inflow, whichever is less, to the bypassed reach from January 1 to May 31 and from November 16 to December 31 to protect aquatic habitat in the bypassed reach. Staff assumes that the 10 cfs would not otherwise be released from the dam. Maine DMR recommends a 10-cfs minimum flow from January 1 to May 30 and December 1 to December 31, which only differs from Interior's and Commerce's recommendation by a single day. Staff assumed the 1-day difference would not significantly change the loss generation and associated cost.

[e] KEI Power's estimated average annual energy loss was adjusted to reflect only the incremental difference between the average annual energy loss between existing operation and proposed operation.

[f] Section 18 preliminary fishway prescription.

[g] Staff assumed that the value of the lost generation associated with this measure would be minimal on the basis that the measure is only required on a temporary basis until the new downstream fish passage facility is installed and operational. Any cost associated with this measure would also be included in the $5,630 annual cost of operating and maintaining the new downstream fish passage facility as shown above.

[h] Includes KEI Power's estimated operation and maintenance cost of the modified downstream fish passage facility plus cost of the average annual energy loss for providing a minimum flow of 29 cfs or inflow, whichever is less, into the bypassed reach from June 1 to November 15 each year to provide safe passage for alewives downstream of the project.

[i] Staff estimated this cost based on the cost of the lost generation associated with operating the downstream fishway from June 1 to November 30 with a 25-cfs attraction flow.

[j] Staff assumed that the value of the lost generation associated with operating an upstream fishway from May 1 to July 31 would be minimal on the basis that flows associated with the downstream passage facilities could be redirected to operate the new upstream fish passage facility for alosines.

[k] Staff estimated this cost based on the value of the lost generation associated with extending the existing operating window for downstream eel passage (*i.e.*, September 1 to November 15) to the new operating window (August 15 to November 15) under the existing flow regime.

[l] Staff assumed that these costs would be included in the staff-recommended measures described above to continue providing passage for alosines and by installing the new fish passage facility for alosines.

[m] Staff assumed no cost for this measure at this time because it is required only if the existing downstream eel passage facility does not pass eels in a safe, timely, and effective manner.

[n] Staff estimated this cost based on an estimated installation cost of $75,000 plus an estimated testing cost of $36,000.

[o] Staff assumed that the value of the lost generation associated with operating an upstream fishway for eels would be minimal on the basis that any flows associated with upstream passage for American eel would be minimal and could be redirected from the downstream passage facilities.

[p] Staff assumed that the cost of this measure is included in the total annual cost ($444,500) of designing, modifying, or constructing the fishways for eel and alosine shown above.

[q] Staff assumed no cost for this measure at this time because it is required only if fishways do not meet performance standards.

[r] If the Gardiner Mill remains are eligible for listing on the National Register, then KEI Power would develop specific measures to ensure the protection of the historic property in consultation with the Maine SHPO.

5.0 CONCLUSION AND RECOMMENDATIONS

5.1 COMPREHENSIVE DEVELOPMENT AND RECOMMENDED ALTERNATIVE

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

Based on our independent review of agency and public comments filed on the project and our review of the environmental and economic effects of the proposed project and project alternatives, we selected the staff alternative as the preferred alternative. We recommend this alternative because: (1) issuing a subsequent license for the project would allow KEI Power to continue operating its project as a dependable source of electrical energy; (2) the 1.0 MW of electric capacity comes from a renewable resource that does not contribute to atmospheric pollution; (3) the public benefits of the staff alternative would exceed those of the no-action alternative; and (4) the proposed and recommended measures would protect and enhance fish and wildlife resources.

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

5.1.1 Measures Proposed by KEI Power

Based on our environmental analysis of KEI Power's proposal in section 3.0, *Environmental Analysis,* and the costs presented in section 4.0, *Developmental Analysis,* we conclude that the following environmental measures proposed by KEI Power would protect and enhance environmental resources and would be worth the cost. Therefore, we recommend including these measures in any license issued for the project.

To protect or enhance fisheries resources and aquatic habitat at the project, KEI Power proposes to:

- Continue to operate the project in a run-of-river mode to protect aquatic resources;

- Provide a continuous minimum flow of 10 cfs, or inflow if less, to the bypassed reach from November 16 to May 31 to protect fish habitat, and a continuous minimum flow of 29 cfs, or inflow if less, to the bypassed reach from June 1 through November 15 to protect fish habitat and facilitate downstream fish passage;[74]

- Install a new downstream fish passage facility that replaces the existing downstream fish passage facility by constructing a surface weir that increases the conveyance flow for downstream passage of alewives from 10 cfs to 29 cfs, and improving the structural integrity and reliability of the plunge pool to provide safe and reliable passage for juvenile and adult alewives downstream of the project, consistent with Interior's section 18 preliminary fishway prescriptions;

- Install an upstream eel passage facility on the west end of the spillway to facilitate upstream passage of American eel over the dam, consistent with Interior's and Commerce's section 18 preliminary fishway prescriptions; and

- Remove approximately 0.7 acre of land and water from the existing project boundary downstream of the dam, including a significant section of the bypassed reach that do not serve a project purpose.

5.1.2 Additional Measures Recommended by Staff

In addition to KEI Power's proposed measures noted above, we recommend including the following additional measures in any license that may be issued for the American Tissue Project.

- Develop an operation compliance monitoring plan to document compliance with run-of-river operation and minimum flow releases for the protection of aquatic resources in the impoundment and downstream of the dam;

- Operate and maintain the proposed new downstream fish passage facility, including a new surface weir on top of the dam and a plunge pool at the base of

[74] The 10-cfs flow release would contribute to flows for downstream fish passage from June 1 to November 15 of each year.

the dam, from June 1 to November 30 of each year, consistent with Interior's and Commerce's section 18 preliminary fishway prescription, instead of June 1 to November 15 of each year, as proposed by KEI Power;

- Construct and operate the proposed new downstream fish passage facility before the second migratory season after issuance of any subsequent license, consistent with Interior's and Commerce's section 18 preliminary fishway prescription;

- Continue operating and maintaining the existing downstream fish passage facility for alosines from June 1 to November 30 of each year until a new downstream fish passage facility is operational by: (1) conveying a continuous minimum flow of 10 cfs or inflow, whichever is less, through the existing 1-foot by 2-foot notch in the flashboards; and (2) operating and maintaining the existing plunge pool at the base of the dam, consistent with Interior's and Commerce's section 18 preliminary fishway prescriptions;

- Continue monitoring the downstream reach for injured or dead alewives from June 1 to November 30 instead of June 1 to November 15, as proposed by KEI Power, and reduce or cease generation if injured or dead alewives are observed, to protect the fishery;

- Provide downstream eel passage from August 15 to November 15 of each year through: (1) the existing downstream fish passage facility for alosines until the new downstream fish passage facility for alosines is constructed and operational; and (2) the new downstream fish passage facility for alosines once the facility is constructed and operational;

- Continue installing blinding plates at the base of the trashrack and a partial trashrack overlay with 7/8-inch clear spacing over the upper trashrack intake from June 1 to November 30 of each year to protect alewives and eels from being entrained, consistent with Commerce's section 18 preliminary fishway prescription, instead of September 1 to November 15 of each year, as proposed by KEI Power;

- Continue to protect downstream migrating eels from August 15 to November 15 of each year (instead of September 1 to November 15 as proposed by KEI Power), by: (1) reducing generation at night if any dead or injured adult eel are observed during passage season; and (2) ceasing generation at night for the remainder of the eel passage season if any entrained eels are observed;

- Operate and maintain the proposed new upstream eel passage facility on the west end of the spillway from June 1 to September 15 of each year to facilitate upstream passage of American eel, consistent with Interior's and Commerce's section 18 preliminary fishway prescriptions;

- Construct and operate the proposed new upstream eel passage facility before the second migratory season after issuance of any subsequent license, consistent with Interior's and Commerce's section 18 preliminary fishway prescription;

- Design eel and alosine fishways using the following provisions: (1) submit design plans to resource agencies for review and approval; and (2) submit the final design plan to the Commission for approval following resource agency approval, consistent with Interior's and Commerce's section 18 preliminary fishway prescriptions;

- Design eel and alosine fishways using FWS's 2017 Design Criteria Manual, consistent with Interior's section 18 preliminary fishway prescription;

- Develop a fish passage operation and maintenance plan to ensure proper operation and maintenance of all existing and newly-constructed fishways, and to ensure that project operation is adjusted if dead or injured alewives or eels are observed downstream of the project;

- Operate each newly-constructed or modified fishway for a one-season "shakedown" period following construction or modification to ensure that the fishway is generally operating as designed, and if not, make minor adjustments to the facility and operation;

- Complete any maintenance and changes to fish passage facilities 30 days prior to the start of the next migratory season, consistent with Interior's section 18 prescription, consistent with Interior's section 18 preliminary fishway prescription;

- Provide FWS personnel and FWS-designated representatives access to the project site and to pertinent records in the performance of their official duties and with reasonable advanced notification;

- Perform an archaeological survey of the Gardiner Mill remains in consultation with the Maine SHPO during the next scheduled drawdown of the project impoundment and determine the National Register eligibility of Gardiner Mill;[75]

- Consult with the Maine SHPO to establish protocols to be implemented prior to conducting maintenance activities in the vicinity of the project that could affect cultural resources; and

[75] If the Gardiner Mill remains are eligible for listing on the National Register, then KEI Power would develop specific measures to ensure the protection of the historic property in consultation with the Maine SHPO.

- If previously unidentified cultural resources are encountered during the course of constructing, maintaining, or developing project facilities, consult with the Maine SHPO to ensure the proper treatment of these resources and discontinue all exploratory or construction-related activities until the proper treatment of the resources is established.

In addition to installing and operating a new downstream fish passage facility for alosines; continuing to operate the existing downstream fish passage facility for an interim period until the new facility is constructed; continuing to protect downstream migrating eels by installing a partial 7/8-inch trashrack and curtailing generation in the event of eel injury or mortality; installing and operating a new upstream eel passage facility; and developing a fish passage operation and maintenance plan for fish passage facilities, we are recommending all of the preliminary fishway prescriptions, with the exception of those discussed in section 5.1.3, *Measures Not Recommended*.

Below, we discuss the basis for our additional staff-recommended modifications and measures.

Operation Compliance Monitoring Plan

KEI Power proposes to continue operating the project in run-of-river mode, to release a year-round minimum flow of 10 cfs to the bypassed reach, and to release a conveyance flow of 29 cfs for downstream passage of alosines. KEI Power currently uses sensors to monitor water levels at the project and to control the impoundment and discharges from the powerhouse to the downstream reach, but does not have formalized monitoring protocols or reporting requirements to verify compliance with run-of-river operation and minimum flow releases.

Maine DEP states that KEI Power should consider developing an "operations and monitoring" plan that specifies the methods that will be used at the project to monitor and maintain minimum flows and pond levels within licensed limits. Maine DEP states that such a plan can be expected to provide KEI Power and regulatory agencies with the tools necessary to evaluate project operation through the license term.

KEI Power did not specify how it would document compliance with run-of-river operation, minimum flows, and fishway conveyance flows required under any subsequent license that is issued for the project. Formalizing KEI Power's existing monitoring protocol in an operation compliance monitoring plan would help KEI Power document its compliance with the operational provisions of any subsequent license, provide a mechanism for reporting operational data and deviations, facilitate administration of the license, ensure the protection of resources that are sensitive to impoundment fluctuations, and ensure that the fish passage facility is conveying minimum flows to the bypassed

reach. We recommend that KEI Power develop an operation compliance monitoring plan that includes provisions for monitoring minimum flows, conveyance flows, and impoundment elevation levels to document compliance with the provisions of any subsequent license; and a provision for reporting operational data and deviations to the Commission. We estimate that the annual levelized cost of developing a monitoring plan would be $470, and conclude that the benefits of the plan outweigh the cost.

Downstream Fish Passage for Alosines

KEI Power proposes to continue providing downstream fish passage for alewives on a seasonal basis from June 1 to November 15. KEI Power proposes to construct a new fish passage facility to replace the existing downstream fish passage facility,[76] including by constructing a new surface weir to increase the conveyance flow from 10 cfs to 29 cfs and modifying the plunge pool on the downstream side of the spillway to improve the structural integrity and reliability of the downstream passage system for alewives, in consultation with NMFS, FWS, and Maine DMR.

KEI Power also proposes to continue implementing protection measures on a seasonal basis for fish that are migrating downstream, including: (1) monitoring the downstream reach for injured or dead eels and alewives during the downstream passage season, and reducing or ceasing generation if injured or dead alewives or eels are observed; and (2) installing a 7/8-inch partial trashrack overlay in combination with blinding plates over the remainder of the trashrack from September 1 to November 15 to prevent alewife and eel from entering the turbine intake.

Commerce, Interior, and Maine DMR support KEI Power's proposal, but prescribe/recommend specific design and operational provisions in their respective section 18 preliminary fishway prescriptions and section 10(j) recommendations. All three resource agencies state that KEI Power should provide downstream passage and protection for alosines from June 1 to November 30 (as opposed to June 1 to November 15), and should replace the seasonal 1-foot by 3-foot flashboard opening and existing plunge pool with a minimum 2-foot-deep by 3-foot-wide permanent surface weir that produces a gradually accelerating discharge from the impoundment into an adequately-sized plunge pool at the base of the dam. Commerce would require and Maine DMR recommends a minimum conveyance flow of 25 cfs over the surface weir to attract and

[76] The existing downstream fish passage facility consists of a notch in the flashboards that provides a 10 cfs conveyance flow to a 15-foot-long, 3-foot-wide, 4-foot-high steel and plywood plunge pool located on the downstream side of the spillway.

convey migrants downstream;[77] and Interior would require a flow of approximately 29 cfs to be used. Commerce would also require KEI Power to continue installing a 7/8-inch trashrack overlay with blinding plates at the base of the penstock intake from June 1 to November 30 each year. In contrast, rather than continuing to use a partial 7/8-inch trashrack overlay in combination with blinding plates at the base of the intake, Interior would require a 3/4-inch trashrack overlay the full length of the trashrack, and Maine DMR recommends a 3/4-inch trashrack overlay with blinding plates at the base of the penstock intake.

Installing a new downstream fish passage facility to replace the existing facility would provide safer and more effective downstream passage for alosines. Relative to the existing surface bypass and plunge pool, a new surface weir that is wider and deeper would provide more conveyance flow. A higher conveyance flow would create a stronger hydraulic signal than the existing 10 cfs conveyance flow, which would attract more alosines to the entrance of the surface bypass. Improving the plunge pool would also benefit alosines migrating downstream. The existing plunge pool is only 4 feet deep and is subject to damage from storm events. Increasing the size and depth of the plunge pool would ensure that fish falling into the plunge pool from the surface weir would not be injured or killed by striking the bottom of the plunge pool. Improving the structural integrity of the plunge pool would reduce the chance of the plunge pool being damaged during high flow events and would ensure more consistent passage than what currently exists at the project. Designing the surface weir and plunge pool consistent with FWS's Design Criteria Manual, which provides guidance on design, operation, and maintenance of fishways throughout the northeastern United States, would ensure that the modified downstream fish passage facility provides safe, timely, and effective movement of fish through the project, and would be consistent with Interior's preliminary fishway prescription. Specifically, the Design Criteria Manual recommends a surface-oriented downstream fish passage that is a minimum of 2-foot-deep by 3-foot-wide that produces a gradually accelerating flow that discharges into a plunge pool with a depth of at least 25 percent of the equivalent fall height of the weir or 4 feet, whichever is greater (*i.e.*, equal to a depth of approximately 5.75 feet for the project). The Design Criteria Manual also specifies conveyance flows that are 5 percent of station hydraulic capacity (equal to 18 cfs at the project) or a minimum of 25 cfs. We estimate that the annual levelized cost of constructing the downstream fish passage facility with this design would be $20,300, and conclude that the benefits of the downstream fish passage facility outweigh the cost.

Below, we discuss the benefits and costs of the proposed and recommended downstream fish passage and protection measures, and explain the rationale for our downstream passage and protection recommendations, including the construction and

[77] Commerce's section 10(j) recommendation includes a release of 29 cfs, consistent with KEI Power's proposal.

operation of the new downstream fish passage facilities, the magnitude of flows to be conveyed over the dam, the spacing size for the trashrack overlay, and interim measures for protecting migrating fish before completion of the new downstream fish passage facilities.

Schedule for Downstream Fish Passage Measures

KEI Power proposes to provide downstream passage for juvenile and adult alewives by conveying 29 cfs of flow from the impoundment to the plunge pool and the bypassed reach from June 1 to November 15. KEI Power also proposes to provide protection measures for alewives by reducing or ceasing generation during the downstream passage season in the event that dead or injured alewives are observed downstream of the project; and by installing a 7/8-inch partial trashrack overlay from September 1 to November 15. We recommend that KEI Power provide downstream passage and protection measures for alewives from June 1 to November 30, consistent with Commerce's and Interior's section 18 preliminary fishway prescriptions and Maine DMR's section 10(j) recommendation, instead of June 1 to November 15.

Juvenile and adult alewives are known to migrate downstream through the project impoundment and bypassed reach from June 1 to November 30 (MDMR, 2002). Providing downstream passage from June 1 to November 30, instead of June 1 to November 15 as proposed by KEI Power, would provide a timely downstream passage route for alosines that migrate later in the season and would reduce the risk of injury and mortality associated with less safe means of downstream passage, including passage through the turbines and spill over the dam. In addition, installing the 7/8-inch partial trashrack overlay and blinding plates from June 1 to November 30, instead of September 1 to November 15 as proposed by KEI Power, would reduce the risk of entrainment for adult and juvenile alewives that are migrating downstream from June 1 to August 31 and from November 16 to November 30. We estimate that the annual levelized cost of operating the downstream passage facility for juvenile and adult alewives for 15 extra days would be $680[78] and conclude that the benefits outweigh the cost. We estimate that the annual levelized cost of installing the partial 7/8-inch trashrack overlay and blinding plates from June 1 to November 30, instead of September 1 to November 15 would be $0 and conclude that the benefits outweigh the cost. We also estimate that the annual levelized cost of monitoring the downstream reach for injured or dead alosines from June 1 to November 30 as opposed to June 1 to November 15, and reducing or ceasing

[78] The levelized annual cost of providing an extra 15 days of fish passage was calculated by subtracting the levelized annual cost of providing a continuous flow of 29 cfs from June 1 to November 30 ($5,630) from the levelized annual cost of providing a continuous minimum flow of 29 cfs from June 1 to November 15 ($4,950).

generation if injured or dead alewives are observed between June 1 and November 30, would be $2,140 and conclude that the benefits outweigh the cost.

Conveyance Flows for Downstream Passage of Alosines

KEI Power proposes and Interior's preliminary section 18 prescription would require a flow release of 29 cfs for downstream fish passage for alosines; whereas, Commerce's preliminary prescription and Maine DMR's section 10(j) recommendation recommend a flow release of 25 cfs.[79] The project currently provides a conveyance flow of 10 cfs for the downstream passage of alewife. A flow release of 10 cfs provides sufficient water depth in the bypassed reach to pass alewives. However, the existing 10 cfs conveyance flow does not provide an adequate flow to attract fish to the entrance of the downstream fish passageway when the project is generating.

FWS's Design Criteria Manual provides guidance for proper conveyance flows for downstream fish passage. According to the Design Criteria Manual, a conveyance flow of 25 cfs is adequate to attract fish to the entrance of the fishway (FWS, 2017a). Therefore, a 25-cfs conveyance flow would be sufficient to attract fish to the entrance of the new surface weir. The 25-cfs flow could also increase dissolved oxygen levels and would increase the availability of aquatic habitat in the bypassed reach relative to the existing 10-cfs flow. The 29-cfs flow could slightly increase dissolved levels due to the greater volume of flow but would have similar aquatic habitat benefits relative to a 25-cfs release.

We estimate that increasing the conveyance flow from 10 cfs to 29 cfs from June 1 to November 30 would have an annual levelized cost of $5,630 and increasing the conveyance flow from 10 cfs to 25 cfs from June 1 to November 30 would have an annual levelized cost of $4,530, which we conclude is not a substantial difference. Therefore, we find that the benefits of a 29-cfs flow from June 1 through November 30 are worth the cost and recommend it. [80]

Protective Measures for Downstream Fish Passage

KEI Power proposes to continue to install a partial trashrack overlay with 7/8-inch clear bar spacing over the upper intake and blinding plates at the base of the intake on a

[79] Commerce's section 10(j) recommendation includes a release of 29 cfs for downstream fish passage, consistent with KEI Power's proposal.

[80] A flow release of 29 cfs would also be consistent with Maine DMR's recommendation and Commerce's preliminary prescription for releasing a *minimum* flow of 25 cfs over the surface weir.

seasonal basis at the project to protect eels and alewives from entrainment. KEI also Power proposes to continue monitoring the downstream reach for injured or dead alewives during the downstream passage season, and reducing or ceasing generation if injured or dead alewives are observed. Commerce's section 18 prescription is consistent with KEI Power's proposal. Interior prescribes and Maine DMR recommends installing a 3/4-inch trashrack overlay with blinding plates at the base of the penstock intake, the combination of which would cover the full length of the trashrack. Interior and Maine DMR do not provide any information in support of a 3/4-inch trashrack overlay.

As evidenced by a fish kill in 2001, turbine passage is unsafe for alewives that are migrating downstream through the project. The licensee has monitored the tailrace area of the project on a daily basis from September 1 to November 15 each year since 2003, and has not observed any alewife mortalities since initiating the existing downstream protection measures. Installing blinding plates at the base of the trashrack and a partial trashrack overlay with 7/8-inch clear spacing over the upper intake appears to provide adequate protection for alewives and eels. Adult alewives and eels have burst speeds that are greater than the 1.4 cfs through velocity when the trashrack overlay is installed, which reduces the risk of impingement and entrainment. In addition, the 7/8-inch trashrack overlay spacing is approximately equivalent to the average width of adult alewives and is less than the reported width of adult eels, which also reduces the risk of entrainment.

Reducing the clear space opening of the trashrack overlay opening from the existing 7/8 inch to 3/4 inch would not have a significant incremental beneficial effect on fish and eels because the 7/8-inch overlay already screens out all or nearly all fish and eels. Also, since KEI Power currently installs a partial 7/8-inch clear spacing trashrack overlay, there is no incremental cost of installing the partial 7/8-inch trashrack overlay on a seasonal basis; whereas the estimated annual cost of a trashrack overlay with 3/4-inch clear spacing would be $56,500. Because a 3/4-inch and 7/8-inch trashrack overlay provide similar benefits, but the 7/8-inch overlay provides these benefits at a substantially lower cost, staff recommends that KEI Power continue to install the partial 7/8-inch trashrack from June 1 to November 30 of each year. We conclude that the benefits of installing a 3/4-inch trashrack overlay do not outweigh the costs.

Interim Passage Measures

KEI Power proposes to upgrade the existing downstream fish passage facility to release 29 cfs from June 1 to November 15, and to modify the design of the plunge pool to improve the structural integrity and reliability of the downstream passage system for alewives, in consultation with NMFS, FWS, and Maine DMR. However, these modified facilities would not be constructed and operational until the second migration season after issuance of any subsequent license, according to staff's recommended construction schedule.

To provide safe passage for alosines, we recommend that KEI Power continue to operate and maintain the existing downstream fish passage facility from June 1 to November 30 of each year until the proposed new facility is constructed and operational, including: (1) conveying a continuous minimum flow of 10 cfs or inflow, whichever is less through the existing 1-foot by 2-foot notch in the plunge pool; (2) operating and maintaining the existing plunge pool at the base of the dam; (3) installing a partial trashrack overlay with 7/8-inch clear spacing and blinding plates at the base of the trashrack; and (4) monitoring the downstream reach for injured or dead alewives during the downstream passage season, and reducing or ceasing generation if injured or dead alewives are observed. We estimate that the levelized annual costs of operating the existing downstream fish passage facilities from June 1 to November 30 on an interim basis until the modified facility is constructed and operational would be minimal[81] and conclude that the benefits of this measure outweigh the cost.

Bypassed Reach Flows

KEI Power proposes to provide a continuous flow of 10 cfs or inflow, whichever is less, to the bypassed reach to protect and enhance aquatic habitat in the bypassed reach when flows are not otherwise being released to the bypassed reach for fish passage. Commerce, Interior, and Maine DMR recommend a 10-cfs minimum flow in their respective section 10(j) recommendations.

KEI Power proposes to release a minimum flow of 10 cfs to the bypassed reach from January 1 to May 31 and from November 16 to December 31 to enhance aquatic habitat in the for fish and aquatic resources, and to release 29 cfs of flow for downstream fish passage from June 1 to November 15. As discussed above, we recommend extending the schedule for downstream fish passage operation (and the recommended 29 cfs of flow) by 15 days, from November 15 to November 30. Extending the schedule for releasing a minimum flow of 29 cfs affects the schedule for releasing a minimum flow of only 10 cfs to the bypassed reach. Based on the recommended June 1 to November 30 schedule for releasing 29 cfs for downstream fish passage, we recommend revising the schedule for releasing 10 cfs of flow. Specifically, we recommend releasing a minimum of 10 cfs or inflow, whichever is greater to the bypassed reach from January 1 to May 31 and from *December 1* to December 31 (instead of from *November 16* to December 31), to enhance aquatic habitat in the bypassed reach for fish and aquatic resources. A minimum flow of 10 cfs waters 95.6 percent of the bankfull cross-sectional width in the cascades/falls habitat located immediately below the dam, and 77.9 percent of the

[81] There are incremental costs of operating the downstream fish passage facility for an additional 15 days (*e.g.*, lost generation from the 10 cfs conveyance flow and monitoring the downstream reach); however, these costs would only be incurred for a single migration season under the staff-recommended alternative.

bankfull cross-sectional width in the riffle habitat located downstream of the dam. Relative to existing conditions where leakage might be the only source of water for the bypassed reach during certain times of the year, a minimum flow of 10 cfs would continually water the majority of the bypassed reach and expand habitat for fish and aquatic resources. We estimate that the annual levelized cost of providing this minimum flow of 10 cfs would be $2,980 and conclude that the benefits of providing the flow outweigh the cost.

Downstream Eel Passage

KEI Power proposes to provide protective measures for eels migrating downstream from September 1 to November 15 of each year, including installing a partial trashrack overlay with 7/8-inch clear bar spacing over the upper intake and blinding plates at the base of the intake to protect eels from entrainment, reducing generation at night if any dead or injured adult eel are observed during passage season, and ceasing generation at night for the remainder of the eel passage season if any entrained eels are observed. Interior's and Commerce's preliminary section 18 fishway prescriptions require and Maine DMR recommends under section 10(j) that protection measures be implemented from August 15 to November 15.

In Maine, the downstream migration period for American eel begins as early as mid-August (Haro *et al*., 2003). Implementing protective measures for eels for an additional 17 days (*i.e.*, from August 15 to November 15 instead of from September 1 to November 15) would reduce injury and mortality associated with turbine passage for eels that are migrating downstream at the beginning of the downstream migration period. Based on the known downstream migration season for American eel in New England, staff recommends implementing the protection measures from August 15 to November 15. We estimate that the annual levelized cost of providing 17 extra days of protective measures including monitoring would be $2,220 as indicated above and conclude that the benefits outweigh the cost.

Upstream Passage for American Eel

There are no existing upstream fishways for juvenile eels at the American Tissue Project. KEI Power proposes to design and install an upstream eel passage facility in consultation with NMFS, Interior, and Maine DMR on the west side of the river to facilitate the upstream passage of juvenile eels. Interior and Commerce would require KEI Power to construct the upstream eel passage facility before the second migration season after issuance of any subsequent license, and operate and maintain the upstream eel passage facility from June 1 to September 15 annually thereafter. Maine DMR recommends that the facility be operational within two years of license issuance.

To migrate upstream passed the project, juvenile eels must climb over or around the project dam. During the juvenile American eel study conducted between June 9 and

August 19, 2015, KEI Power observed a total of 1,056 juvenile eels searching for passage over the project dam. The majority of eels (84 percent) were observed on the west side of Cobbosseecontee Stream, within the pools and rock crevices, and along the rock wall just below the dam. A temporary eel fishway installed at the project on the west end of the dam in August 2006 attracted and facilitated passage of over 1,800 eels.

Based on this information, constructing and operating a dedicated upstream eel passage facility at the project the juvenile eel upstream migration season (from June 1 to September 15) would likely increase upstream passage effectiveness and improve access to upstream habitat for eels. Designing the upstream passage facility consistent with FWS's Design Criteria Manual, which provides guidance on design, operation, and maintenance of fishways throughout the northeastern United States, would ensure that the modified downstream fish passage facility provides safe, timely, and effective movement of fish through the project, and would be consistent with Interior's preliminary fishway prescription. According to FWS's Design Criteria Manual, an upstream eel passage facility generally consists of a covered metal or plastic volitional ramp lined with a wetted substrate that is 100 foot long or less, and angled at a maximum slope of 45 degrees with 1-inch-deep resting pools sized to the width of the ramp every 10 feet. The Design Criteria Manual also suggests sizing the width of the ramp to accommodate a maximum capacity of 5,000 eels per day (FWS, 2017a). We estimate that the annual levelized cost of constructing and operating an upstream fish passage facility for American eel with this design would be $8,530 and conclude that the benefits of constructing and operating the upstream passage facility outweigh the cost.

Fish Passage Operation and Maintenance Plan

To provide safe, timely, and effective fish passage, fishways need to be properly operated and maintained. KEI Power does not propose to develop an operations and maintenance plan for the existing or proposed fishways. Commerce's and Interior's preliminary fishway prescriptions and Maine DMR's section 10(j) recommendation include specific provisions for operation and maintenance of new and existing upstream and downstream fish passageways.

Interior's prescription requires the development of a Fishway Plan that includes measures for operating and maintaining the upstream and downstream fish passage facilities that are in operation at the time. Interior's preliminary prescription also requires KEI Power to complete maintenance 30 days prior to the beginning of a migration season, and to amend the Fishway Plan within 30 days of a request from the FWS. Interior also prescribes that KEI Power provide FWS personnel, and its designated representatives, access to the project site and to pertinent project records for the purpose of inspecting the fish passage facilities and to determine compliance with its prescription.

Maine DMR recommends specific fish passage operation and maintenance measures, including: (1) maintaining fishways in proper working order and performing routine maintenance before a migratory season begins; (2) developing fishway operating procedures, including maintenance schedules, procedures for routine operation, procedures for monitoring and reporting on facility operation, schedules for annual start-up and shutdown procedures, and procedures for emergencies and outages that could significantly affect fishway operations; and (3) maintaining and operating fishways during defined upstream and downstream migration periods.

Commerce's preliminary fishway prescription would require KEI Power to maintain downstream passage facilities by clearing trash, logs, and other material that could hinder flow and passage, and performing anticipated maintenance before the migratory period.

Most fishways require operation and routine maintenance to ensure the fishways operate effectively. A fish passage operation and maintenance plan that incorporates Maine DMR's recommendations and Interior's and Commerce's requirements would provide KEI Power with procedures necessary to ensure that the project fishways are maintained and in proper working order before and during the migratory fish season, including procedures for routine cleaning and maintenance, including debris removal. In addition, the plan could include provisions necessary to ensure that: (1) any fishways constructed at the project would be operated during the appropriate times of the day and year, and with an appropriate conveyance flow; and (2) standard procedures are developed for reducing or ceasing generation if dead or injured alewives or eels are observed downstream of the project, including specifications for the timing and magnitude of generation reductions and shutdowns. Completing all maintenance on fishways 30 days prior to a migratory season, as recommended by Interior would ensure that maintenance is completed in a timely fashion and that all fish passage facilities would operate as designed over the course of a migration season.

To ensure that project fishways are maintained and in proper working order, we recommend that KEI Power develop a fish passage operation and maintenance plan that includes measures for operating and maintaining existing and newly-constructed fishways, and adjusting project operation to reduce or cease generation in the event dead or injured alewives or eels are observed downstream of the project. We estimate that the levelized annual cost of the plan would be $470 and conclude that the benefits of the measure outweigh the cost.

With regard to Interior's requirement for KEI Power to provide FWS personnel and its designated representatives with site access for inspecting the fish passage facilities and determining compliance with Interior's prescription, the Commission's standard terms and conditions for a hydropower license require the licensee to provide employees of the U.S. Government access to project land and works in performance of their official

duties. This standard article would apply to site access for FWS employees and its designated representatives to inspect fish passage facilities.

Fishway "Shakedown" Period

Maine DMR recommends operating each modified or newly-constructed fishway for a one-season "shakedown" period to ensure that the fishways are generally operating as designed, and if not, to make adjustments. KEI Power does not propose to test modified or newly constructed fishways for proper operation prior to full scale implementation.

KEI Power is proposing to construct a new surface-level downstream fish passage and a new upstream eel passage facility. As discussed above, we recommend constructing the new downstream fish passage facility to provide safe, timely, and effective passage for downstream migrating fish by increasing attraction flows to the new proposed surface weir and improving the structural integrity and reliability of the plunge pool. We also recommend constructing a new upstream passage facility for eels to assist with passage upstream of the American Tissue Dam. Conducting a one-season "shakedown" period for these facilities, and any future modified or newly-constructed facilities would ensure safe, timely, and effective passage for migrating species.

However, Maine DMR does not specify the timing of its proposal, and the lack of specificity could result in "shakedown" periods interfering with the migration season. To prevent interference with the fish passage season, the "shakedown" period and any necessary adjustments should be timed so that they are completed prior to relevant fish passage seasons.

To ensure that the new downstream fishway and the upstream eel passage facility are operating as designed and to make minor adjustments to facilities and operations, as needed, we recommend that KEI Power operate the fishways for a "shakedown" period that would occur prior to the relevant upstream passage season. We estimate that the levelized annual cost of the "shakedown" would be included in routine operation and maintenance, and thus the cost would be negligible. Therefore, the benefits of the measure outweigh the cost.

Fish Passage Facility Construction Schedule

KEI Power proposes to construct a new downstream fish passage facility and a new upstream eel passage facility, but does not provide a schedule for constructing the facilities in a timely manner. Commerce's and Interior's preliminary fishway prescriptions would require KEI Power to construct and operate the facilities before the second migration season after issuance of any subsequent license; whereas, Maine DMR recommends under section 10(j) that the facilities be operational two years after license issuance. If a subsequent license for the project were issued during a migration season,

then the 2-year timeline recommended by Maine DMR would end during a migration season. Construction during the migration season would negatively affect fish migration. In addition, the new facilities would need to be checked for safe and effective passage before the migration seasons begin. Therefore, construction of the facilities should be finished prior to the beginning of the migration seasons in June, as required in Commerce's and Interior's fishway prescription. To provide time for facility testing and any minor alteration prior to the migration season, we recommend that construction of the facilities be completed prior to the second migration season after license issuance, and no later than the beginning of April. Constructing the new facilities before the second migration season would not be expected to increase the cost of constructing the facilities.

Cultural Resources

KEI Power does not propose any specific measures for protecting cultural resources in the APE. The only potential historic site within the APE is the remains of the Gardiner Mill that are submerged beneath the project impoundment. These remains are only exposed for a few days at a time during rare impoundment dewatering events that occur several years apart. The last documented drawdown was in 2004. KEI Power has not performed a reconnaissance survey of the remains, as requested by the SHPO, and little is known about the Gardiner Mill remains. However, the SHPO has stated that periodic drawdowns of the impoundment for maintenance and repair could result in the exposure of inundated historic archaeological resources associated with the Gardiner Mill.

Access to the remains of the Gardiner Mill is restricted because the remains are submerged. Absent a drawdown, there is no imminent threat to the property, such as erosion, vandalism, or damage resulting from recreational use of the impoundment. Determining the National Register eligibility of the mill remains during the next dewatering of the impoundment would inform the need for protective measures (*e.g.* erosion control, security, and access restrictions) during any dewatering of the impoundment that would expose the mill remains. Therefore, we recommend that KEI Power perform an archeological survey of the Gardiner Mill remains and conduct an assessment of National Register eligibility of the remains in consultation with the SHPO during the next scheduled drawdown that would dewater the impoundment to the point where the remains are exposed. If the Gardiner Mill remains are eligible for listing on the National Register, specific measures could be developed at that time in consultation with the SHPO to ensure the protection of the historic property from erosion, vandalism, or damage resulting from recreational use when the impoundment is dewatered. Any such measures would need to be filed with the Commission for its approval. We estimate that the cost of an archaeological survey and an assessment of National Register eligibility for the Gardiner Mill remains would be $10,000 and conclude that the benefits of the measure would be worth the estimated cost.

During the term of any subsequent license issued for the project, the licensee would occasionally need to conduct maintenance activities in the vicinity of the project or on project facilities. These activities could include general landscaping and ground-disturbing yard maintenance within the project boundary. These activities would not require prior Commission approval; however, they could affect unidentified historic resources in the vicinity of the project. Consulting with the Maine SHPO on protocols to be implemented prior to conducting these activities would ensure that unidentified historic resources are not adversely affected. Consultation would include the identification of any potential project effects on historic resources, and the development of protocols to mitigate the effects. There may be a future minimal cost associated with this measure.

Archaeological or historic sites could be discovered during land-disturbing activities associated with project construction, operation, or maintenance. Therefore, we recommend that KEI Power notify the Commission and the Maine SHPO if previously unidentified archaeological or historic properties are discovered during the course of constructing, maintaining, or developing project works or other facilities at the project. In the event of any such discovery, the applicant would discontinue all exploratory or construction-related activities until the proper treatment of any potential archaeological or cultural resources is established. There may be a future minimal cost associated with this measure.

Project Boundary

KEI Power proposes to remove approximately 0.7 acre of land and water from the project bypassed reach. KEI Power states this land and water is not necessary for project operation and maintenance, or the protection of environmental resources.

KEI Power's proposal would remove approximately nine percent of the existing project land and water from the project boundary. The land and water in the bypassed reach is not used for project operation and maintenance, or the protection of environmental resources. Removing the land from the project boundary would not result in a change in the project's effect on environmental, recreational, or cultural resources. Removal of the land and water would create a new project boundary that would cover the area needed for project operation and maintenance, and would eliminate land and water from the project boundary that are not needed for project purposes. There would be no cost incurred for removing 0.7 acre of land and water from the project boundary, and we agree with KEI Power's proposal to modify the project boundary.

5.1.3 Measures Not Recommended

Some of the measures proposed by KEI Power and recommended by other interested parties would not contribute to the best comprehensive use of Cobbosseecontee

Stream water resources, do not exhibit sufficient nexus to the project environmental effects, or would not result in benefits to non-power resources that would be worth their cost. The following discussion includes the basis for staff's conclusion not to recommend such measures.

Minimum Flow Downstream of Powerhouse

KEI Power proposes and Interior, Commerce, and Maine DMR recommend that KEI Power release a continuous minimum flow of 52 cfs or inflow, whichever is less, from the powerhouse to protect aquatic resources in the downstream reach.[82] However, the project is not hydraulically capable of releasing flows as low as 52 cfs from the powerhouse. When inflow is less than the minimum hydraulic capacity of the turbine (100 cfs), KEI Power must release flows over the dam or through the discharge pipe at the base of the dam. A minimum flow of 52 cfs cannot be released directly from the powerhouse into the downstream reach. Therefore, staff does not recommend including this measure in any subsequent license issued for the American Tissue Project.

However, staff does recommend that KEI Power continue operating the project in an instantaneous run-of-river mode in which outflow from the project approximates inflow to the impoundment. The effects of project operation on water quantity in the downstream reach would be minimized to the greatest extent possible by operating the project in run-of-river mode and no additional benefit to aquatic resources would be expected from operating the project with a minimum flow release of 52 cfs. Operating the project as a run-of-river facility would help to maintain and support habitat for fish and aquatic organisms in Cobbosseecontee Stream, both upstream and downstream of the project.

Upstream Passage for Anadromous Fish

The project does not currently provide upstream passage for anadromous fish, and KEI Power does not propose any upstream fish passage facilities for anadromous fish. Interior's preliminary fishway prescription would require KEI Power to design and install

[82] Interior's recommendation does not specifically account for instances when inflow to the impoundment drops below 52 cfs, but we assume that Interior's recommendation is consistent with KEI Power's proposal and Commerce's and Maine DMR's recommendations, *i.e.*, that Interior is recommending a flow of 52 cfs or inflow, whichever is less, from the powerhouse. The impoundment is relatively small in size (with a total storage capacity of only 108 acre-feet) and withdrawing a continuous flow of 52 cfs from the impoundment when inflows are less than 52 cfs could substantially lower impoundment elevation levels and dewater aquatic habitat in the impoundment, which could adversely affect aquatic life, including fish and benthic macroinvertebrates.

an upstream passage facility for alosines two years after upstream passage for alosines becomes operational at the Gardiner Paperboard Dam. Maine DMR also recommends upstream passage for anadromous fish. We estimate that construction and operation of an upstream fishway at the American Tissue Dam would have a levelized annual cost of $415,670.

Anadromous fish attempting to migrate upstream do not have access to Cobbosseecontee Stream upstream of the Gardiner Paperboard Dam. The Gardiner Paperboard Dam is located 0.3 mile downstream of the American Tissue Dam and blocks passage upstream because it does not have any installed upstream fish passage facilities. The Gardiner Paperboard Dam is privately-owned and there are no known plans for the installation of fish passage facilities or for removing the dam. Although Interior and Maine DMR state that Cobbosseecontee Stream once supported runs of diadromous fish and that the lakes and ponds in the drainage could support a population of over 3 million adult alewives, there would be no benefit to requiring installation of upstream passage facilities at the project until an upstream fishway for diadromous fish is operational at the Gardiner Paperboard Dam or until the dam is removed. Because there are currently no known plans for the installation of fish passage facilities at the Gardiner Paperboard Dam or for the removal of the dam, there would be no benefit to constructing a fishway at the American Tissue Dam at this time. Therefore, we have no justification for recommending an upstream fishway at the American Tissue Dam.

Fishway Design and Operation

KEI Power is proposing to install a new surface-level downstream fish passageway and a new upstream eel passageway, in consultation with resource agencies. As-built drawings are an important component of the fishway design process because they provide documentation that fishways are designed properly. Commerce's and Interior's preliminary fishway prescriptions would require KEI Power to provide as-built drawings to the resource agencies for any new fishways; and Maine DMR recommends that KEI Power provide as-built drawings for modified fishways, along with a licensed engineer's letter of certification. However, because it is the responsibility of the Commission to approve and ensure proper design of fishways, there is no justification for a license condition requiring that certified as-built drawings be provided to the resource agencies. Nevertheless, as-built drawings would be filed with the Commission and would be accessible to the resource agencies from the Commission under the normal protocol for drawings of such nature.

Maine DMR recommends that KEI Power send copies of the fishway operating procedures to resource agencies. However, copies of these plans would already be filed with the Commission and would be accessible to the public, so there is no justification for a license condition requiring KEI Power to provide copies to the agencies.

Interior and Maine DMR state that the fishway operating schedules could change during the term of the license based on new information, such as migration data and improved access downstream of the project. In addition, Maine DMR's recommendation states that, upon request of licensee and approval of resource agencies, the actual dates of fishway operation could vary in any given year in response to river conditions, maintenance requirements, or annual variability in fish migration patterns. However, Interior's requirement and Maine DMR's recommendation do not include limits regarding the number of days (earlier or later) that the fishways should be able to operate beyond the proposed schedules. In the absence of recommended limits on operating schedule modifications, we have no information to analyze, and therefore no information to determine whether a particular schedule modification would or would not provide benefits to alosines and American eel. More directly, we are unable to determine whether the schedule modifications would be in the public interest. Therefore, we are unable to identify any benefits to implementing unspecified modifications to the upstream fishway operating schedule. Thus, we do not recommend a license requirement that allows the operating schedules of the fishways to be modified without limits. However, the Commission's standard terms and conditions, which would be included in any subsequent license issued for the project, provide that the Commission can modify project structures and project operation for the conservation and development of fish and wildlife resources upon the Commission's own motion or upon the recommendation of resource agencies, after notice and opportunity for hearing.

Downstream Fish Passage for American Eel

KEI Power proposes to continue facilitating downstream eel passage at the project from September 1 to November 15 of each year by: (1) installing blinding plates at the base of the trashrack and a partial trashrack overlay with 7/8-inch clear spacing to protect eels and alosines from being entrained; (2) releasing 40 cfs from the discharge pipe at the base of the dam at night to provide a passage route for eels; (3) monitoring for any dead or injured adult eel during passage season and reducing generation at night if any dead or injured adult eel are observed during the passage season; and (4) ceasing generation at night for the remainder of the eel passage season if any entrained eels are observed downstream of the project. Interior's and Commerce's preliminary section 18 fishway prescriptions require and Maine DMR recommends under section 10(j) that downstream eel passage be provided from August 15 to November 15 of each year, instead of September 1 to November 15.

Effectiveness of the Discharge Pipe for Downstream Eel Passage

In its section 10(j) recommendation, Maine DMR states that the existing downstream eel passage facility has never been tested to ensure that it provides safe, timely, and effective passage, and that preliminary information collected by Maine DMR in the fall of 2017 indicates that eels do not use the discharge pipe at the base of the dam

as a means of downstream passage. Commerce estimates that the flow velocity at the deep gate of the discharge pipe is approximately 23 fps and could repulse eels from the downstream passage facility.

The calculated 23-fps flow velocity at the deep gate exceeds suitable velocities for effective downstream eel passage and likely causes an avoidance response from eels that are migrating downstream. In addition, based on information from FWS's Design Criteria Manual, the 8-inch opening provided at the discharge pipe for downstream eel passage is too small for safe and effective eel passage. The high flow velocity at the discharge pipe intake and the size of the intake opening likely reduce the effectiveness of the existing downstream facility and could present a risk of injury to eels that attempt to use the downstream facility. Staff concludes that the 40-cfs flow release through the discharge pipe does not provide a safe and effective means of passage for adult eels. Accordingly, staff recommends eliminating the flow release of 40 cfs through the discharge pipe at night for downstream eel passage and relying on alternative means of passage and protection measures for eels migrating downstream, as discussed below.

Alternative Means of Downstream Passage

Maine DMR recommends testing the effectiveness of alternative means of downstream eel passage, including: (1) the downstream surface-level passage facility that conveys flows over the dam for alosines; and (2) an "experimental airlift-assisted deep bypass" at the project. Interior states that if the existing downstream passage facility does not pass American eels in a safe, timely, and effective manner, Interior would require the licensee to consult with FWS to design and construct a new downstream eel passage facility.

Eels are not strictly bottom-oriented during downstream migration (Haro *et al*., 2000) and will utilize a surface-oriented downstream fish passage facility (Brown *et al*., 2009). Based on Maine DMR's and Commerce's analyses indicating that the 40-cfs flow release at the base of the dam is ineffective and unsafe, the surface-level downstream passage facility for alewife is the most probable means of downstream eel passage at the project.[83] However, there is no evidence that the effectiveness of the downstream surface-level passage needs to be tested at the project. KEI Power has implemented eel protection measures at the project on a seasonal basis since 2003, including: (1) installing a partial trashrack overlay with 7/8-inch clear spacing and blinding plates at the

[83] Eels are most likely not using turbine passage or spill over the dam during high flows as a means of passage. Turbine passage is known to cause injury and mortality at the project, and passage through spill would increase the risk of injury and mortality from impact on the concrete and rock surface at the base of the dam during high flows. No injured or dead eels have been observed downstream of the project since the downstream passage and protection measures were implemented in 2003.

base of the trashrack during the downstream eel migration season to protect adult eels from entrainment; and (2) monitoring for eel injury and mortality downstream of the project on a daily basis and ceasing generation at night if entrained eels are observed in the downstream reach. No dead or injured eels have been observed in the downstream reach of the project since implementation of these downstream passage measures in 2003 and there is no evidence that eels are otherwise adversely affected by the project.

KEI Power proposes to continue implementing the existing protection measures at the project, and proposes to construct a new surface-level downstream fish passage facility that would provide a greater attraction flow for downstream migrants throughout the entire passage season and improve the structural integrity and reliability of the plunge pool. Staff recommends these measures to improve the safety and efficiency of downstream passage at the project. Based on the lack of evidence in this proceeding that the project is adversely affecting downstream eel migration, and based on KEI Power's proposal to increase the safety and effectiveness of the surface-level downstream fish passage facility and to continue implementing protection measures for eels, there is no justification for recommending a license condition that requires KEI Power to test the effectiveness of the surface-level downstream fish passage facility. For these same reasons, there is no justification for testing the effectiveness of an "experimental airlift-assisted deep bypass" at the project.

In addition, Maine DMR did not include performance standards that would be used to test the effectiveness of the new downstream fish passage facility. Without specific performance standards, we cannot conduct a cost-benefit analysis of Maine DMR's recommendation.

Protective Measures for Downstream Eel Passage

KEI Power proposes to continue to install a partial trashrack overlay with 7/8-inch clear spacing and blinding plates at the base of the trashrack during the downstream eel migration season to protect adult eels from entrainment. KEI Power also proposes to continue monitoring for eel injury and mortality downstream of the project on a daily basis and to cease generation at night if entrained eels are observed in the downstream reach. Maine DMR recommends installing a 3/4-inch trashrack overlay during the downstream migration period.[84]

[84] Interior's preliminary fishway prescription and section 10(j) recommendation would require a trashrack overlay with three different sizes of clear bar spacing to facilitate downstream eel passage. Interior's fishway prescription requires KEI Power to: "continue to use the existing downstream facility (installing the blinding plates and the 7/8-inch punchplate overlay and opening the deep gate at the required time)" and "continue to install the 3/4-inch, full-length punchplate during the American eel passage

As evidenced by a fish kill in 2001, turbine passage is unsafe for eels that are migrating downstream through the project. The licensee has monitored the downstream reach of the project on a daily basis from September 1 to November 15 each year since 2003, and has not observed any eel mortalities since initiating the downstream passage measures. Therefore, installing blinding plates at the base of the trashrack and a partial trashrack overlay with 7/8-inch clear spacing over the upper intake appears to provide adequate protection for eels. In addition, studies in New England have documented adult eels ranging in size from 24 to 30 inches long (ASMFC, 2000; Haro *et al*., 2000) and 0.9 to 1.1 inches wide (Great River Hydro, 2016). Based on this size range, the existing trashrack overlay with 7/8-inch (0.875 inch) clear spacing would protect most adult eels migrating downstream from entrainment. There is also a low potential for impingement on the trashracks because American eels have a burst speed of over 4 fps (Bell, 1991) that is sufficient to overcome the maximum through velocity of 1.4 fps at the trashrack with the 7/8-inch overlay installed.

Reducing the clear space opening of the trashrack overlay opening from the existing 7/8 inch to 3/4 inch would not have a significant incremental beneficial effect on fish and eels because the 7/8-inch overlay already screens out all or nearly all fish and eels. Since KEI Power currently installs a partial 7/8-inch clear spacing trashrack overlay, there is no incremental cost of installing the 7/8-inch trashrack overlay on a seasonal basis; whereas the estimated annual cost of a trashrack overlay with 3/4-inch clear spacing would be $56,500. Because the 3/4-inch and 7/8-inch trashrack overlays provide similar benefits, but the 7/8-inch overlay provides these benefits at a substantially lower cost, staff recommends that KEI Power continue to install the partial 7/8-inch trashrack overlay from June 1 to November 30 of each year.

Effectiveness of New Fish Passage Facilities

KEI Power is proposing to construct a new downstream fish passage facility to replace the existing passage facility for alosines, and construct a new upstream passage facility for American eel. Commerce, Interior, and Maine DMR recommend that KEI Power test the effectiveness of the new fish passage facilities. Interior's preliminary fishway prescription requires KEI Power to develop effectiveness testing and evaluation plans in consultation with FWS after conceptual design plans are developed for the

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downstream migration period…." Interior's section 10(j) recommendation would require KEI Power to install a different overlay, with 1-inch clear spacing. It is unclear which trashrack overlay Interior is proposing. However, based on the size range of eels described above, a 1-inch trashrack overlay would provide less protection from entrainment than the 7/8-inch overlay that is currently installed at the project on a seasonal basis.

facilities. Commerce states that it will provide performance standards during the development of monitoring plans.

Maine DMR recommends that KEI Power develop and conduct a quantitative monitoring study for each new or modified fish passage facility at the start of the second migration season after a fishway is operational. Interior's and Commerce's preliminary fishway prescriptions would require KEI Power to conduct effectiveness testing for a minimum of two years after a fishway is operational. If the facility does not meet performance measures for safe, timely, and effective passage, then Commerce would require and Maine DMR recommends conducting studies on a biennial basis until achievement of performance standards.

Fishway efficiency evaluations may take many forms including video observation, sample collection, hydro-acoustics, telemetry, or passive integrated transponder studies. A passage effectiveness study typically evaluates factors such as attraction flows, attraction efficiency, passage efficiency, passage delay, and survival rates. As stated in the FWS Design Criteria Manual, efficiency testing is typically evaluated quantitatively through a site-specific framework and performance standards are generally informed by state and federal agencies with expertise in the life history requirements of the region's fish populations. Factors to consider include the impact of all barriers within the watershed and the minimum number of fish required to sustain a population's long-term health and achieve identified management plan objectives and goals. Commerce, Interior, and Maine DMR have not included any specific performance standards that would be used to test the effectiveness of the new downstream fish passage facility or the upstream eel passage facility. Instead, they would require the development of plans and performance standards post-licensing, in consultation with resource agencies. Without specific performance standards to evaluate, there is no information to analyze and no information to determine whether effectiveness testing would or would not provide benefits to alosines and American eel. Therefore, there is no justification for recommending the effectiveness studies.

On a conceptual level, Interior states in its preliminary fishway prescription that effectiveness testing is critical to evaluating passage success, diagnosing problems, and determining when fish passage modifications are needed and what modifications are most likely to be effective. Interior states that effectiveness testing is essential to ensuring the effectiveness of fishways over the term of the license, particularly in cases where the changing size of fish populations may also change fish passage efficiency or limit effectiveness. However, Interior's preliminary fishway prescription would require (and staff recommends) that the new fish passage facilities be designed in accordance with proven, species-specific design criteria from the FWS's Design Criteria Manual, and that the facilities be operated and maintained in accordance with a fish passage operation and maintenance plan that is developed in consultation with the resource agencies and approved by the Commission. These facilities would also be installed at locations that

have previously been used for passage by fish and eels. Since the facilities would be designed, operated, and maintained in accordance with proven fish passage standards and operating procedures, there is no evidence that the facilities would be ineffective. Accordingly, there is no basis for recommending license conditions that would require effectiveness testing and potential modification of the passage facilities within two years of construction and operation.[85]

Annual Meeting on Fish Passage Facilities

Interior's preliminary fishway prescription would require KEI Power to meet with FWS and other resource agencies in the late fall to report on fish passage maintenance and operation, report on monitoring results, and review a fish passage operation and maintenance plan.

Interior does not identify a specific need or benefit to aquatic resources of meeting annually to review fish passage operational data, effectiveness monitoring results, and the fish passage operation and maintenance plan. KEI Power would operate and maintain all fishways by following specific operation and maintenance plans that are developed in consultation with the resource agencies, and approved by the Commission. Therefore, there is no justification for a license condition requiring KEI Power to meet annually with the resource agencies.

Recreation Plan

The City of Gardiner recommends that KEI Power develop a recreation plan that includes provisions for evaluating potential adverse effects of the dam on recreation opportunities for area residents, measures to mitigate any adverse effects, and measures to support recreation opportunities at the project, including swimming, fishing, boating, walking, and bird and nature viewing. However, the City of Gardiner did not provide specific examples of any negative effects in its comments, and no other party has submitted comments indicating that the project is adversely affecting recreational resources. The project creates a small 5.5-acre impoundment, and operates in a run-of-river mode, so there are no impoundment fluctuations that could affect recreation. Although KEI Power does not provide formal recreational access, the impoundment is open to the public and accessible through the city park, and downstream access is provided over project land. For these reasons, we have no justification for a license condition requiring the development of a recreation plan.

[85] *See also Yakima Indian Nation v. FERC*, 746 F.2d 1451 (9th Cir. 1984) (noting that FERC must consider fishery issues before, not after, issuance of a license.)

5.1.4 Conclusion

Based on our review of the agency and public comments filed on the project and our independent analysis pursuant to sections 4(e), 10(a)(1), and 10(a)(2) of the FPA, we conclude that licensing the American Tissue Project, as proposed by KEI Power with the additional staff-recommended measures, would be best adapted to a plan for improving the Cobbosseecontee River Basin.

5.2 UNAVOIDABLE ADVERSE IMPACTS

Some entrainment mortality is likely unavoidable for juvenile and adult alewives and adult eels migrating downstream, even with downstream passage for these species. Most adult fish could avoid involuntary entrainment, but entrainment of some small fish could still occur.

5.3 SUMMARY OF SECTION 10(J) RECOMMENDATIONS

Under the provisions of section 10(j) of the FPA, 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 finds 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 such inconsistency, giving due weight to the recommendations, expertise, and statutory responsibilities of the agency.

In response to our September 28, 2017 notice accepting the application to relicense the project and soliciting motions to intervene, protests, comments, recommendations, preliminary terms and conditions, and preliminary fishway prescriptions, Interior filed five section 10(j) recommendations on November 27, 2017, Commerce filed three section 10(j) recommendations on November 27, 2017, and Maine DMR filed 24 section 10(j) recommendations on November 22, 2017. Table 11 lists the recommendations filed pursuant to section 10(j), and indicates whether the recommendations are included under the staff alternative, as well as the basis for our preliminary determinations concerning measures that we consider inconsistent with section 10(j). Environmental recommendations that we consider outside the scope of section 10(j) have been considered under section 10(a) of the FPA and are addressed in the specific resource sections of this document.

Table 11. Analysis of fish and wildlife agency recommendations for the American Tissue Project.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
Operate in an instantaneous run-of-river mode with minimal impoundment fluctuation.	Commerce, Interior, Maine DMR	Yes.	$0	Yes.
Provide a continuous year-round minimum flow of 52 cfs or inflow, whichever is less, from the powerhouse.	Commerce, Interior, Maine DMR	Yes.	$0	No. Measure is inconsistent with substantial evidence standard of FPA section 313(b). The minimum hydraulic capacity of the turbine is 100 cfs, such that flows below 100 cfs cannot be released from the powerhouse. Staff recommends that the project operate in instantaneous run-of-river mode, where outflow from the project approximates inflow to the impoundment.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
Provide a continuous year-round minimum flow of 10 cfs or inflow, whichever is less, to the bypassed reach.[86]	Interior, Maine DMR	Yes.	$2,980	Yes.
Release a continuous minimum flow of 29 cfs to the bypassed reach from June 1 to November 30 to support downstream fish passage.	Commerce, Interior	Yes.	$5,630	Yes.
Release a minimum flow of 25 cfs to the bypassed reach from June 1 to November 30 to support downstream fish passage.	Maine DMR	Yes.	$4,530	Yes. Staff recommends a minimum flow of 29 cfs, which is consistent with the recommended minimum flow of 25 cfs.
From June 1 to November 30, install a 3/4-inch trashrack overlay with		Yes.	$56,500	No. Measure is inconsistent with section 10(a) of the FPA. Staff's

[86] Maine DMR recommends a 10-cfs minimum flow from January 1 to May 30 and December 1 to December 31, which only differs from Interior's recommendation by a single day (May 30 versus May 31, respectively), after accounting for the agencies' proposal to provide flows for downstream fish passage from June 1 to November 30 of each year.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
blinding plates at the penstock intake to physically exclude diadromous fish migrating downstream from the turbine intake.				recommendation to use a 7/8-inch partial trashrack overlay and blinding plates provide adequate protection at a substantially lower cost; therefore, benefits would not justify the cost.
Construct, operate, and maintain a modified downstream fish passage facility for diadromous fish that consists of: (1) a minimum 2-foot-deep by 3-foot-wide surface weir that produces a gradually accelerating discharge, and a minimum flow of 25 cfs; and (2) an adequately-sized plunge pool at the toe of the spillway, designed in accordance with FWS's Design Criteria Manual and in consultation with resource agencies.	Maine DMR	Yes.	$20,300	Yes. Staff recommends a minimum flow of 29 cfs, which is consistent with the recommended minimum flow of 25 cfs.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
Operate the modified downstream passage facility for diadromous fish species by two years after license issuance.	Maine DMR	Yes.	$0	No. Measure is inconsistent with FPA section 18 preliminary fishway prescriptions. Commerce's and Interior's section 18 preliminary prescriptions require construction and operation of the fish passage facility before the second migration season after issuance of a subsequent license, which could occur before Maine DMR's recommended schedule. Staff recommends a construction schedule that is consistent with Commerce's and Interior's section 18 preliminary prescription.
Maintain the existing downstream measures for diadromous fish passage in the interim period between license issuance and the		Yes.	$0	Yes. Staff recommends that downstream passage be provided for alosines from June 1 to November 30 of each year, instead of

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
operation of the modified facilities.				September 1 to November 15, as required by the October 16, 2003 Order.
Develop an evaluation plan and conduct effectiveness testing and quantitative monitoring of the modified downstream fish passage facilities for diadromous fish.	Maine DMR	No[a]	Unknown – recommendation lacks specificity needed to estimate a cost.	No.
Develop an operation and maintenance plan for the modified downstream fish passage facility for diadromous fish.	Maine DMR	Yes.	$0 – Costs would be included in the $470 cost of developing and maintaining a comprehensive operation and maintenance plan for all fish and eel passage facilities, as shown below for maintaining fishway	Yes.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
			operating procedures.	
Two years after upstream passage for anadromous fish becomes operational at the Gardiner Paperboard Dam, install an upstream fish passage facility at the project that provides safe, timely, and effective passage for approximately 3.2 million river herring and operate the upstream fish passage facility from May 1 to July 31 each year.	Maine DMR	No.[b]	$415,670	No.
Design the new upstream passageway for anadromous fish consistent with FWS's Design Criteria Manual in consultation with resource agencies, and allow resource agencies to review design drawings	Maine DMR	No.[b]	$0 – Costs would be included as part of the $415,670 cost of constructing, operating, and maintaining an upstream	No.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
			passage facility for anadromous fish.	
Develop an evaluation plan and conduct effectiveness testing and quantitative monitoring of the upstream fish passage facilities for anadromous fish.	Maine DMR	No.[a, b]	Unknown – recommendation lacks specificity needed to estimate a cost.	No.
Develop an operation and maintenance plan for the new upstream passage facility for anadromous fish.	Maine DMR	No.[b]	$0 – Costs would be included in the $470 cost of developing and maintaining a comprehensive operation and maintenance plan for all fish and eel passage facilities, as shown below for maintaining fishway	No.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
			operating procedures.	
Release 40 cfs from September 1 to November 15 through the discharge pipe at the base of the dam and install a 1-inch punchplate (*i.e.*, trashrack overlay) to facilitate downstream passage of American eel.	Interior	Yes.	$0	No. Measure is inconsistent with section 10(a) of the FPA. Recommended flow release could injure eels due to the high flow velocity at the deep gate and the restricted size of the intake opening. Staff recommends protection measures during the downstream eel migration season, including a 7/8-inch partial trashrack overlay and blinding plates at the base of the trashrack.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
Continue implementing the existing downstream measures for American eel from August 15 to November 15 of each year.	Maine DMR	Yes.	$0	Yes (Staff recommends that downstream eel passage protection measures continue to be provided from August 15 to November 15 of each year, including (1) installing blinding plates and a 7/8-inch trashrack overlay to protect alewives and eels from being entrained; and (2) monitoring for injured or dead eels, and reducing or ceasing generation if injured or dead eels are observed.); No (Staff does not recommend continuing to release 40 cfs from the discharge pipe because the flow release could injure eels due to the high flow velocity at the deep gate and the restricted size of the intake opening.)

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
Install a 3/4-inch trashrack overlay with blinding plates at the base of the intake from June 1 to November 30 each year to physically exclude eels from the turbine intake, within two years after license issuance.	Maine DMR	Yes.	$0 – Cost of $56,500 is already accounted for above for installing a trashrack overlay to physically exclude diadromous fish that are migrating downstream from the turbine intake.	No. The measure is inconsistent with FPA section 10(a). Staff's recommendation to use a 7/8-inch partial trashrack overlay and blinding plates provide adequate protection at a substantially lower cost than the $56,500 cost of installing a new 3/4-inch trashrack overlay; therefore, benefits would not justify the cost.
Test the new downstream passage facility to assess whether it provides safe, timely, and effective passage for juvenile and adult alewife, blueback herring, and American eel.	Maine DMR	No.[a]	Unknown – recommendation lacks specificity needed to estimate a cost.	No.
Test an experimental air-lift assisted deep bypass at the project for passing		No.[a]	$10,450	No. However, the staff alternative does not adopt the applicant's proposal to

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
downstream migrating American eels. If testing of downstream fish passage facility or the air-lift bypass proves effective, the 40-cfs flow released from the discharge pipe may be terminated.		No.[c]	$0	continue releasing 40 cfs from the discharge pipe. No.
Construct an upstream eel passage facility on the west end of the spillway in accordance with FWS's Design Criteria Manual and in consultation with resource agencies, and operate and maintain the facility from June 1 to September 15 of each year.	Maine DMR	No.[d]	$8,530	Yes. The new upstream eel passage facility would consist of a covered metal or plastic volitional ramp lined with a wetted substrate that is 100 foot long or less, angled at maximum slope of 45 degrees with one inch deep resting pools sized to the width of the ramp every 10 feet. The ramp width would be sized to accommodate a maximum capacity 5,000 eels/day per inch of ramp width (mean

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
				eel size of 150 mm total length).
Operate the new upstream passageway for American eel by two years after license issuance.	Maine DMR	Yes.	$0	No. Measure is inconsistent with FPA section 18 preliminary fishway prescriptions. Commerce's and Interior's Section 18 preliminary prescriptions require KEI Power to construct and operate the upstream eel passage facility before the second migration season after issuance of a new license, which could occur before Maine DMR's recommended schedule. Staff recommends a construction schedule that is consistent with Commerce's and Interior's section 18 preliminary prescription.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
Develop an evaluation plan and conduct effectiveness testing and quantitative monitoring of the upstream eel passage facilities.	Maine DMR	No.[a]	Unknown – recommendation lacks specificity needed to estimate a cost.	No.
Develop an operation and maintenance plan for the new upstream eel passage facility in consultation with resource agencies.	Maine DMR	Yes.	$0 – Costs would be included in the $470 cost of developing and maintaining a comprehensive operation and maintenance plan for all fish and eel passage facilities, as shown below for maintaining fishway operating procedures.	Yes.
Operate each newly-constructed or modified fishway for a one-season	Maine DMR	Yes.	$0	Yes.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
"shakedown" period to ensure that it is generally operating as designed and to make minor adjustments to facilities and operations, as needed.				
At the end of each shakedown period, have a licensed engineer certify that the fishway is constructed and operating as designed in all material aspects.		No.[e]	$0	No.
Provide Maine DMR, FWS, and NMFS with a copy of the as-built fishway drawings as submitted to FERC, along with the licensed engineer's letter of certification.		No.[e]	$0	No.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
Maintain fishways in proper working order and remove trash, logs, and material that would hinder passage. Perform routine maintenance before a migratory period such that fishways can be tested and inspected, and will be operational during the migratory periods.	Maine DMR	Yes.	$0 – Costs would be included in the $470 cost of developing and maintaining a comprehensive operation and maintenance plan for all fish and eel passage facilities, as shown below for maintaining fishway operating procedures.	Yes.
The licensee shall develop and conduct quantitative effectiveness monitoring studies in consultation with resource agencies for each new or modified fish passage facility. Monitoring shall begin at the start of the second	Maine DMR	No.[a]	Unknown – recommendation lacks specificity needed to estimate a cost.	No.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
migration season after the fishway facility is operational. Conduct biennial effectiveness studies for fishways that do not meet performance standards.		No.[d, e]	Unknown – recommendation lacks specificity needed to estimate a cost.	No.
Maintain fishway operating procedures in consultation with stakeholders, including general schedules of routine maintenance, procedures for routine operation, procedures for monitoring and reporting on the operation of each fish passage facility or measure, and schedules for procedures for annual start-up and shutdown, and procedures for emergencies and project outages significantly	Maine DMR	Yes.	$470	Yes. This measure is consistent with our recommendation to develop a comprehensive operation and maintenance plan for fish passage facilities at the project.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
affecting fishway operations. Send copies of the fishway operating procedures, and any revisions made during the term of the license to resource agencies.		No.[f]	$0	No. Copies of the operation and maintenance plan, and modifications thereto would be filed with the Commission and made available to the public.
Maintain and operate permanent fish passage facilities during predefined upstream and downstream migration periods for alosines and American eel.	Maine DMR	Yes (for downstream passage of alosine and American eel, and upstream passage for American eel); No (for upstream passage of alosines).[a]	$0 – Cost of operating and maintaining the facility during a pre-defined migration period is included separately above for each facility.	Yes. (for downstream passage of alosine and American eel, and upstream passage for American eel); No (for upstream passage of alosines).
Modify the fishway operating schedules during the term of the license		No.[g]	$0	No.

Recommendation	Agency	Within scope of section 10(j)?	Levelized Annual Cost	Recommend Adopting?
based on migration data, new information, and in consultation with the Maine DMR, FWS, and NMFS. Upon request of licensee and approval of resource agencies, the actual dates of operation may vary in any given year in response to river conditions, maintenance requirements, or annual variability in fish migration patterns.				

[a] This is not a specific fish and wildlife measure. The provisions of this recommendation are generic and uncertain. In addition, there is no reserved authority under section 10(j) for future, uncertain actions such as modification of the facilities.

[b] Maine DMR's justification for the recommendation is based on conditions that do not warrant passage at the project at this time, and the expectation that the conditions will be favorable in the future. Measures instituted at an indeterminate future time conditioned on future events that might never occur (*i.e.*, upstream migration of anadromous fish) are outside of the scope of section 10(j).

[c] There is no reserved authority under section 10(j) for measure related to uncertain, future actions. Measures instituted at a time conditioned on future events that might never occur, are outside the scope of section 10(j).

[d] This is not a specific fish and wildlife measure. The provisions of this recommendation are generic and uncertain.

[e] The measure is based on the occurrence of a future event. There is no reserved authority under section 10(j) for future, uncertain actions such as modifying the design and operation of facilities if undefined performance standards are not met.

[f] Not a specific fish and wildlife measure. Measure does not specifically provide for the protection, mitigation, or enhancement of fish and wildlife resources.

[g] This is not a specific fish and wildlife measure. Modifying the operating schedules without specific limits would represent an uncertain future action. There is no reserved authority under section 10(j) for future, uncertain actions.

5.4 CONSISTENCY 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 federal or state comprehensive plans for improving, developing, or conserving a waterway or waterways affected by the project. We reviewed the following 17 comprehensive plans that are applicable to the American Tissue Project. No inconsistencies were found.

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6.0 FINDING OF NO SIGNIFICANT IMPACT

If the American Tissue Project is issued a subsequent license as proposed with the additional staff-recommended measures, the project would continue to operate while providing enhancements to aquatic resources, and protection of cultural and historic resources in the project area.

Based on our independent analysis, we find that the issuance of a license for the American Tissue Project, with additional staff-recommended environmental measures, would not constitute a major federal action significantly affecting the quality of the human environment.

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8.0 LIST OF PREPARERS

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APPENDIX A

U.S. DEPARTMENT OF COMMERCE'S SECTION 18 PRELIMINARY FISHWAY PRESCRIPTIONS

7.3 Section 18 Preliminary Fishway Prescription

We hereby submit the following preliminary fishway prescriptions pursuant to Section 18 of the FPA, 16 USC §811. Section 18 of the FPA states in relevant part that, "the Commission must require the construction, maintenance, and operation by a Licensee of...such fishways as may be prescribed by the Secretary of Commerce or the Secretary of the Interior." Congress provided guidance on the term "fishway" in 1992 when it stated as follows:

"The items which may constitute a 'fishway' under Section 18 for the safe and timely upstream and downstream passage of fish must be limited to physical structures, facilities, or devices necessary to maintain all life stages of such fish, and Project operations and measures related to such structures, facilities, or devices which are necessary to ensure the effectiveness of such structures, facilities, or devices for such fish." Pub.L. 102-486, Title XVII, § 1701(b), Oct. 24, 1992.

We base the following mandatory fishway prescription on the best biological and engineering information available at this time, as described in the explanatory statements that accompany each prescription. Our biological and engineering staff developed this prescription over a period of several years, in close consultation with the Licensee, the USFWS and other entities that participated in this relicensing proceeding. We support each prescription measure by substantial evidence contained in the record of pre-filing consultation, and subsequent updates, compiled and submitted in accordance with the Commission's procedural regulations. The explanatory statements included with each prescription summarizes the supporting information and analysis. We include an index to the administrative record for this filing herein, and reserve the right to file updated and

supplemental supporting information in conjunction with comments submitted on our preliminary prescription.

7.3.1 Downstream Fish Passage – Diadromous

The Licensee shall construct, operate and maintain downstream fishways for diadromous fish species that provide safe, timely and effective downstream passage consistent with the performance standards described in Section 7.3.5. The downstream passage system shall be: (1) a minimum two-foot deep by three-foot wide surface weir that produces gradually accelerating discharge; (2) a minimum flow of 25 cfs to attract and convey migrants over the surface weir without impacting the concrete surface[87]; (3) the surface weir flow shall fall into an adequately-sized plunge pool at the toe of the spillway that then discharges to flowing water in the Project bypass reach; and (4) seasonal installation of 7/8-inch, full depth trash rack overlays with blinding plates at the base of the penstock intake (USFWS 2017). Downstream passage facilities shall be constructed and operational before the second migratory season after the issuance of a new license. In the interim, the Licensee shall maintain existing downstream measures at the project. Downstream passage facilities shall operate during the downstream migration season defined in Section 7.3.4. The Licensee shall keep the downstream passage facilities in proper order and clear of trash, logs, and material that would hinder flow and passage. Anticipated maintenance shall be performed in sufficient time before a migratory period such that fishways can be tested and inspected and will operate effectively prior to the migratory periods. Design review of any new downstream fishways shall follow the process outlined in Section 7.3.5 Fishway Design Review such that modifications can be implemented and operational within 2 years of license issuance.

[87] See Attachment B "P-2809 American Tissue Downstream Fish Passage Conceptual Design Review Meeting of June 1, 2017" for a discussion of this recommendation.

KEI (Maine) proposes to make improvements to the existing downstream fishway (described in Section 6.1.3) to promote safe passage. The final license application provides neither details of the proposed improvements nor a schedule. However, notes from a meeting with the resource agencies and KEI (Maine) on June 1, 2017 outlines several agreed upon improvements (Attachment B). We concur with proposed action, including measures described under Attachment B. The design details and proposed flows identified in those meeting notes meet the intent of the fishway prescription.

Rationale

Dedicated downstream fishways are necessary to protect diadromous species migrating downstream past the Project. We base this position on the factual background herein and the following:

1. Alewife and blueback herring are presently stocked upstream the American Tissue Project (MDMR 2013, KEI (Maine) 2017).
2. American eel are present upstream of the project (KEI (Maine) 2017).
3. Downstream migrating adult and juvenile alosines, and adult American eel are exposed to project related impacts (Franke et al. 1997).
4. Downstream migrating adults and juvenile fish can be protected from project operations that result in injury and mortality (Franke et al. 1997, Larinier 2000, FERC 2004, NMFS 2012). 74 FR 29344, June 19, 2009, 78 FR 48944, August 12, 2013.
5. The design features proposed for downstream passage at the spillway address agency guidelines as developed by the USFWS (USFWS 2017).

7.3.2 Upstream Fish Passage – Anadromous Species

Based on the best available data and status of migratory fish in the watershed, no dedicated upstream fishway facilities are required at this time. The first dam on the Cobbosseecontee Stream in Gardiner (Gardiner Dam) prevents upstream anadromous fish

passage. If this were to change, and fish passage were provided at the first dam on the stream, we would seek to use our reserved authority, as stated in Section 7.4, to require an upstream fishway facility. The target species would primarily be alewife and the goals set for in the Draft Fishery Management Plan for the Cobbosseecontee Stream ((MDMR 2002).

7.3.3 Upstream Fish Passage – American Eel

The Licensee shall construct, operate and maintain an upstream passage facility for American eel that provides safe, timely and effective upstream passage. This facility shall provide passage from the downstream side of the dam to the American Tissue headpond. This facility shall be operational before the second migration season after the issuance of a new license. The Licensee shall keep the upstream eel passage facility in proper order and clear of trash, logs, and material that would hinder flow and passage. Anticipated maintenance shall be performed in sufficient time before a migratory season such that fishways can be tested and inspected and will operate effectively prior to migration. Design review of any new fishway shall follow the process outlined in Section 7.3.6 Fishway Design Review.

KEI proposes to design and construct upstream eel passage in consultation with the resource agencies (FLA, Exhibit E, Section 2.4). We concur with the licensee's finding that state: "The 2015 monitoring results…..demonstrate that the river left side of the American Tissue dam is likely to be the most effective location install an upstream eel passage system to pass juvenile eel upstream." (FLA, Exhibit E, Section 4.3.3.1). Therefore, the upstream eel fishway should be constructed on river left.

Rationale

Dedicated upstream eel passage is necessary to provide migration to rearing habitat upstream of the Project throughout the migratory season. We base this position on the factual background herein and the following:

1. Upstream migrating juvenile eel were observed at the American Tissue Project (MDMR 2002, 2013, KEI (Maine) 2017).
2. Dams such as the American Tissue Project inhibits the passage of American eel juveniles, including elver and yellow eel (Shepard 2015).
3. Upstream migrating juvenile eels can be effectively passed at hydroelectric projects (Solomon and Beach 2004).
4. The proposed upstream fishway design can function to support passage and prevent injury and mortality of adult eel (Solomon and Beach 2004).

7.3.4 Seasonal Migration Windows

Fishways shall be operational during the migration windows for target species present. The migratory season for diadromous fish is well known in the major rivers of the Northeast (Facey and Van Den Avyle 1987, Loesch 1987, ASMFC 2000, 2009, MDMR 2015). Season depends on geographic location, water temperature, river flow and other habitat cues. These dates may change based on new information, improved access at the lower dam, and agency consultation. Based on state-wide and Kennebec River watershed specific data, approved fish passage protective measures shall be operational during the follow migration windows:

1. Downstream alosine adults and juveniles: June 1 – November 30
2. Upstream alosine (once construction of the new fishway is required): May 1 to July 31
3. Downstream American eel: August 15 – November 15
4. Upstream American eel: June 1 – September 15

7.3.5 Passage Performance Standards and Monitoring

The Licensee shall conduct a minimum of two years of quantitative monitoring for the prescribed fish passage measures. Monitoring shall begin at the start of the second migratory season after the fishway facility is operational. If the facility does not meet

performance standards for safe, timely and effective passage, studies will continue biennially until achievement of performance standards. We will provide performance standards during the development of monitoring plans. If the facility does meet performance standards, a second year of monitoring will occur during the license timeframe through consultation with the resource agencies. If performance standards are not met, additional improvements to the fishways will be required.

The same monitoring process will occur for any new upstream or downstream fish passage measure implemented at the Project through our reservation of Section 18 authority.

7.3.6 Fishway Design Review

The Licensee shall submit design plans to NMFS for review and approval during the conceptual, 30, 60 and 90 percent design stages. The Licensee shall adhere to the following design milestone schedule:

1. Conceptual design within 15 months of construction date,
2. 30% design within one year of construction date,
3. 60% design within nine months of construction date, and
4. 90% design within three months of construction date.

Following NMFS approval, the Licensee shall submit final design plans to the Commission for final approval prior to the commencement of fishway construction activities. Once the fishway is constructed, final as-built drawings that accurately reflect the project as constructed shall be filed with NMFS.

7.4 Reservation of Authority

We developed this preliminary prescription in response to the proposals being considered by the Commission in this proceeding, our current policies and mandates, and our understanding of current environmental conditions at the Project. If any of these factors

change over the term of the license, then we may need to alter or add to the measures prescribed in this licensing process. Therefore, we hereby reserve authority under Section 18 of the FPA to prescribe such additional or modified fishways at those locations and at such times as we may subsequently determine are necessary. Our intention for reserving authority is to provide for effective upstream and downstream passage of diadromous fish through the Project facilities, including, without limitation, our authority to amend our fishway prescriptions upon approval by us of such plans, designs, and completion schedules pertaining to fishway construction, operation, maintenance, and monitoring as may be submitted by the Licensee in accordance with the terms of the license articles containing such fishway prescriptions. We reserve our authority and request that the Commission include the following condition in any license it may issue for the Project:

Pursuant to Section 18 of the Federal Power Act, the licensee shall build the fishways described in the National Marine Fisheries Service' Prescription for Fishways at the American Tissue Hydroelectric Project (FERC No.2809). The Secretary of Commerce reserves his authority to prescribe additional or amended fishways as he may decide are required in the future.

Directly relevant to this prescription is the presence of the Gardiner Dam, the first dam on the Cobbosseecontee Stream in Gardiner, Maine. The Gardner Dam is located at the head of tide. This first dam on the stream does not provide fish passage for anadromous species. For many years, there has been discussion of removing this dam, building a fish ladder around the structure and even installing hydropower. To date, this has not occurred. The Gardiner Dam remains a barrier to passage for diadromous fish. It is possible that the owner or third party implements fish passage or dam removal of the Gardiner Dam during the term of any new license issued for the American Tissue Project. If either action were to occur, alewife and other fish species would have access to the American Tissue Project area. We would then seek to implement upstream fish passage for diadromous at the American Tissue Project.

The other relevant aspect of this prescription is the lack of clear data that indicated downstream migrating eel are passing in a safe, timely and effective manner through the existing deep gates. We are aware of recent observations made by MDMR using DIDSON technology that indicate emigration of eels may be delayed by hydraulic conditions at the deep gate. Based on those observations, eel appear to explore routes of egress; however, the rapidly accelerating water in front of the deep gate repulse the eels who then swim upstream. We have calculated velocities through the deep gate using the following orifice equation:

$$Q = CA\sqrt{2gH}$$

where Q is flow, C is the coefficient of discharge, A is area of gate opening, g is acceleration due to gravity, and H is the head over the gate. Based on the data available, we estimate the velocity through the deep gate to be approximately 23 feet per second with no infrastructure to minimize rapid acceleration of flow. This acceleration and velocity exceeds recommended guidelines for safe, timely, and effective downstream passage (Piper et al. 2015). In addition, if eels do eventually commit to the deep gate, the high velocity expulsion of the eel from the deep gate may injure the fish by impacting ledge or retaining walls immediately downstream. Based on the results of required monitoring studies, we may seek to implement improvements to downstream passage for American eel.

APPENDIX B

U.S. DEPARTMENT OF THE INTERIOR'S SECTION 18 PRELIMINARY FISHWAY PRESCRIPTIONS

10 RESERVATION OF AUTHORITY TO PRESCRIBE FISHWAYS

In order to allow for the timely implementation of fishways, including effectiveness measures, the Department proposes to reserve its authority by requesting that the Commission include the following condition in any license it may issue for the Project:

> *Pursuant to Section 18 of the Federal Power Act, the Secretary of the Interior herein exercises his authority under said Act by reserving that authority to prescribe fishways during the term of this license and by prescribing the fishways described in section 13 of the Department of Interior's Prescription for Fishways at the American Tissue Hydroelectric Project.*

11 PRELIMINARY PRESCRIPTION FOR FISHWAYS

Pursuant to Section 18 of the Federal Power Act, as amended, the Secretary of the Department of the Interior, as delegated to the Service, hereby exercises his authority to prescribe the construction, operation and maintenance of such fishways as deemed necessary, subject to the procedural provisions contained above.

The Department's Preliminary Prescription for Fishways reflects a number of issues and concerns related to fish restoration and passage that have been raised by KEI (Maine) Power Management (Applicant), Commission staff, state resource agencies, and other parties involved in these proceedings. Fishways shall be constructed, operated, and maintained to provide safe, timely, and effective

passage for river herring (alewife and blueback herring), American eel, American shad at the Licensee's expense.

11.1 UPSTREAM AND DOWNSTREAM PASSAGE

The Licensee will construct, operate, maintain, and periodically test the effectiveness of fishways for sea-run alewife, American shad, blueback herring, and American eel (target species) as described below. The fishways will be designed, constructed, maintained, and operated (which includes Project operations) to safely, timely, and effectively pass the target species upstream and downstream through the zone of passage. Anadromous species will be timely passed at the peak hour of the peak day of their migratory run without material delay or change of fish migratory behavior.

11.2 DESIGN POPULATIONS

The Service does not have an estimate of the American eel carrying capacity of the Cobbosseecontee watershed. Therefore, the Service has not determined a design population for eels that could be expected to use eelways for upstream and downstream passage through the Project.

The Service's design population for sea-run alewife, blueback herring, and American shad is 3.1 million, which is based on MDMR's 2017 alewife production potential calculation (personal communication, Gail Wippelhauser, MDMR, November 6, 2017) plus a margin for blueback herring and American shad.

11.3 FISH PASSAGE OPERATING PERIODS

Fishways shall be operational during the migration windows for target species present. The migratory season for diadromous fish is well known in the major rivers of the Northeast (Facey and Van Den Avyle 1987, page 7; ASMFC 2000, page 8; Saunders *et al*. 2006, page 539; ASMFC 2009, page 9). The season depends on geographic location, water temperature, river flow and other habitat cues. These dates may change based on new information, improved access at the lower dam, and agency consultation. Based on state-wide and Kennebec

River watershed specific data, approved fish passage protective measures shall be operational during the follow migration windows:

a. Downstream alosine adults and juveniles: June 1 – November 30
b. Upstream alosine May 1 to July 31
c. Downstream American eel: August 15 – November 15
d. Upstream American eel: June 1 – September 15

11.4 FISHWAY OPERATION AND MAINTENANCE PLAN

Within 12 months of license issuance, Licensee will prepare and provide to the U.S. Fish and Wildlife Service and resource agencies a Fishway Operation and Maintenance Plan (FOMP) covering all operations and maintenance of the upstream and downstream fish passage facilities in operation at the time. The FOMP shall be submitted to the U.S. Fish and Wildlife Service for review and approval prior to submitting the FOMP to the Commission for its approval. Thereafter, the Licensee will keep the FOMP updated on an annual basis, to reflect any changes in fishway operation and maintenance planned for the year. If the U.S. Fish and Wildlife Service requests a modification of the FOMP, the Licensee shall amend the FOMP within 30 days of the request and send a copy of the revised FOMP to the U.S. Fish and Wildlife Service. Any modifications to the FOMP by the Licensee will require the approval of the U.S. Fish and Wildlife Service prior to implementation and prior to submitting the revised FOMP to the Commission for its approval.

The Licensee shall provide information on fish passage operations, and project generating operations that may affect fish passage, upon written request from the U.S. Fish and Wildlife Service or other resource agencies. Such information shall be provided within 10- calendar days of the request, or upon a mutually agreed upon schedule.

11.5 INSPECTION

The Licensee shall provide U.S. Fish and Wildlife Service personnel, and its designated representatives, access to the project site and to pertinent project records for the purpose of inspecting the fish passage facilities and to determine compliance with the Prescription.

11.6 FISHWAY DESIGN REVIEW

a. The Licensee shall submit design plans to the U.S. Fish and Wildlife Service and other resource agencies for review and approval during the conceptual, 30, 60, and 90 percent design stages. Designs shall be consistent with the 2017 Fish Passage Engineering Design Criteria Manual (USFWS 2017, entire) or updated version.

The Licensee shall adhere to the following design milestone schedule:

b. Conceptual design within 15 months prior to the start of construction of the fishway;
c. 30% design within one year prior to the start of construction;
d. 60% design within nine months prior to the start of construction and a basis of design report (if requested);
e. 90% design within three months prior to the start of construction.

Following approval by the U.S. Fish and Wildlife Service and the other resource agencies, the Licensee shall submit final design plans to the Commission for its approval prior to the commencement of fishway construction activities. Once the fishway is constructed, final as-built drawings that accurately reflect the project as constructed shall be filed with the U.S. Fish and Wildlife Service, the other resource agencies, and the Commission.

11.7 FISH PASSAGE EFFECTIVENESS MEASURES

Effectiveness testing of both upstream and downstream American eel and alosine passage is critical to evaluating the passage success, diagnosing problems, determining when fish passage modifications are needed, and what modifications are most likely to be effective. It is essential to ensuring the effectiveness of

fishways over the term of the license, particularly in cases where the changing size of fish populations may also change fish passage efficiency or limit effectiveness.

The downstream bypass for alosines and the upstream eelway are to be operational no later than two years after license issuance. Effectiveness testing and evaluation plans shall be developed by the Licensee, in consultation with the Service and must be submitted to the Service 3 months after conceptual design are provided. The effectiveness testing and evaluation plans must be reviewed, accepted, and approved by the U.S. Fish and Wildlife Service prior to implementation. The Licensee shall begin implementing effectiveness testing measures at the start of the first migratory season after a fishway is operational and shall conduct quantitative fish passage effectiveness testing and evaluation for a minimum of two years.

The Licensee shall meet annually, in the late fall, with the U.S. Fish and Wildlife Service and the other resource agencies to report on the occurrence of fish passage maintenance and operations, monitoring results, and review the operating plan. Any changes and planned maintenance will be accomplished 30 days prior to the start of the next migratory season.

11.8 DOWNSTREAM ALOSINE PASSAGE

1. The Licensee shall construct a downstream alosine passage system with: (1) a minimum two-foot deep by three-foot wide surface weir that produces gradually accelerating discharge; (2) a flow of approximately 29 cfs to attract and convey migrants over the surface weir without contacting the concrete surface; and (3) the flow through the surface weir shall fall into an adequately-sized plunge pool at the toe of the spillway that then discharges to flowing water in the Project bypass reach. The design, operation, and maintenance shall be consistent with the U.S. Fish and Wildlife Service's 2017 Fish Passage Engineering Design Criteria Manual (USFWS 2017, entire).

2. The Licensee shall install 3/4-inch punchplate to the full length of the trashracks, or less if effectiveness testing shows otherwise, from June 1 through November 30 of each year to prevent post-spawn alosines from entering the penstock intake.
3. The new downstream passage facility shall be operational at least 30 days before the second migratory season after the issuance of a new license. In the interim, the Licensee shall maintain existing downstream measures at the Project. The Licensee shall keep the downstream passage facilities in proper order and clear of trash, logs, and material that would hinder flow and passage.
4. The new downstream facility shall be designed in consultation with the U.S. Fish and Wildlife Service and the other resource agencies, and they will have 30 days to review and comment on the 30%, 60%, and 90% drawings that will be consistent with the Service's 2017 Fish Passage Engineering Design Criteria Manual (USFWS 2017, entire).
5. The Licensee shall conduct effectiveness testing of the new facility. The study plan for effectiveness testing shall be developed in consultation with the U.S. Fish and Wildlife Service and the other resource agencies.
6. The Licensee shall develop an operations and maintenance plan for the facility in consultation with the U.S. Fish and Wildlife Service.
7. All designs and plans will be approved by the U.S. Fish and Wildlife Service prior to them being submitted to the FERC for its approval.

Justification

Dedicated downstream fish passage facilities are necessary to protect migrating diadromous species and may also be used by American eel. This position is based on the factual background that alewife and blueback herring are presently stocked

upstream of the American Tissue Project (KEI 2017a, page 4-30). American eel are present upstream of the project (KEI 2017a, page 4-30). Downstream migrating adult and juvenile alosines, and adult American eel are exposed to project related impacts (Larinier 2001, page 47-53 and 4). Downstream migrating adults and juvenile fish can be protected from project operations that result in injury and mortality (NMFS 2012, page 21). The basic design was discussed at the meeting with the resource agencies and KEI (Maine) on June 1, 2017, which outlined several agreed upon improvements (KEI 2017b, pages 1-4).

11.8 - UPSTREAM ALOSINE PASSAGE

1. Two years after upstream passage for alosines becomes operational at the Gardiner Paperboard Dam, the Licensee shall install an upstream passage facility at the Project to provide safe, timely, and effective passage of alosines. The facility shall be designed to pass a maximum of approximately 3.1 million river herring.
2. The upstream facility shall be designed in consultation with the resource agencies, and the resource agencies shall review the 30%, 60%, and 90% drawings and is to be consistent with the Service's 2017 Fish Passage Engineering Design Criteria Manual (USFWS 2017, entire).
3. The Licensee shall conduct effectiveness testing. The study plan for effectiveness testing shall be developed in consultation with the U.S. Fish and Wildlife Service.
4. The Licensee shall develop an operations and maintenance plan for the facility in consultation with the U.S. Fish and Wildlife Service.

<u>Justification</u>

The Cobbosseecontee Stream once supported runs of diadromous species including alosines. (KEI 2017a, page 4-30). The MDMR's policy is to restore Maine's

native diadromous fishes to their historic habitat. The MDMR has been stocking Pleasant Pond (upstream of the New Mills dam) with adult river herring since 1997 (KEI 2017a, page 4-30). The MDMR has estimated that the lakes and ponds in the Cobbosseecontee watershed could produce approximately 3.1 million river herring (personal communication, Gail Wippelhauser MDMR, November 6, 2017).

11.9 - DOWNSTREAM AMERICAN EEL PASSAGE

1. The Licensee shall continue to use the existing downstream facility (installing the blinding plates and the 7/8-inch punchplate overlay and opening the deep gate at the required time) until further notice. If the existing structure does not pass American eels in a safe, timely, and effective manner, as proposed by recent MDMR studies, the Licensee shall consult with the U.S. Fish and Wildlife Service to design and construct a new downstream eel facility.
2. The Licensee shall continue to install the 3/4- inch, full-length punchplate during the American eel downstream migration period unless a new downstream eel passage facility makes them obsolete.
3. The new facility shall be designed in consultation with the resource agencies, and the resource agencies shall review the 30%, 60%, and 90% drawings and the design is to be consistent with 2017 Fish Passage Engineering Design Criteria Manual (USFWS 2017, entire).
4. The Licensee shall conduct effectiveness testing. The study plan for effectiveness testing shall be developed in consultation with the U.S. Fish and Wildlife Service.
5. The Licensee shall develop an operations and maintenance plan for the facility in consultation with the U.S. Fish and Wildlife Service.

Justification

The existing downstream eelway has been operational since 2003, but it has never been tested to ensure that it provides safe, timely, and effective passage. The MDMR has preliminary data that indicates that the facility is not being used by migrating eels (personal communication, Gail Wippelhauser MDMR, November 6, 2017). The U.S. Fish and Wildlife Service will review Maine Department of Marine Resources' assessment of eel downstream passage at the project, and any other pertinent information, to determine if a new facility will be needed. The U.S. Fish and Wildlife will consult with the Licensee and resource agencies in this process.

11.10 - UPSTREAM AMERICAN EEL PASSAGE

1. The Licensee shall construct, operate and maintain an upstream passage facility for American eel that provides safe, timely and effective upstream passage. This facility shall provide passage from the downstream side of the dam to the American Tissue headpond.
2. This facility shall be operational before the second migration season after the issuance of a new license.
3. The upstream facility shall be designed in consultation with the resource agencies, and the resource agencies shall review the 30%, 60%, and 90% drawings and is to be consistent with the Service's 2017 Fish Passage Engineering Design Criteria Manual (USFWS 2017, entire).
4. The Licensee shall conduct effectiveness testing. The study plan for effectiveness testing shall be developed in consultation with the U.S. Fish and Wildlife Service.
5. The Licensee shall develop an operations and maintenance plan for the facility in consultation with the U.S. Fish and Wildlife Service.

Justification

KEI proposes to design and construct upstream eel passage in consultation with the resource agencies (KEI 2017a, Exhibit E, Section 2.4). We support the licensee's finding that states: "The 2015 monitoring results…..demonstrate that the river left side of the American Tissue dam is likely to be the most effective location install an upstream eel passage system to pass juvenile eel upstream." (KEI 2017a, Exhibit E, Section 4.3.3.1).

Dedicated upstream eel passage is necessary to provide migration to rearing habitat upstream of the Project throughout the migratory season. We base this position on the factual background that upstream migrating juvenile eel were observed at the American Tissue Project (MDMR 2002, page 4; KEI 2017a, page 4-30). Upstream migrating juvenile eels can be effectively passed at hydroelectric projects (Solomon and Beach 2004, entire).