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04333-0021

CARL J. WILSON
COMMISSIONER

August 28, 2026

Debbie-Anne A. Reese, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, DC 20426

Re: Maine DMR notice of intervention, comments, recommendations, and preliminary terms and conditions for the Ripogenus Hydroelectric Project (P-2572) and the Penobscot Mills Hydroelectric Project (P-2458)

Dear Secretary Reese:

On June 29, 2026 the Federal Energy Regulatory Commission (FERC) published its Notice of Application Ready for Environmental Analysis and Soliciting Comments, Recommendations, Terms and Conditions, and Prescriptions for the Ripogenus Hydroelectric Project (P-2572) and the Penobscot Mills Hydroelectric Project (P-2458) on the West Branch Penobscot River in Maine. The Maine Department of Marine Resources (MDMR) is the state agency in charge of managing diadromous fish resources in the state and has been an active participant in the relicensing of the Projects. Enclosed are MDMR's comments, recommendations, and preliminary terms and conditions for the Project pursuant to section 10(j) of the Federal Power Act (FPA). In addition, this letter provides notice pursuant to 18 C.F.R. §385.214(a), as amended that our Agency is requesting intervenor status in this proceeding.

The Department of Marine Resources looks forward to further collaboration with the Licensee on diadromous fish passage at the Ripogenus and Penobscot Mills Projects. Please contact Casey Clark (casey.clark@maine.gov; 207-350-9791) or Lars Hammer (lars.hammer@maine.gov; 207-557-1564) if you have any questions.

Sincerely,

Sean Ledwin

Sean Ledwin, Director
Bureau of Sea Run Fisheries and Habitat

Cc: Sean Ledwin; MDMR
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Table of Contents

1.0 Introduction.....	3
1.1 MDMR Statutory Authority.....	3
2.0 Goals and objectives for the Penobscot River.....	3
2.2 Target species and management objectives	6
2.3 Migration periods for target species.....	8
3.0 Factual background.....	8
3.1 Project descriptions	8
3.2 Project fishways	9
3.3 Historic fisheries resources	9
3.4 Current fisheries resources	10
3.5 American shad.....	10
3.6 American eel	11
3.7 Alewife.....	12
3.8 Atlantic salmon	12
3.9 Blueback herring.....	13
3.10 Sea lamprey.....	14
4.0 Section 10(j) recommendations.....	15
4.1 Proposed fisheries environmental measures supported by MDMR.....	15
4.2 Recommendation #1 Design, install, and operate upstream eel fishways	16
4.3 Recommendation #2: Design, install, and operate new downstream fish passage infrastructure....	17
4.4 Recommendation #3: Species-specific fish passage performance standards for safe, timely, and effective passage at the Project.	19
4.5 Recommendation #4: Fish Passage Effectiveness Testing	22
4.6 Recommendation #5: Implement an adaptive management plan.....	23
4.7 Recommendation #6: Develop and implement a Fishway Operation and Maintenance Plan (FOMP) and Fishway Operation and Maintenance Report (FOMR).....	26
4.8 Recommendation #7: Prevent entrainment and impingement of eels into the Millinocket Lake pumphouse	27
4.9 Recommendation #8: Implement trap-and-transport or alternative diadromous fisheries restoration measures	27
4.10 Recommendation #9: Atlantic Salmon Habitat Access Mitigation and Restoration	28
5.0 References.....	31
6.0 Appendix A. Penobscot River Cumulative Impacts Analysis for American eel	36

1.0 Introduction

The Maine Department of Marine Resources (MDMR) has identified direct and indirect effects on diadromous fishes in and around the Ripogenus (P-2572) and Penobscot Mills (P-2458) Hydroelectric Projects (the Projects). The Projects are owned and operated by Great Lakes Hydro America, LLC (Licensee). Below, we provide our preliminary comments, recommendations, and terms and conditions for the protection of, mitigation of damages to, and enhancement of fish resources pursuant to Section 10(j) of the Federal Power Act. These recommendations are based on the Penobscot River Strategic and Operational Plans for the Restoration of Diadromous Fishes (MDMR and MDIFW 2008, 2009, Penobscot River Plans), state and interstate fisheries management plans and relevant Addenda (including ASMFC 1985; ASMFC 1988; ASMFC 2000), which are FERC Comprehensive Management Plans, studies completed during this licensing proceeding, updated species specific plans and modeling, and consultation with state and federal resource agencies. The recommendations are intended to provide biologically effective, adaptive, and measurable fish passage improvements consistent with the protection, mitigation, and enhancement of fisheries resources under Section 10(j) of the Federal Power Act. Where direct volitional passage (i.e., fishways) may not provide a net biological benefit due to cumulative passage effects, and downstream survival, MDMR's recommendations include alternative measures intended to mitigate Project-related effects on habitat access and diadromous fish production through controlled restoration or other biologically related measures within the Penobscot River watershed.

1.1 MDMR Statutory Authority

MDMR is a cabinet level agency of the State of Maine. MDMR was established to regulate, conserve, and develop marine, estuarine, and diadromous fish resources; to conduct and sponsor scientific research; to promote and develop marine coastal industries; to advise and cooperate with state, local, and federal officials concerning activities in coastal waters; and to implement, administer, and enforce the laws and regulations necessary for these purposes. MDMR is the lead state agency in the restoration and management of diadromous (anadromous and catadromous) species of fishes.

MDMR has been an active participant throughout the licensing process. In 2021, MDMR provided written comments on the Pre-Application Document (PAD) and submitted six study requests¹. In 2024, MDMR submitted comments on the Draft License Application for the project².

2.0 Goals and objectives for the Penobscot River

MDMR's goal is to restore Maine's native diadromous fishes to their historic habitat. The goals and objectives of MDMR are represented in our comments, the Strategic and Operational Plans for the Restoration of Diadromous Fishes to the Penobscot River (MDMR and MDIFW 2008, 2009, Penobscot River Plans) and various state and interstate fisheries management plans and relevant Addenda (ASMFC 1985; ASMFC 1988; ASMFC 2000), the 2019 Atlantic Salmon Recovery Plan, which are FERC Comprehensive Management Plans.

The overarching goal of the Operational Plan is to restore and guide the management of diadromous fish populations, aquatic resources, and the ecosystems on which they depend, for their intrinsic, ecological, economic, recreational, scientific, and educational values for use by the public. The complementary

¹ Accession No. 20211012-5681

² Accession No. 20240801-5092

Strategic Plan defined four strategic goals: 1) coordinating fisheries management activities into a cohesive multispecies management program, 2) providing safe, timely, and effective fish passage (upstream and downstream), 3) maintaining or improving habitat for diadromous and select resident species, and 4) adopting an adaptive, ecosystem-based management program. The Operational Plan outlines a list of Objectives, Measures, and Strategies to accomplish these objectives during a 40- to 50-year timeframe.

The Atlantic States Marine Fisheries Commission (ASMFC) has developed four documents related to the management of American shad and river herring (alewife and blueback herring) and hydropower facilities:

1. Interstate fishery Management Plan for American Shad and River Herrings. October 1985. Atlantic States Marine Fisheries Commission.
2. Amendment 1 to the Interstate Fishery Management Plan for American Shad and River Herring. April 1999. Atlantic States Marine Fisheries Commission.
3. Amendment 2 to the Interstate Fishery Management Plan for American Shad and River Herring. May 2009. Atlantic States Marine Fisheries Commission.
4. Amendment 3 to the Interstate Fishery Management Plan for American Shad and River Herring. February 2010. Atlantic States Marine Fisheries Commission.

The objectives of the ASMFC management plan include:

1. Prevent overfishing of American shad stocks by constraining fishing mortality below 30%.
2. Develop definitions of stock restoration, determine appropriate target mortality rates and specify rebuilding schedules for American shad populations within the management unit
3. Maintain existing or more conservative regulations for hickory shad and river herring fisheries until new stock assessments suggest changes are necessary. This should keep fishing mortality sufficiently low to ensure survival and enhancement of depressed stocks and the maintenance of stabilized stocks.
4. Promote improvements in degraded or historic alosine habitat throughout the species range.
5. State and federal managers should consider the following methods to achieve this objective:
 - a. Improve or install passage facilities at dams and other obstacles to provide upstream passage to historic spawning areas, or remove these obstacles entirely.
 - b. Improve water quality in areas where water quality degradation may have affected alosine stocks.
 - c. Evaluate current fish passage facilities for efficiency.
 - d. Ensure that water withdrawal (e.g., cooling flow, drinking water) effects (e.g., impingement and entrainment mortalities, turbine mortalities) do not affect alosine stocks to the extent that they result in stock declines.
 - e. Evaluate and improve downstream passage for adults and juveniles.
 - f. Promote and coordinate alosine stocking programs for:
 - i. Reintroduction to historic spawning areas.
 - ii. Expansion of existing stock restoration programs.
 - iii. Initiation of new strategies to enhance depressed stocks.
 - g. Promote cooperative interstate research, monitoring, and law enforcement.

ASMFC has also developed five documents related to the management of American eel and hydropower facilities:

1. Interstate Fishery Management Plan for American Eel. April 2000. Atlantic States Marine Fisheries Commission.
2. American Eel Addendum II: Commercial Silver Eel Management. Atlantic States Marine Fisheries Commission. Approved October 23, 2008. 8pp.
3. Addendum III to the Fishery Management Plan for American Eel: Commercial/Recreational Glass, Yellow, and Silver Eel Management. Atlantic States Marine Fisheries Commission. Approved August 2013. 22 pp.
4. American Eel Benchmark Stock Assessment and Peer Review Report. Atlantic States Marine Fisheries Commission. Approved August 2023. 320 pp.
5. Addendum VII to the American Eel Interstate Fishery Management Plan: Commercial Yellow Eel Management and Monitoring Requirements. Approved May 2024. 13 pp.

Objectives of ASMFC management plans include: (1) protect and enhance American eel abundance in all watersheds where eel now occur; and (2) where practical, restore American eel to those waters where they had historical abundance, but may now be absent, by providing access to inland waters for glass eel, elvers, and yellow eel, and adequate escapement to the ocean for pre-spawning adult eel. The ASMFC's American Eel management plans recognize dams and hydropower facilities as important factors affecting eel survival and migration, with Addenda II and III providing clear recommendations for addressing these impacts. Addendum II states that "33,663 dams potentially hinder American eel movement," including "1,511 (4.5 percent)" hydropower dams, and identifies "barriers to upstream and downstream migration" as factors influencing eel populations. The ASMFC "strongly encourages member states and jurisdictions to consider and mitigate factors limiting eel survival" and specifically "requests that member states and jurisdictions request special consideration for American eel in the Federal Energy Regulatory Commission relicensing process," including "improving upstream passage and downstream passage, and collecting data on both means of passage." Addendum III further supports these measures by directing that the Technical Committee to "develop materials to support states or jurisdictions interested in making recommendations to the Federal Energy Regulatory Commission (FERC) for upstream and downstream fish passage provisions for American eels in the hydropower licensing and relicensing process," and to "work with states and jurisdictions to develop a list of non-FERC licensed dams and other impoundments which impact eel movements and migration."

The 2023 ASMFC Benchmark Stock Assessment found that the American eel stock "remains depleted at or near historically low levels" and identified a combination of factors contributing to this condition, including "historical overfishing, habitat loss, food web alterations, predation, turbine mortality, environmental changes, toxins and contaminants, and disease." More specifically, Addendum VII notes that the assessment and peer review recognized that stock status is affected by "habitat loss due to damming mainstems and tributaries of rivers" and "mortality from passing through hydroelectric turbines," in addition to historical overfishing and other factors. In response to the continued decline in yellow eel abundance, Addendum VII reduced the coastwide commercial yellow-eel harvest cap by 43%, from 916,473 pounds to 518,281 pounds, to "reduce coastwide landings of yellow eel." This measure reduces fishing-related mortality while recognizing that fishing is only one of several factors affecting the depleted stock; importantly, Addendum VII does not identify reduced harvest as a substitute for addressing other sources of mortality. Rather, the ASMFC's existing management recommendations continue to recognize dams and hydropower facilities as significant sources of impact, including recommendations for "upstream and downstream fish passage provisions" during FERC hydropower licensing and relicensing and for addressing dams and impoundments that "impact eel movements and migration." Thus, the reduced coastwide yellow-eel cap represents an effort to reduce

one source of mortality while the broader ASMFC management framework continues to support measures to reduce mortality associated with hydropower dams, turbine passage, and barriers to eel migration.

Taken together, these provisions demonstrate that ASMFC has explicitly recognized hydropower dams and other dams as impediments to American eel migration and has recommended special consideration of eel passage, passage-performance monitoring, dam removal where feasible, and improved upstream and downstream passage where removal is not feasible.

2.2 Target species and management objectives

All of Maine's native diadromous species occur in the Penobscot River system. Alewife, American shad, blueback herring, Atlantic salmon, sea lamprey, and American eel occur or historically occurred within or upstream of the Ripogenus and Penobscot Mills Projects.

The Penobscot River Strategic and Operational Plans establish a long-term objective of restoring native diadromous fishes and the ecological functions they provide within the watershed. The Plans contemplate restoration through a combination of safe, timely, and effective fish passage, active management such as trap-and-transport, habitat restoration, and other measures appropriate to individual species and locations. Restoration objectives therefore do not require immediate volitional passage of every species to all historically accessible habitat. Where cumulative passage effects, downstream survival, resident fisheries management, or other biological considerations make volitional passage inappropriate, controlled trap-and-transport or other restoration measures may provide a more effective means of advancing fisheries management objectives.

For American shad, blueback herring, and alewife, MDMR's long-term objective is to restore populations to their historical distribution and productive capacity in the Penobscot watershed. Species-specific production estimates provide useful measures of the biological value and potential production of historically accessible habitat, but they are not intended to establish the number of fish that must presently be passed into the West Branch Penobscot River. Restoration will occur incrementally and may include volitional passage, trap-and-transport, stocking, habitat restoration, or combinations of these measures as biological and management conditions warrant.

For Atlantic salmon, MDMR's objective is to support recovery of the Gulf of Maine Distinct Population Segment by increasing survival, natural production, distribution, and access to productive habitat where doing so provides a net conservation benefit. Atlantic salmon historically occupied the West Branch Penobscot River, which contains a substantial amount of historically accessible and high-value rearing habitat. Under current conditions, however, adults and outmigrating smolts using this habitat would encounter multiple hydroelectric developments, with associated cumulative mortality and migration delay. MDMR therefore does not presently recommend volitional passage or trap-and-transport of Atlantic salmon into the West Branch Penobscot River. This current management determination does not diminish the biological significance of the historically accessible habitat or the effects associated with its continued inaccessibility. Where access to that habitat cannot presently be restored consistent with recovery objectives, restoration or mitigation measures elsewhere in the Penobscot watershed that improve habitat access, survival, production, or resilience can advance Atlantic salmon recovery while providing a more immediate net conservation benefit.

For sea lamprey, the management objective is to increase abundance and distribution within historically accessible habitat and restore the ecological functions provided by this native species. Controlled trap-and-transport may be appropriate where it can restore access to suitable spawning habitat while maintaining agency control over species, numbers, and release locations.

For American eel, the management objective is to increase access to freshwater growth habitat and provide safe downstream passage for outmigrating silver eels. Because American eel likely historically accessed much of the watershed and individuals occupying upper-watershed habitat may make an important contribution to reproductive output, safe, timely, and effective upstream and downstream passage remains an important long-term management objective. MDMR does not currently have a reliable estimate of potential American eel abundance for the habitat associated with these Projects.

Historical Habitat and Potential Production

Historical habitat and production estimates provide context for the magnitude of fisheries resources affected by barriers within the watershed. These estimates characterize the potential biological value of historically accessible habitat; they are not project-specific passage standards, annual trap-and-transport requirements, or predictions of the number of fish that would immediately use this habitat if access were restored.

Available habitat and production estimates indicate that historically accessible habitat associated with the upper West Branch Penobscot River has the potential to support substantial production of native diadromous fishes, including:

- approximately 112,090 adult blueback herring;
- approximately 25,706 adult American shad;
- approximately 1,866 adult Atlantic salmon;
- substantial production and ecological use by sea lamprey, and American eel; and
- unknown production of alewife.

These estimates demonstrate the biological significance of historical habitat access and provide context for evaluating passage, trap-and-transport, and alternative or supplemental restoration and mitigation measures. MDMR does not presently propose to restore these numbers of fish to the West Branch Penobscot River through trap-and-transport. Rather, for alewife, blueback herring, American shad, and, where appropriate, sea lamprey, trap-and-transport is intended to provide a controlled and adaptive means of restoring selected fish to suitable upstream habitats, with species, numbers, release locations, and timing determined in consultation with the resource agencies and coordinated with downstream passage and resident fisheries management. Trap-and-transport may be implemented in combination with other passage, habitat access, barrier remediation, habitat restoration, mortality reduction, or fisheries enhancement measures within the Penobscot River watershed that provide meaningful biological benefits to the same species and populations. Together, these measures can address the loss or impairment of access to historically available habitat without requiring that the full estimated production potential of that habitat be achieved through trap-and-transport alone. Because Atlantic salmon passage into the West Branch Penobscot River is not presently recommended, the estimated salmon production potential similarly provides important context for the conservation value of the inaccessible habitat and for evaluating appropriate Atlantic salmon mitigation and restoration measures elsewhere within the Penobscot watershed.

2.3 Migration periods for target species

The dates below are based on migration periods observed in the Saco, Androscoggin, Kennebec, and Penobscot River and may change based on new information, evaluation of new literature, and agency consultation. Target species are denoted as (A) anadromous or (C) catadromous.

Species	Upstream migration period	Downstream migration period
Atlantic salmon (A)	May 1 – November 10	April 1 – June 15 smolts and kelts October 15 – December 15 kelts
Alewife and blueback herring (A)	May 1 – July 31	June 1 – November 30 adults and juveniles
American shad (A)	May 15 – July 31	June 1 – July 31 adults July 15 – November 15 juveniles
Sea lamprey (A)	May 1 – June 30 (night)	March 1 – June 1 September 1 – December 31
American eel (C)	June 1 – September 15	August 15 – November 15 (night)

3.0 Factual background

3.1 Project descriptions

The Ripogenus project is located on the West Branch Penobscot River in Piscataquis County, Maine. The Ripogenus project consists of a 795-foot-long concrete gravity dam, a 3,850-foot-long tunnel, and a powerhouse known as McKay Station. Ripogenus Dam is a concrete structure with a short earth-filled section on the river left side of the West Branch Penobscot River. The dam is comprised of two spillway sections, an intake structure, gated sections, and earthen embankment. The dam has a maximum height of 83 feet. Water is conveyed through an intake structure and tunnel downstream to McKay Station. The intake structure is protected by trashracks that have a clear spacing of 2-5/8 inches. The powerhouse contains three vertical Francis turbines with an authorized capacity of 37,530 kW and a hydraulic capacity range from 3,400 to 3,500 cfs.

The Penobscot Mills project consists of five developments on the West Branch Penobscot River and Millinocket Stream in Piscataquis and Penobscot Counties, Maine. Developments include four hydropower stations (North Twin, Millinocket, Dolby, East Millinocket; listed upstream to downstream) and one storage facility (Millinocket Lake Storage Development). The Penobscot Mills project has a total authorized capacity of 67.7 MW.

The Millinocket Lake Storage Development consists of a 635-foot-long concrete and earth-filled dam and a pumping station approximately 6.2 miles from the dam. The pumping station is used to pump water from Millinocket Lake into Ambajejus Lake within the North Twin impoundment. Trashracks with 1" clear spacing are located at the pumping station intake. There are no generating facilities associated with the Millinocket Lake project.

The North Twin Development consists of a 1,051-foot-long concrete and earth-filled dam including an intake structure and powerhouse facilities, six earthen dikes upstream of the dam, a substation, and transmission lines. Trashracks are located on the upstream side of the powerhouse intake and have a 2-5/8-inch clear spacing between the bars. The intake conveys water through nine 8-foot-wide by 13-foot-tall water passages equipped with steel headgates that control the flow of water to the turbines. The powerhouse contains three turbines. Units 1 and 2 are fixed-blade units and Unit 3 is a Kaplan turbine. The total rated capacity is 7,012.5 kW with a hydraulic capacity range of 470-4,500 cfs. There are three generators at the development with a total capacity of 9,840 kW.

The Millinocket Development includes a 1,262-foot-long concrete dam (Stone Dam), a gatehouse adjacent to the dam, eight earthen dikes, two canal structures, an intake structure, seven steel penstocks, and a powerhouse. Trashracks are constructed upstream of the penstocks and have a clear spacing of 2-1/2 inches. The powerhouse contains seven operable Francis turbines with a total authorized capacity of 37,193 kW and a hydraulic capacity ranging from 275 to 4,688 cfs.

The Dolby Development consists of a 1,395-foot-long concrete and earth-filled dam, including an intake structure and powerhouse and appurtenant facilities. Trashracks of varying spacing are constructed upstream of the powerhouse. Trashracks for bays 2-4 have a 1-5/8 inch clear spacing while racks for bays 5-8 have a clear spacing of 2-5/8 inches. The intake structure contains nine water passages that currently convey water to four operable turbines. The four turbines (Units 5-8) are located in the powerhouse. Three turbines are of Kaplan design and one is a vertical, fixed blade turbine. The total authorized capacity is 16,513 kW with a hydraulic capacity from 423 to 4,570 cfs.

The East Millinocket Development consists of a 717.5-foot-long concrete and earth-filled dam, including an intake structure and powerhouse. The intake structure contains 12 gate openings that lead to 6 flumes. Trashracks are located immediately upstream of the gate openings and have 1-1/4-inch clear spacing. The powerhouse contains six Francis turbines with a total authorized capacity of 6,975 kW and a hydraulic capacity range from 395-4,200 cfs.

3.2 Project fishways

The North Twin Development includes an upstream pool, weir, and orifice style fishway for the upstream passage of resident fish. Fishway flow is controlled by three gates located upstream of the fishway. An eight-inch gravity pipe provides attraction flow to the fishway entrance.

There are no other fishways in operation at the Ripogenus or Penobscot Mills Projects.

3.3 Historic fisheries resources

Historically 12 species of native diadromous fishes were found in the Penobscot River and its tributaries. American shad ascended as far upstream as the mouth of Wassataquoik Stream on the East Branch Penobscot and near North Twin Lake (Grand Falls or Shad Pond) on the West Branch Penobscot^{3,4,5}. The upstream migratory extent for Alewife and blueback herring is documented as similar to that of

³ Foster, N.W. and C.G. Atkins. 1868b. Reports of the Commissioners of Fisheries of the State of Maine for the Years 1867 and 1868: First Report 1867. Owen and Nash, Printers to the State, Augusta.

⁴ Atkins, C.G. 1870. Fourth Report of the Commissioner of Fisheries of the State of Maine for the year 1870. Owen and Nash, Printers to the State, Augusta.

⁵ Stillwell and Smith 1879

American Shad, indicating that Grand Falls was likely the first natural barrier to migration on the West Branch Penobscot^{6,7}. Accordingly, the hydroelectric developments downstream of these historical limits affect access to substantial areas that formed part of the historical production potential of these species, even where current fisheries management considerations favor controlled restoration rather than unrestricted volitional passage. Atlantic salmon likely migrated further into the East and West Branch Penobscot Rivers, and while the historical distribution of sea lamprey is unknown, it is assumed to be similar to that of Atlantic salmon. The historical distribution of American eels in the Penobscot River is also unknown.

Prior to dam construction, alewife, American shad, blueback herring, Atlantic salmon, and American eel were very abundant in the Penobscot River. However, man-made barriers to passage have been present throughout the Penobscot Watershed for over 200 years. Dams were built on tributaries to the estuary in the late 1700s and the first mainstem dam was built in the Old Town-Milford area in the mid-1820s. Populations of sea-run fish were radically altered in 1834 with the construction of a large dam at Eddington Bend, which was the first to completely block the river and prevented most species from passing upstream.

3.4 Current fisheries resources

The ability of diadromous fish species to migrate to upstream habitat was significantly improved by the implementation of the Penobscot River Restoration Project (PRRP), which resulted in the removal of Great Works Dam in 2013, removal of Veazie Dam in 2014, construction of a fish lift at the Milford Project that became operational in 2014, and decommissioning of the Howland Project and construction of a nature-like bypass that became operational in 2015. In addition, upstream eel passage became available at Milford, Orono, Stillwater, and West Enfield projects in 2008. Recent increases in river herring counts at the Milford Project demonstrate the results of improved upstream passage and MDMR's river herring stocking program that began in 2010. Despite these improvements and resulting increases in sea-run fish abundance, populations remain substantially below their potential abundance, and remaining barriers continue to limit access to historical spawning, nursery, and rearing habitats and the fish production those habitats could otherwise support.

3.5 American shad

The American Shad is a highly migratory, pelagic, schooling species that ranges along the east coast of North America from Newfoundland to Florida (Collette and Klein-MacPhee 2002; Scott and Crossman 1973). American Shad spend most of their lives in the ocean. As adults they return to their natal rivers to spawn, exhibiting low stray rates (3%) and can migrate long distances upstream (CRASC 1992; MDMR and MDIFW 2008; SRAFR 2010). Generally, in river systems with limited barriers, American Shad prefer to spawn in upstream and mid-river segments until energy reserves or water temperatures no longer facilitate spawning (Massmann 1952, Bilkovic et al. 2002). Spawning sites in Virginia were associated with hydrographic parameters (high current velocity, high dissolved oxygen, and shallow depth), physical habitat features (increasing sediment size and woody debris), and the presence of a forested shoreline (Bilkovic et al. 2002). American Shad are broadcast spawners with semi-buoyant eggs, and females will spawn multiple times throughout their annual migration (Hyle et al. 2014,

⁶ Atkins, C.G. 1887. The River Fisheries of Maine. In: Goode, B.G. et al. The Fisheries and Fishery Industries of the United States., Section V, Volume 1, pages 673-728.

⁷ Saunders, R. M. A. Hachey, C.W. Fay. 2006. Maine's Diadromous Fish Community: Past, Present, and Implications for Atlantic Salmon Recovery. Fisheries 31(11):537 - 547.

McBride et al. 2016). Populations of American Shad that spawn north of Cape Hatteras are iteroparous with the repeat spawners ranging from 63-74% in the Connecticut, Saint John, and Miramichi Rivers (Collette and Klein-MacPhee 2002). Repeat spawners are especially important due to higher lifetime fecundity rates and reduced annual variability of spawning stock size (Harris and Hightower 2012). Larvae transform into juveniles 3 to 5 weeks after hatching. Juveniles disperse downstream of the spawning areas, generally staying in a lower portion of the same river for the summer (McCormick et al. 1996). Most juveniles in river systems in the northern Atlantic states will begin their seaward migration when water temperatures are between 18 and 26°C (Marcy 1976, Watson 1970). In the Connecticut, year-class strength is determined during the larval emergence stage and is significantly correlated with mean river discharge, water temperature, and total monthly precipitation (Crecco et al 1983; Crecco and Savoy 1984; Crecco and Savoy 1985).

There is historical habitat for American shad within the Penobscot River. MDMR estimates that there are 231.59 acres of American shad habitat within the West Branch Penobscot River, which could support up to 25,706 American shad⁸. The 2008 Penobscot River Strategic Plan similarly documented historical American shad access to this reach and included a comparable West Branch Penobscot River production estimate of 25,773 adult shad (Mattaceunk Dam to Shad Pond), while noting that the West Branch was not currently targeted for restoration at that time (MDMR and MDIFW 2008). Multiple fish passage improvements have occurred in the Penobscot River Watershed since the development of the 2008 Strategic Plan, including a plan to provide anadromous fish passage above the Mattaceunk Project by 2036. Thus, MDMR is pursuing restoration of anadromous fish species into historical habitat in the West Branch Penobscot River through volitional passage, controlled trap-and-transport, active management, habitat restoration, and other measures as appropriate.

3.6 American eel

The American Eel is a highly migratory, semelparous, facultative catadromous species that spends most of its life in freshwater or estuarine environments and spawns in the ocean (Collette and Klein-MacPhee 2000; Shepard 2015). The species ranges over more than 50 degrees of latitude, being found from the southern tip of Greenland, along the entire eastern coast of North America, around the Gulf of Mexico, and through most of the West Indies (Smith 1989). Spawning occurs in winter and early spring only in a large region of the Sargasso Sea (Kleckner and McCleave 1985; Wippelhauser et al. 1985; McCleave et al. 1987). The eggs hatch and release a long-lived larval stage (leptocephalus) which drift and swim in the upper 300 m of the water column for several months, growing slowly to a length of 5-6 cm (Kleckner and McCleave 1985). Oceanic currents transport the leptocephali to the southwest into the Gulf Stream, which transports them northward along the east coast of the U.S. Somewhere over the continental shelf, the larvae metamorphose into a miniature transparent eel (glass eels). Glass eels actively migrate toward land and freshwater and ascend rivers during the winter and spring by drifting on flooding tides and holding position near bottom on ebb tides (McCleave and Kleckner 1982; Wippelhauser and McCleave 1987) and by actively swimming along shore in the estuaries and above tidal influence (Sheldon and McCleave 1985). When the migrating glass eels become pigmented, they are termed elvers or yellow eels. Depending on where they cease their upstream migration, some yellow eels reach the extreme upper portions of the rivers while others stay behind in the brackish areas (Hardy 1978, Fahay 1978). Eventually yellow eels undergo a final metamorphosis into a silver eel, the adult stage that will migrate to the Sargasso Sea to spawn and die. The timing of the American Eel migrations in Maine is well-known from commercial harvests and MDMR monitoring. The upstream migration of glass eels is

⁸ This number is based on an assumed carrying capacity of 111 American shad per acre of habitat.

considered to occur from March 15- June 15. The upstream migration season for elvers and yellow eels is June 1-September 30. The downstream migration of silver eels broadly occurs from August 15- November 15. Migration mostly occurs at night although glass eels may occasionally move during the day.

American eels have been observed at many of the dams in the Penobscot River Watershed including at the Penobscot Mills⁹ and Ripogenus Projects¹⁰. Trout Unlimited also documented an eel just downstream of McKay Station in 2024. Safe, timely, and effective fish passage is necessary for this species to migrate upstream to freshwater growth habitat and migrate downstream to the sea to spawn. Access to upstream growth habitat may produce a higher proportion of female eels.

3.7 Alewife

The alewife is an anadromous, highly migratory, euryhaline, pelagic, schooling species that historically ranged from South Carolina to Labrador, Nova Scotia, and northeastern Newfoundland (Berry 1964; Winters et al. 1973; Burgess 1978). Alewife and blueback Herring are collectively referred to as river herring because of their similarity in size and appearance. Alewife and blueback herring co-occur throughout much of their respective ranges, but Alewife are typically more abundant than blueback herring in the northern portion of their range (Schmidt et al. 2003). The Alewife spends the majority of its life at sea, returning to freshwater river systems along the Atlantic coast of the United States to spawn. Alewife spawn in lakes and ponds in coastal watersheds (Loesch 1987), in the slow-moving sections of rivers or streams (Jones et al. 1978), in shore-bank eddies or deep pools below the dams (Loesch and Lund 1977). Alewife may ascend long distances in freshwater to reach spawning habitat (O'Connell and Angermeier 1997). Spawning typically is initiated at water temperatures ranging from 5-10°C (Loesch 1987). Alewife are repeat spawners, with some individuals completing seven or eight spawning events in a lifetime (Jessop et al. 1983). The spawning habitat of Alewife can range from sand, gravel, or coarse stone substrates to submerged vegetation or organic detritus (Edsall 1964; Mansueti and Hardy 1967; Jones et al. 1978). Adults migrate downstream soon after spawning. Outmigration of the juveniles is related to declining water temperature (Pardue 1983; Loesch 1987) and changes in water flow, water levels, precipitation, and light intensity (Cooper 1961; Kissil 1974; Richkus 1975; Pardue 1983).

Alewives historically made it to Grand Falls on the West Branch Penobscot River.

3.8 Atlantic salmon

The Atlantic Salmon is a highly migratory, anadromous, iteroparous fish that historically ranged from northeastern Labrador to the Housatonic River in Connecticut (Collette and Klein-MacPhee 2002). Adults may spend several years at sea before returning to their natal rivers to spawn. Adults that return after one year at sea are called “grilse” or “1-sea-winter” fish while individuals that return after two or three years at sea are called “2-sea-winter” or “3-sea-winter” fish, respectively. Adults enter their natal rivers from spring through fall with peak upstream migration from May through mid-July in Maine (NMFS 2012). They spawn in the late fall and will build nests (“redds”) in suitable gravel or cobble substrate (NMFS 2012). The eggs overwinter and hatch between March and April. After the fry emerge from the redd, they disperse to feed, grow, and develop into parr. The parr typically grow for 1-3 years

⁹ Accession No. 20240422-5168

¹⁰ Accession No. 20210611-5071

in freshwater before undergoing a physiological transformation (smoltification) after which the smolts migrate to the ocean in the early spring (NMFS 2012).

Atlantic salmon are a federally endangered species. The project area is within the Gulf of Maine Distinct Population Segment (GOM DPS) and is within designated critical habitat for the species. Extensive efforts have been made to restore Atlantic salmon to the Penobscot River, including targeted stocking, broodstock collection, improvements to fish passage, and restoration activities. The Penobscot River now has the largest run of Atlantic salmon in Maine, averaging 1,084 individuals per year over the last five years (2021-2025). From 2015 to 2025, 10,811 Atlantic salmon have been captured at the Milford fishway and have been passed upstream or have been trucked to an off-site hatchery for use as broodstock.

The West Branch Penobscot River also represents a substantial historically accessible component of Penobscot Atlantic salmon habitat. Habitat assessments have estimated approximately 28,000 Atlantic salmon rearing habitat units in the West Branch Penobscot River, or roughly 28 percent of the potential rearing habitat in the Penobscot drainage, and more recent analyses identify the West Branch Penobscot River as containing a substantial share of the watershed's high-value salmon habitat. At the same time, Atlantic salmon reaching and leaving the West Branch Penobscot River would encounter multiple hydroelectric developments, and cumulative passage mortality and migration delay can materially reduce survival. NMFS dam-impact modeling has therefore emphasized the tradeoff between access to higher-quality upper-watershed habitat and cumulative dam-related mortality. The Medway Project is currently the first dam controlling access to the West Branch Penobscot River. Under the existing Atlantic Salmon Species Protection Plan and the 2012 NMFS Biological Opinion applicable to Medway and other lower Penobscot projects, the Licensee is required to consult periodically with NMFS and other resource agencies regarding Atlantic salmon recovery objectives. In 2023, NMFS advised that, because the West Branch Penobscot River is not designated critical habitat, operation of Medway without upstream salmon passage remained consistent with then-current recovery objectives. Accordingly, MDMR is not recommending volitional upstream passage of Atlantic salmon into the West Branch Penobscot River at this time. This current management determination does not diminish the conservation significance of the historically accessible habitat above Medway or the potential value of that habitat under future recovery and climate conditions.

Thus, the present decision not to restore volitional salmon passage to the West Branch Penobscot River reflects a biological judgment concerning cumulative passage mortality and current recovery priorities; it should not be interpreted to mean that loss or impairment of access to this substantial historically accessible habitat has no biological consequence. Where restoring access itself would presently create an unfavorable survival tradeoff, conservation measures elsewhere in the Penobscot watershed that increase access to productive habitat, improve habitat quality, or reduce mortality can provide a more immediate net recovery benefit.

3.9 Blueback herring

The blueback herring is an anadromous, highly migratory, pelagic, schooling fish found along the east coast of North America from Cape Breton, Nova Scotia and the Bay of Fundy watershed, New Brunswick, to Florida in the United States (Scott and Crossman 1973; Collette and Klein-MacPhee 2002). Blueback herring and Alewife are collectively referred to as river herring because of their similarity in size and appearance. Blueback herring spend most of their lives in the ocean and as adults they return to their coastal rivers to spawn. In the portions of their range where blueback herring and alewife co-occur, blueback herring prefer to spawn over hard substrates in swift current (Loesch and Lund 1977; Johnston and Cheverie 1988). Blueback herring will ascend freshwater far upstream

(Massmann 1953; Davis and Cheek 1966; Perlmutter et al. 1967; Crecco 1982); their distribution is a function of habitat suitability and hydrological conditions, such as swift flowing water (Loesch and Lund 1977). Spawning occurs at temperatures ranging from a minimum of 13°C (Hawkins 1979; Rulifson et al. 1982) to a maximum of 27°C (Loesch 1968). Blueback herring are repeat spawners and there appears to be an increase in repeat spawning from south to north (Rulifson et al. 1982). In Nova Scotia, 75% of adults in Nova Scotia had previously spawned (O'Neill 1980). Juvenile blueback herring spend three to nine months in their natal rivers before migrating to the ocean (Kosa and Mather 2001).

There is historical habitat for blueback herring within the Penobscot River. MDMR estimates that there are 231.59 acres of blueback herring habitat in the West Branch Penobscot River, which could be capable of supporting up to 112,090 blueback herring¹¹. Unlike alewife and American shad, the Strategic Plan states that blueback herring's historical distribution in Maine "is not well documented," assumes it corresponds to American shad's distribution, and expressly notes that "no estimate of unit production for blueback herring", and therefore no Penobscot-basin total production estimate, was available (MDMR and MDIFW 2008). MDMR assumes a production potential of 484 adults/acre based on estimates from other systems in Maine.

3.10 Sea lamprey

The Sea Lamprey is an anadromous, semelparous, species that ranges in the western Atlantic Ocean from the St. Lawrence River in Canada to the State of Florida in the United States (Scott and Crossman 1973; Collette and Klein-MacPhee 2002). Unlike the other diadromous species native to Maine, there is evidence that Sea Lamprey do not home to their natal river system (Hansen et al. 2016). They spawn in gravel-cobble substrate, and the spawning process results in streambed modification and sediment transport (Nislow and Kynard 2009; Sousa et al. 2012; Hogg et al. 2014). Lamprey spawning activities condition the habitat for other species, including Atlantic Salmon, by removing fines and reducing substrate embeddedness (Kircheis 2004). Given the high degree of embeddedness in Maine streams due to past land use practices, the role of lamprey as "ecosystem engineers" is particularly important (Kircheis 2004; Sousa et al. 2012). Sea Lamprey spawning in Maine begins in late May and extends into early summer and peaks at water temperatures of 17-19°C (Kircheis 2004). Sea Lamprey metamorphose as juveniles and swim downstream to feed in the ocean in the late fall and spring (Kircheis 2004). General movement is thought to occur at nighttime and during high flow events (Kircheis 2004).

There is limited information related to sea lamprey in the Penobscot River. Counts of sea lamprey at the Milford dam on the Penobscot River have averaged 2,931 fish since the facility opened in 2014. The lowest count was recorded in 2015 (485) and the highest in 2022 (6,624). Safe, timely, and effective passage for the species, particularly at night, is important to allow adults to access upstream spawning habitat and for juveniles to pass downstream to growth habitat in the ocean.

Because sea lamprey do not exhibit the same degree of natal homing as many anadromous fishes, controlled trap-and-transport to suitable upstream spawning habitat may be particularly compatible with the species' life history and can also provide ecosystem benefits through marine-derived nutrient delivery and spawning-related habitat conditioning.

¹¹ This number is based on an assumed carrying capacity of 484 blueback herring/acre, which has been used in other systems in Maine.

4.0 Section 10(j) recommendations

Section 10(j) of the FPA requires that each license issued for a hydropower project contain conditions to adequately and equitably protect, mitigate damages to, and enhance fish and wildlife affected by the development, operation, and management of a project (16 U.S.C. § 803(j)). Therefore, each license issued shall include such conditions, based on recommendations of the U.S. Fish and Wildlife Service, National Marine Fisheries Service (Services), and state fish and wildlife agencies. MDMR is submitting 10(j) fisheries recommendations that are based upon our enabling legislation, the goals and objectives for the Penobscot River, and information developed during the licensing proceeding in consultation with other resource agencies and the Licensee. Our recommendations assume License issuance in May 2028, consistent with the Licensee's FLA Amendment.

MDMR has sought to tailor these recommendations to the biological effects of the Projects. Where construction of volitional passage is presently warranted, MDMR recommends passage measures. Where immediate volitional anadromous passage is not presently warranted because of cumulative survival effects, resident fisheries management, or other biological considerations, MDMR recommends controlled restoration or other measures with a demonstrated nexus to the affected fish resources and Project-related loss or impairment of habitat access.

The objective of these recommendations is to provide safe, timely, and effective passage and protection for target diadromous species consistent with current Penobscot River restoration and fisheries management objectives. The engineering measures recommended below represent the minimum modifications currently supported by the available biological studies, hydraulic analyses, and engineering evaluations to achieve those objectives.

These measures are directed at effects of Project structures and operations on migration, entrainment, injury, mortality, and access to habitat. The phased schedules and adaptive provisions are intended to address those Project effects while recognizing site-specific engineering constraints, the Licensee's proposed measures, and the need to coordinate diadromous fish restoration with MDIFW's management of resident fisheries.

4.1 Proposed fisheries environmental measures supported by MDMR

The Licensee has proposed measures related to American eel passage at the project including an Operations Compliance Management Plan, and infrastructure improvements. MDMR appreciates inclusion of these items in the Licensee's proposal. While MDMR is supportive of specific components of some of these measures, we are not supportive of the measures as written in the Final License Application. We include components of the proposed measures in our own recommendations below. MDMR considers the recommendations below as an integrated package. The recommended schedules, design measures, performance standards, effectiveness testing, adaptive management, and operation and maintenance requirements work together to address project effects over the term of the licenses. If a recommended measure is materially modified or replaced, the remaining measures should be reevaluated as necessary to ensure that the overall package continues to provide equivalent protection, mitigation, and enhancement for affected diadromous fish resources. This is particularly important where MDMR is not presently recommending construction of volitional anadromous upstream passage and instead relies upon controlled trap-and-transport or alternative restoration measures to address habitat-access and production effects.

4.2 Recommendation #1 Design, install, and operate upstream eel fishways

1. The Licensee shall design and install upstream eel fishways at each of the projects to be operational on the following schedule:
 - a. East Millinocket Dam: operational within two years of license issuance
 - b. Dolby Dam: operational within two years of license issuance
 - c. Millinocket Lake Dam: operational within two years of license issuance
 - d. Stone Dam: operational within four years of license issuance
 - e. North Twin Dam: operational within four years of license issuance
 - f. Ripogenus Dam: operational within eight years of license issuance
2. The Licensee shall submit design plans to MDMR and other resource agencies for review and concurrence during the 30%, 60%, and 90% design stages. Design milestones shall be considered complete once the design and agency approvals are submitted to FERC. Designs shall be consistent with information collected during upstream eel relicensing studies and with the 2019 Fish Passage Engineering Design Criteria Manual (USFWS 2019) or an updated version.
3. The Licensee shall operate and maintain the upstream fish passage facilities to pass American eels in a safe, timely, and effective manner consistent with the performance standards identified in Recommendation #3.

Justification

The Licensee proposed installing eel passage at three of the developments within two years (East Millinocket and Dolby) or five years (Millinocket Lake). While we support the timelines proposed for East Millinocket and Dolby, the available information does not support delaying installation at Millinocket Lake until year five. In addition, MDMR believes upstream eel passage is warranted at the other developments of the Penobscot Mills Project and the Ripogenus Project.

American eels have been found above all the developments related to the Ripogenus and Penobscot Mills Hydroelectric Projects historically and during relicensing studies. Providing safe, timely, and effective passage at each development is crucial to restore American eel populations to their historical habitats. MDMR appreciates the complexity of both Hydroelectric Projects, and that it is unreasonable to recommend design and installation of new upstream eel fishways at all 6 developments simultaneously. Thus, MDMR is recommending a phased approach to provide safe, timely, and effective passage at all the projects on reasonable timelines. Upstream eel passage is typically not difficult to design, and new facilities are often operational within two years. We recommend implementation of upstream eel passage within two years at the East Millinocket, Dolby, and Millinocket Lake developments based on the numbers of eels observed at these projects during nighttime surveys and the need to phase design and implementation across six projects. After those three facilities have been designed and implemented, we recommend an additional two years to design and implement passage at Stone Dam and North Twin Dam. Passage at these locations will allow for continued restoration of American eel populations into upstream habitats. We recommend upstream eel passage be implemented in year eight at the Ripogenus Project based on the potential complexity of passage at the dam. As stated in the project description, the Ripogenus Project has a maximum height of 83 feet. That factor as well as the geographic separation between McKay Station and the Dam may make eel passage more complex at this project. Despite potential complexities, safe, timely, and effective upstream eel passage at this project is important given the vast amount of habitat located upstream of the project (Appendix A).

4.3 Recommendation #2: Design, install, and operate new downstream fish passage infrastructure

1. The Licensee shall design, install and operate new downstream fish passage facilities for American eel at the Projects. Facilities at the East Millinocket and Dolby Dams shall also provide safe, timely, and effective downstream passage for alosine species. Fish passage facilities shall become operational in alignment with the following schedule:
 - a. Millinocket Lake Dam: operational within two years of license issuance
 - b. East Millinocket Dam: operational within four years of license issuance
 - c. Dolby Dam: operational within four years of license issuance
 - d. Stone Dam/Millinocket Station: operational within six years of license issuance
 - e. North Twin Dam: operational within six years of license issuance
 - f. Ripogenus Dam: operational within fourteen years of license issuance
2. The Licensee shall submit design plans to MDMR and other resource agencies for review and concurrence during the 30%, 60%, and 90% design stages. Design milestones shall be considered complete once the design and agency approvals are submitted to FERC. Designs shall be consistent with information collected during upstream eel relicensing studies and with the 2019 Fish Passage Engineering Design Criteria Manual (USFWS 2019) or an updated version.
3. Unless alternative designs receive MDMR concurrence, downstream passage infrastructure at hydroelectric projects shall exclude migrants from the turbines and provide effective guidance to low-level and surface bypasses (i.e., full depth 0.75-inch angled or inclined rack structures with associated bypasses) or utilize “fish-friendly” turbines to provide downstream passage.
4. The Licensee shall operate and maintain the downstream fish passage facilities for diadromous species to provide safe, timely, and effective downstream passage consistent with the performance standards described in Recommendation #3 .
5. From license issuance through the operational date of new downstream passage infrastructure, the Licensee shall implement interim nighttime shutdowns at the East Millinocket, Dolby, Millinocket, and North Twin Developments. Nighttime shutdowns shall occur from dusk (1/2 hour after sunset) to dawn (1/2 hour before sunrise) from August 15 to November 15 to reduce impacts on American eel during their downstream migration.

Justification

The Licensee has proposed installing downstream fish passage measures at the Dolby and East Millinocket Projects within 20 years of license issuance. However, the available information does not support such a delay or foregoing installation of downstream eel passage measures at the Ripogenus Project and other developments in the Penobscot Mills Project. As described in the Licensee’s FLA, American eels have been observed within the project area since at least 2004, and it is likely that they have been present but undetected for a longer time period. As noted by the Licensee, American eel age at outmigration varies widely, and has been estimated from 6-18 years in Maine Rivers (Shepard 2015; ASMFC 2012). Thus, many eels observed in 2004 may have already outmigrated and upstream migrants in the years since 2004 will also be maturing and or starting their outmigration in the coming years. The observation of over 2,000 eels during relicensing studies at the Projects provides a snapshot of annual passage numbers. However, MDMR notes that this is likely an underestimate of absolute abundance given the scale of sampling efforts. Thus, it is likely that thousands of American eels have passed upstream of many of the developments since 2004. As such, downstream protections should be constructed as soon as practicable. MDMR typically recommends four years for design and installation of comprehensive downstream measures at hydroelectric projects. Here, where downstream passage is required at six locations, we recommend a phased approach. Downstream passage at Millinocket Lake will likely be straightforward given the lack of hydropower turbines at the development. MDMR

anticipates that downstream passage solutions may consist of operational or minor structural measures that can be designed and implemented within two years of license issuance. For East Millinocket and Dolby, we recommend downstream passage be implemented within four years of license issuance. Design of downstream passage facilities at Stone Dam and North Twin dam can reasonably occur during construction of measures at East Millinocket and Dolby, so we recommend facilities be operational at Stone and North Twin within six years after license issuance. At Ripogenus Dam, MDMR recognizes that no eels have been observed in the impoundment in recent years and that actual abundance is likely low given the height and magnitude of the Ripogenus Dam. Thus, we recommend downstream passage at Ripogenus dam fourteen years after license issuance (six years after upstream passage is available at Ripogenus). While we agree with the Licensee that eels further upstream in a watershed typically mature at an older age, age at outmigration has not been specifically quantified above the Ripogenus dam. Thus, we recommend a conservative approach to install downstream passage at the Project in time to protect any migrants that may be moving downstream six years after passing upstream of the project.

While MDMR remains open to alternative methods, full depth 0.75-inch angled or inclined racks and associated low-level and surface bypass structures or “fish friendly” turbines are likely to be comprehensive solutions to provide safe, timely, and effective passage for species at the projects. The 0.75-inch rack approach would meet USFWS design criteria and is the recommended approach for eel passage specifically. “Fish Friendly Turbines” are a developing technology that show promise as a solution to provide safe, timely, and effective passage. This technology has been proposed at the West Enfield project, where modeling has indicated that high survival can be achieved for all species¹². At Millinocket Station/Stone Dam, solutions should either prevent entrainment into Ferguson Lake at Stone Dam or provide safe, timely, and effective downstream passage at Millinocket Station. Where fish-friendly turbines or another alternative to physical exclusion and bypass is proposed, the design should be supported by site-specific engineering and biological information demonstrating a reasonable expectation that the applicable performance standards will be achieved. Continued use of the alternative should be contingent on post-installation effectiveness testing, with operational or structural fallback measures implemented through Recommendation #5 if the standards are not met.

Downstream protective measures will take time to implement (e.g., six years for North Twin and Stone Dam), and eels will continue to experience negative project effects during that time without interim protections. MDMR recommends nighttime shutdowns from dusk to dawn from August 15 to November 15 as an interim protective measure for downstream migrating eels. This timeline is informed by decades of biological observations and research demonstrating that downstream migration of eels in Maine rivers begins as early as mid-August and continues through the fall in response to declining water temperatures, increased river discharge, and lunar cues¹³. MDMR’s monitoring and management programs similarly recognize that adult American eels emigrate from Maine waters during the late summer and fall, generally from August through November, and this period has formed the basis for MDMR’s recommendations for interim protections for downstream migrating eels. MDMR’s recommended operational period for this interim measure is consistent with findings adopted by the Federal Energy Regulatory Commission (FERC) in multiple hydropower licensing proceedings. In the

¹² Accession No. 20260706-5179

¹³ Haro, A., T. Castro-Santos, J. Noreika, and M. Odeh. 2003. Swimming performance of upstream and downstream migrating fishes in relation to fish passage design.

Weaver, D.M., D.B. Sigourney, et al. 2021. Characterizing Downstream Migration Timing of American Eels Using Commercial Catch Data in the Penobscot and Delaware Rivers. Marine and Coastal Fisheries.

Environmental Assessment for the American Tissue Hydroelectric Project (P-2809) FERC concluded that “the downstream migration period for American eel begins as early as mid-August” and determined that downstream protective measures should begin on August 15 to reduce turbine-related injury and mortality of the earliest migrating eels and continue through November 15¹⁴. This migration window has since been incorporated into numerous Maine hydropower licenses, including the Milford Project on the Penobscot River, and is further supported by telemetry studies conducted in the Penobscot River that document migration occurring during late summer and fall and being strongly influenced by seasonal environmental conditions¹⁵. The Ripogenus Project is excluded from this interim requirement only until upstream eel passage becomes operational. Beginning with the first downstream migration season after upstream eel passage is opened at Ripogenus, the Licensee shall implement comparable interim downstream protection at Ripogenus until permanent downstream passage measures become operational.

4.4 Recommendation #3: Species-specific fish passage performance standards for safe, timely, and effective passage at the Project.

1. The Licensee shall design and operate the Project’s fish passage facilities to meet, and shall test against the species-specific performance standards recommended by MDMR below.

a. Alewife –

i. For downstream passage: at least 95% of the adult and juvenile alewives that approach within 200 m of the Project’s powerhouse pass the project malady-free within 24 hours and survive.

b. American shad –

i. For downstream passage: at least 95% of the adult and juvenile American shad that approach within 200 m of the Project’s powerhouse pass the project malady-free within 24 hours and survive.

c. American eel –

i. For downstream passage: at least 95% of the adult eels that approach within 200 m of the Project’s powerhouse pass the project malady-free within 24 hours and survive.

ii. For upstream passage: at least 90% of eels that approach the Project are attracted to the vicinity of the eelway and pass upstream within 24 hours.

d. Blueback herring –

i. For downstream passage: at least 95% of the adult and juvenile blueback herring that approach within 200 m of the Project’s powerhouse pass the project malady-free within 24 hours and survive

2. Performance standards are subject to revision based on development of new modeling approaches, river-specific scientific and technical information, and inclusion of additional habitat in species-specific models. As a state agency responsible for developing and carrying out diadromous fish management plans on the Penobscot River, MDMR must concur with any revision of performance standards at the project.

Justification

¹⁴ FERC. 2007. Environmental Assessment for the American Tissue Hydroelectric Project (FERC Project No. 2809). Washington, D.C.

¹⁵ Mensinger, M.A., E.J. Blomberg, and J.D. Zydlewski. 2021. The consequences of dam passage for downstream-migrating American eel in the Penobscot River, Maine. Canadian Journal of Fisheries and Aquatic Sciences 78:1227–1238.

Diadromous fish species require safe, timely, and effective access to high-quality habitats at different life stages to successfully survive and reproduce. Hydroelectric projects often prevent or delay migrations or cause injury or mortality that contribute to population declines. These adverse impacts can be mitigated by properly designed fishways, however many fishways fail to perform as intended, including fishways developed and operated utilizing USFWS Fish Passage Design Criteria (USFWS 2019). When there are a series of fishways within a migration corridor for diadromous species, such as in the Penobscot River Watershed, the risks increase that one or more underperforming fishways will result in significant cumulative negative impacts to these fish populations. This potential for cumulative impacts creates the need for highly effective fish passage at each of the dams that meet agency design and performance standards.

To ensure that minimum restoration goals for the Penobscot River are met, the new fish passage facility at the Ripogenus and Penobscot Mills Projects and the facilities at other hydropower projects that will undergo relicensing within the next decade will need to be tested for their effectiveness in passing the target species. In a report that analyzed mitigation (fish passage) at hydropower projects, the Federal Energy Regulatory Commission (FERC 2004) acknowledged the impacts of hydropower projects on fish populations and the importance of testing the effectiveness of fish passage facilities and also recognized the use of modeling tools for assessing management actions and fish passage improvements at multiple projects.

In the Environmental Analysis of three recent relicensing proceedings¹⁶, the Commission did not support recommendations made by the resource agencies for effectiveness testing of all new fish passage facilities. One reason FERC did not support effectiveness testing was the lack of specific performance standards by which the effectiveness testing could be evaluated. Therefore, MDMR has developed species-specific performance standards for diadromous fish species at the Ripogenus and Penobscot Mills Projects as described below.

Alosines (American shad, alewife, blueback herring)

MDMR has utilized the anadromous life history model (Stich et al. 2025) to develop species- and river-specific fish passage performance standards for American shad, alewife, and other diadromous species at the Penobscot Mills Project and throughout the watershed. This tool applies the best available scientific information to evaluate population-level responses to varying upstream and downstream passage effectiveness rates at dams within a river system. A peer-reviewed manuscript authored by MDMR, NOAA, and SUNY Oneonta demonstrated the utility of the anadromous model for developing biologically meaningful performance standards for American shad at hydroelectric projects in Maine rivers, including the Penobscot watershed (Hammer et al. 2026). These performance standards are directly tied to achieving MDMR's species-specific management objectives for each alosine species as identified in section 2.2

Modeling results indicate that achieving management objectives for alosine species in the river requires high fish passage performance. For all alosine species, downstream passage needs to be 95% to achieve management goals in upstream habitat for the species. High upstream passage is also required, but

¹⁶ American Tissue FERC No. 2809-034; Barker Mills FERC No. 2808; Ellsworth FERC No. 2727-092.

MDMR is not recommending upstream passage facilities for anadromous species at the Penobscot Mills or Ripogenus Projects at this time.

This approach is consistent with the Penobscot River Strategic Plan for the Restoration of Diadromous Fishes (MDMR and MDIFW 2008), developed jointly by MDMR and MDIFW. The Strategic Plan's Goal 2 objectives for safe and effective upstream and downstream passage were scoped to specific mainstem, Piscataquis, and lower projects (through Mattaceunk, Dover-Foxcroft, and Guilford) and did not extend to the Penobscot Mills or Ripogenus Projects; its Table 8, identifying species to be passed at hydropower projects, likewise ends at the Medway Project. As a 2008-era table, this reflects the State's original sequencing and management intent rather than a permanent biological conclusion, but it shows that today's recommendation continues, rather than departs from, the Strategic Plan's approach. The Strategic Plan further contemplated that restoration could be accomplished through volitional passage, trap-and-transport of adult fish to selected river reaches, stocking, or combinations of these measures, and it directed evaluation of operational modifications that may selectively restrict passage of undesirable species, the same tools reflected in the trap-and-transport approach and MDIFW coordination described below.

MDMR recognizes MDIFW's management interests in fisheries upstream of these developments and believes that restoration of anadromous species to appropriate West Branch Penobscot River habitats should proceed collaboratively with MDIFW and the Licensee. In the near term, a Licensee-supported trap-and-transport program from the Medway Project may provide an appropriate means of restoring selected native diadromous species to suitable upstream habitats while allowing the resource agencies to manage species, numbers, release locations, and timing. Any program implemented as project mitigation should be developed in consultation with MDMR, MDIFW, USFWS, and NMFS and should identify capture and handling methods, release locations and numbers, monitoring, and responsibilities for implementation. Nothing in this recommendation is intended to foreclose consideration of additional or alternative upstream passage measures during the license term if warranted by future biological information, management objectives, or changes in passage conditions.

In addition to passage effectiveness, migration delay represents a significant limitation to successful population restoration and growth. Minimizing project-related delay during both upstream and downstream migrations is therefore necessary to achieve management goals for these species. This controlled approach is particularly appropriate because Medway is presently the first dam at which the agencies must decide whether and which anadromous fishes should enter the West Branch Penobscot River. Trap-and-transport preserves agency control over species composition and numbers, prevents inadvertent introduction of undesirable species, and allows restoration benefits to be targeted to habitats where adequate downstream protection exists.

American eel

American eels are present within the Penobscot River and likely accessed the entire watershed historically. River reaches high in the watershed are more likely to produce mature female American eels because females are more common in upland areas and in areas of lower eel density (Krueger and Oliveira 1999; Oliveira and McCleave 2000). Like anadromous species, the abundance of American eel has declined from historical levels due in part to dams, overfishing, and poor water quality. The species has been considered for listing under the Endangered Species Act twice, but the USFWS determined in both cases that listing was not warranted at the time. States manage their American eel fisheries collaboratively through the Atlantic States Marine Fisheries Commission, which periodically conducts

stock assessments or stock updates on all managed species. According to the 2023 stock assessment, the American eel population remains depleted in U.S. waters¹⁷. The stock is at or near historically low levels due to a combination of factors including turbine mortality, a direct project impact. The stock assessment also points to predation and disease as additional impacts that contribute to near historically low levels. Specific to hydro project, reduction or delay in upstream passage of American eels has been shown to lead to reduced growth and condition, increased parasite loads and mortality due to competition and predation (Machut et al. 2006, 2007). Considering that eels high in the watershed (i.e., those that experience the greatest number of dams) are likely to be egg-bearing females, ensuring effective upstream passage and safe downstream passage throughout the watershed is highly important.

MDMR recommends an upstream performance standard of 90% passage within 24 hours. This criterion has been developed by USFWS and MDMR and has been used to assess multiple eelways in Maine rivers¹⁸. A 90% upstream passage standard is incorporated into the license for the Mattaceunk Project on the Penobscot River, and the Anson and Abenaki licenses on the Kennebec River. A similar standard is also included in the Connecticut River American Eel Management Plan¹⁹. Thus, this standard is consistent with eelway performance and evaluation on many river systems in the region.

MDMR recommends a downstream performance standard of 95% based on several similar standards at other projects throughout New England and mid-Atlantic regions of the U.S. These include: (1) 95% project survival for eels in the Connecticut River²⁰; (2) 95% downstream passage survival for each project on the Merrimack River²¹; and (3) 95% downstream survival for dams on the Naugatuck River in Connecticut²². The USFWS has also noted that numerous other FERC-licensed projects require similar downstream passage standards for eels^{23,24,25}.

MDMR's recommended downstream passage standard is also informed by a cumulative impacts analysis conducted by MDMR for the Penobscot River Watershed (Appendix A).

Highly effective upstream and downstream passage is needed to achieve management goals for all species in the Penobscot River. High performance standards reflect the reality of attempting to pass fish above multiple successive hydroelectric dams in a watershed. Each dam impacts fish during their upstream and downstream migrations and thus, high performance is needed at each facility to achieve management goals.

4.5 Recommendation #4: Fish Passage Effectiveness Testing

1. The Licensee shall develop fish passage effectiveness testing plans for adult and juvenile alosines (alewife, blueback herring, and American shad), and American eel in consultation with MDMR and

¹⁷ Atlantic States Marine Fisheries Commission. (2023). American Eel benchmark stock assessment and peer review report. Atlantic States Marine Fisheries Commission.

¹⁸ FERC No's. 2555, 2556, 2364, 2365, 2611, 2574, 2322, 2325, 5073, 2942, 2984, 2931, and 2932

¹⁹ CRASC. 2023. Connecticut River American Eel Management Plan.

²⁰ CRASC. 2023. Connecticut River American Eel Management Plan.

²¹ Merrimack Technical Committee. 2021. Merrimack River Comprehensive Plan for Diadromous Fishes. The Technical Committee for the Anadromous Fishery Management of the Merrimack River Basin. 180 pp.

²² CTDEEP. 2022. The plan to restore diadromous fishes to the Naugatuck River watershed. Connecticut Department of Energy and Environmental Protection, Bureau of Natural Resources, Fisheries Division. October 2022.

²³ FERC Nos. 2355, 1888, 3472, and 2955.

²⁴ SRARFC. 2013. American Eel Restoration Plan for the Susquehanna River Basin.

NYSDEC. 2024. Fisheries Management Plan for the Impounded Portion of the Upper Hudson River.

²⁵ Accession Number: 20030729-3001 and 20030807-0326. Article 406 requires a 90% standard for permanent facilities.

other resource agencies. After MDMR concurrence with the study design, the Licensee shall file the final study plan with FERC for approval. The Licensee shall begin implementing effectiveness testing at the start of the first migratory season after a fishway is operational and shall conduct quantitative fish passage effectiveness testing and evaluation for up to two years. If after one year of testing, it would be statistically impossible to meet a particular performance standard, the Licensee shall move straight to adaptive management measures as defined in Recommendation #5 and advance the timeline for adaptive management measures to be one year earlier.

2. All monitoring shall adhere to scientifically accepted practices including:

- a. Downstream anadromous passage – radio/acoustic telemetry or equivalent study methods (route of passage) and Hi-Z or equivalent study methods (injury/survival),
- b. Upstream eel passage – nighttime surveys (attraction effectiveness) and mark-recapture methods (e.g., PIT or VIE tags; internal effectiveness), and
- c. Downstream eel passage – radio/acoustic telemetry or equivalent study methods (route of passage and seasonality of migration [in-basin eels]) and Hi-Z or equivalent study methods (injury/survival).

3. The Licensee shall prepare reports of the monitoring studies to MDMR and other resource agencies for a minimum 30-day review and consultation prior to submittal to FERC for final approval.

Justification

Fishways need to be tested to ensure they are constructed, operating and functioning as intended, and whether improvements are needed to ensure safe, timely and effective passage is provided. MDMR has provided performance standards for multiple species, which will be used to interpret the results of testing to understand whether facilities provide safe, timely, and effective passage. MDMR recommends standard, scientifically accepted methods to conduct these studies.

Effectiveness studies should be designed to distinguish attraction, entrance, passage route, delay, injury, and survival to the extent applicable to each species and facility. Study designs should include sufficient sample sizes and measures of uncertainty to determine whether the applicable performance standards have been achieved and to identify the location and cause of any deficiency that requires corrective action.

4.6 Recommendation #5: Implement an adaptive management plan

Upstream Passage -

1. Effectiveness testing and adaptive management for upstream eel passage shall proceed on a development-specific basis in accordance with Recommendation #4 and the operational schedule in Recommendation #1. Testing shall occur the first passage season after each upstream eelway becomes operational so that deficiencies can be identified and corrected without waiting for completion of passage measures at the other developments.
2. The Licensee will prepare study plans for effectiveness testing of American eel in accordance with Recommendation #4 and distribute draft plans to MDMR and other resource agencies for review and comment. Plans will be distributed no later than one year prior to the start of the passage season in

which the study will be conducted. The study plans will include appropriate measures for testing to determine if the Project meets the applicable performance standards.

3. No Later than 8 months after the initiation of effectiveness testing, the Licensee shall distribute a draft study report to MDMR and other resource agencies.

4. If performance standards have not been achieved, but the results are close (within 10% of the performance standard criteria for passage effectiveness or timing), the Licensee can implement minor operational or structural modifications to address the deficiency. These operational or structural modifications shall be developed in consultation with MDMR and other resource agencies and filed with FERC for approval. The Licensee would then retest the facility as described in section 1 of this recommendation, or as determined by MDMR. Structural modifications could include but are not limited to:

a. Modifications to the existing upstream eelway.

b. Modifications to flows within and surrounding the upstream eelway.

5. If upstream performance standards have not been achieved, and the results are not close (not within 10% of performance standard criteria for passage effectiveness or timing), the Licensee shall implement major modifications to the existing eelway or design and construct additional eelways.

6. The Licensee shall submit design plans to MDMR and other resource agencies for review and approval during the 30%, 60%, and 90% design stages. Design milestones shall be considered complete once the design and agency approvals are submitted to FERC. Designs shall be consistent with the 2019 Fish Passage Engineering Design Criteria Manual (USFWS 2019) or an updated version.

7. The major modifications outlined above shall be operational no later than two years after distribution of the study report that documented the deficiency.

8. Once the Licensee has implemented the measures above, the Licensee shall repeat the study timeline and process until performance standards have been achieved.

Downstream Passage –

1. Effectiveness testing to assess downstream passage shall be implemented by the Licensee in the year following installation of fish passage measures detailed in Recommendation #2.

2. The Licensee will prepare study plans for effectiveness testing of American shad, alewife, blueback herring, and American eel in accordance with Recommendation #4 and distribute draft plans to MDMR and other resource agencies for review and concurrence. Plans will be distributed no later than one year prior to the start of the passage season in which the study will be conducted. The study plans will include appropriate measures for testing to determine if the Project meets the applicable performance standards.

3. No Later than 8 months after the initiation of effectiveness testing, the Licensee shall distribute a draft study report to MDMR and other resource agencies.

4. If performance standards have not been achieved, but the results are close (within 10% of the performance standard criteria for passage effectiveness or timing for tested species), the Licensee can implement minor operational or structural modifications to address the deficiency. These operational or structural modifications shall be developed in consultation with MDMR and other resource agencies and filed with FERC for approval. Minor modifications shall be implemented prior to the next downstream passage season. The Licensee would then retest the facility as described in section 1 of this recommendation, or as determined by MDMR. Minor modifications could include but are not limited to:

a. Increased attraction flow

b. Nighttime shutdowns

c. “Off-peak” operations

5. If downstream performance standards have not been achieved, and the results are not close (not within 10% of performance standard criteria for passage effectiveness or timing for tested species), the Licensee shall implement major modifications to the project fish passage. Modifications could include but are not limited to:
- a. Construction of a new bypass structure
 - b. Installation of full depth 0.75-inch angled or inclined racks and associated bypasses (if “fish friendly” turbines or alternative measures were implemented as part of Recommendation #2).
6. The Licensee shall submit design plans to MDMR and other resource agencies for review and approval during the 30%, 60%, and 90% design stages. Design milestones shall be considered complete once the design and agency approvals are submitted to FERC. Designs shall be consistent with the 2019 Fish Passage Engineering Design Criteria Manual (USFWS 2019) or an updated version.
7. The major modifications outlined above shall be operational no later than four years after the distribution of the study report that documented the deficiency.
8. Once the Licensee has implemented the selected measures, the Licensee shall repeat the study and implementation process outlined above until deficiencies have been addressed.
9. A failure to meet an applicable performance standard shall not delay implementation of reasonable interim protective measures while permanent corrective measures are being designed, permitted, or constructed. Interim measures may include operational changes, seasonal shutdowns, modified attraction or bypass flows, or other measures developed in consultation with the resource agencies to reduce ongoing project effects until the deficiency is corrected.

Justification

Effectiveness testing and adaptive management are essential to ensuring that upstream and downstream fish passage measures at the Ripogenus and Penobscot Mills Projects support the restoration goals and performance standards outlined by MDMR for native diadromous fish. The performance of fish passage systems cannot be assumed at the time of construction; instead, it must be verified through monitoring. If the facilities fail to meet biological performance standards, adaptive management provides a structured process to make timely and necessary improvements to achieve those standards over the license term.

Adaptive measures may be necessary to address issues with entrance placement, attraction water delivery systems, and internal fishway components such as resting pools. If entrance conditions, internal velocities, or hydraulics fall outside of USFWS guidelines, operational or structural modifications should be made as part of adaptive management. Ongoing monitoring will be essential for identifying these needs and ensuring effective solutions are implemented.

Downstream passage must also be adaptively managed to reduce the negative impacts of dams on emigrating fish. “Fish friendly” runners are a new technology and while preliminary modeling conducted looks promising, downstream passage, survival, and delay must be tested in the field to verify modeled results and adaptive management measures need to be in place to quickly resolve deficiencies if they exist. Downstream measures must be tailored to site-specific conditions and species behavior and must consider both current design criteria and real-world operational experience. Adjustments to attraction flow, bypass function and location, and turbine operations may all be necessary to achieve safe, timely, and effective downstream passage. The use of regionally supported design principles, including those outlined in the USFWS (2019) criteria, should guide ongoing improvements to these systems.

In summary, effectiveness testing and adaptive management are essential components of a successful fish passage strategy for the Ripogenus and Penobscot Mills Projects. These tools provide clear, detailed information and a decision-making process with flexibility to respond to site-specific challenges. MDMR strongly recommends implementation of a robust adaptive management framework to ensure fish passage facilities at the Projects effectively minimize project-related effects and do not prevent attaining restoration goals.

4.7 Recommendation #6: Develop and implement a Fishway Operation and Maintenance Plan (FOMP) and Fishway Operation and Maintenance Report (FOMR)

1. Concurrent with the 90% design review schedules discussed in Recommendations 1-2 above, the Licensee will prepare and provide MDMR and other resource agencies a draft Fishway Operation and Maintenance Plan (FOMP) for review and concurrence. The FOMP will cover all operations and maintenance of the upstream and downstream fish passage facilities at the project. The FOMP shall include:

- a. A schedule for routine fishway maintenance to ensure the fishways are ready for operation at the start of migration season,
- b. Procedures for routine upstream and downstream fishway operations,
- c. Procedures for monitoring and weekly reporting on the operation and maintenance of the facilities as they affect diadromous fish passage, and
- d. Provisions for revising the FOMP, as specified below.

The Licensee shall keep the FOMP updated on an annual basis to reflect any changes in fishway operation and maintenance planned for the year. If MDMR requests a modification of the FOMP, the Licensee shall amend the FOMP within 30 days of the request. Any modifications to the FOMP by the Licensee shall be developed in consultation with MDMR prior to submitting to FERC for approval. The Licensee shall provide information related to fish passage operations and project generating operations that may affect fish passage upon written request from MDMR. Such information shall be provided within 10-calendar days of the request, or a mutually agreed upon schedule.

2. The Licensee shall prepare a Fishway Operation and Maintenance Report (FOMR) following each passage season. The FOMR should summarize fishway operating periods, outages and deviations from the FOMP, maintenance and repairs, available passage counts or observations, project operations that may have affected passage, and corrective actions taken or proposed. Unplanned outages or conditions that materially impair fish passage should be reported to MDMR and the other resource agencies as soon as practicable, rather than deferred to the annual report.

Justification

Creation and implementation of a Fishway Operations and Maintenance Plan (FOMP) and Fishway Operations and Maintenance Report (FOMR) is standard practice at FERC licensed dams with fishways in Maine. Adherence to a thorough and comprehensive FOMP will ensure that fishway facilities are being properly operated and maintained to continuously allow passage of target species.

4.8 Recommendation #7: Prevent entrainment and impingement of eels into the Millinocket Lake pumphouse

1. The Licensee shall design and install specific measures to prevent entrainment and impingement of eels into the Millinocket Lake pumphouse within four years of license issuance.
2. The Licensee shall submit design plans to MDMR and other resource agencies for review and concurrence during the conceptual and 90% design stages. Design milestones shall be considered complete once the design and agency approvals are submitted to FERC. Designs shall be consistent with best practices for preventing fish entrainment at pumping stations.
3. Following installation, the Licensee shall verify that the selected measures are functioning as intended to prevent eel entrainment and minimize impingement under the range of pumping operations. If monitoring identifies continued entrainment, impingement, or other material deficiencies, the Licensee shall develop and implement additional operational or structural measures in consultation with MDMR and the other resource agencies.

Justification

The Licensee operates a pumping station as part of the Millinocket Lake Development. The station is used to pump water from Millinocket Lake to Ambajejus Lake within the North Twin impoundment. The pumping station intake is currently protected by trashracks with 1-inch clear spacing. This spacing is wide enough to allow adult and juvenile eels to become entrained within the pumping system where they likely experience injury or mortality. To prevent undue injury or mortality, the licensee should design and install specific measures to prevent entrainment of adult and juvenile eels into the pumphouse while simultaneously preventing impingement due to high velocity water entering the pumphouse.

4.9 Recommendation #8: Implement trap-and-transport or alternative diadromous fisheries restoration measures

1. Beginning no later than ten years after license issuance (2038), the Licensee shall implement measures that provide a meaningful restoration benefit for native diadromous fish reasonably commensurate with the upstream passage and habitat-access benefits that would otherwise be provided by volitional upstream passage at the Projects under current management objectives.
2. Unless an alternative measure or package of measures is approved by FERC following consultation with MDMR, MDIFW, USFWS, and NMFS, the Licensee shall implement and support a trap-and-transport program for alewife, blueback herring, American shad, and sea lamprey, where biologically and operationally appropriate, from the first dam encountered by upstream-migrating diadromous fish where safe, timely, and effective volitional upstream passage is not otherwise provided²⁶.
3. The trap-and-transport program shall be developed in consultation with MDMR, MDIFW, USFWS, and NMFS and shall address target species, numbers or collection objectives, collection and handling methods, release locations and timing, disease and biosecurity considerations, exclusion or removal of non-target or undesirable species, monitoring, reporting, and adaptive management. The Licensee shall provide or fund the equipment, staffing, transportation, monitoring, and other support necessary to implement the program.
4. As an alternative to, or in combination with, trap-and-transport, the Licensee may implement or support fish passage, barrier removal or remediation, habitat restoration, tributary connectivity,

²⁶ This location is currently the Medway Project (P-2666), owned and operated by Black Bear Hydro Partners, LLC. However, implementation of a trap-and-transport plan is expected to require coordination with the Licensee for the Penobscot Mills Projects.

watershed restoration, mortality reduction, or other fisheries enhancement measures within the Penobscot River watershed that provide a demonstrated biological benefit to native diadromous fish provide a meaningful and measurable restoration benefit for native diadromous fish that addresses the loss or impairment of access to historical habitat associated with the Projects and advances applicable Penobscot River fisheries management objectives. Preference shall be given to durable measures that benefit the same species and Penobscot River populations affected by the Projects and that address passage, habitat access, mortality, migration delay, spawning or nursery habitat, or other limiting factors reasonably related to Project effects.

5. The Licensee shall submit a Diadromous Fisheries Restoration Plan to FERC no later than three years after license issuance. The Plan shall identify the proposed measure or package of measures; explain the relationship to Project effects and applicable fisheries management objectives; describe expected biological benefits, costs, implementation schedules, durability, and monitoring or verification; document consultation with MDMR, MDIFW, USFWS, and NMFS; and explain how agency comments were addressed.

6. If trap-and-transport becomes impracticable, is discontinued, or does not provide the intended biological benefit, the Licensee shall, following consultation with the resource agencies, implement an alternative or supplemental measure or package of measures that provides a comparable or greater fisheries restoration benefit. Implementation of trap-and-transport or alternative restoration measures shall not constitute a determination that volitional upstream passage at the Projects will not be necessary during the license term and shall not limit any authority otherwise available to FERC or the resource agencies to address future fish passage needs.

Justification

The Penobscot River Strategic and Operational Plans contemplate a combination of active management and passage measures to restore native diadromous fishes and recognize the need to coordinate diadromous fish restoration with resident fisheries management. A controlled trap-and-transport program at the first limiting dam on the West Branch Penobscot River can provide access to selected upstream habitats while allowing the resource agencies to manage species, numbers, release locations, and timing. Sea lamprey should be included where appropriate because they are native to the West Branch Penobscot River, historically occupied upstream habitats, and provide ecological benefits through nutrient transport and spawning-related habitat conditioning. Allowing alternative or supplemental watershed measures provides flexibility to direct comparable resources toward durable passage, connectivity, habitat, or mortality-reduction projects when those measures provide greater biological value than trap-and-transport alone, while retaining a clear nexus to fish resources affected by the Projects. The alternative-measures provision is not intended as a general funding obligation. It is intended to ensure that, if controlled trap-and-transport is impracticable or a different measure would produce greater biological value, Project mitigation remains directed toward the same affected Penobscot diadromous fish resources and the passage, habitat-access, mortality, or production effects that form the basis for this recommendation.

4.10 Recommendation #9: Atlantic Salmon Habitat Access Mitigation and Restoration

1. The Licensee shall implement or support measures within the Penobscot River watershed that provide meaningful conservation and recovery benefits for Atlantic salmon to mitigate Project-related effects associated with the continuing loss or impairment of access to historically accessible Atlantic salmon habitat and cumulative passage constraints within the migration corridor.

2. MDMR is not recommending volitional upstream passage of Atlantic salmon at the Projects at this time. This recommendation reflects current biological and management conditions, including the cumulative mortality and migration delay Atlantic salmon would experience while passing multiple

hydroelectric developments before reaching and after leaving West Branch Penobscot River habitat. The decision not to require volitional passage at this time does not eliminate the biological consequence of maintaining substantial historically accessible Atlantic salmon habitat in an inaccessible or functionally inaccessible condition; rather, it reflects MDMR's determination that under current conditions the conservation benefit of access must be weighed against cumulative passage mortality and migration delay.

3. Within three years of license issuance, the Licensee shall develop, in consultation with MDMR, MDIFW, NMFS, and USFWS, and file with FERC for approval an Atlantic Salmon Habitat Access Mitigation and Restoration Plan. The Plan shall identify a measure or package of measures with a demonstrated nexus to Project-related habitat-access, passage, mortality, migration-delay, or related effects and shall provide a meaningful and durable biological benefit to the Penobscot River Atlantic salmon population.

4. Eligible measures may include removal or remediation of barriers to Atlantic salmon habitat elsewhere within the Penobscot River watershed; construction or improvement of fish passage; restoration or enhancement of spawning and juvenile rearing habitat; restoration of riparian, cold-water, thermal-refuge, or tributary connectivity; measures that reduce mortality or migration delay at other barriers; support for active restoration in suitable accessible habitat; supplementation support; or other actions demonstrated to increase Atlantic salmon survival, production, distribution, or resilience.

5. The Plan shall describe the expected biological benefit, implementation schedule, estimated cost, durability, monitoring or verification, and relationship of each proposed measure to Project effects and Atlantic salmon recovery objectives. The filing shall document agency comments and explain how those comments were addressed.

6. Implementation of Atlantic salmon mitigation or restoration measures shall not constitute a determination that future volitional passage of Atlantic salmon at the Projects is unnecessary. The Licensee shall consult with MDMR, MDIFW, NMFS, and USFWS at least once every five years, and sooner if recovery objectives, critical habitat designations, Project operations, downstream passage conditions, or other material biological information changes, to determine whether the measures remain appropriate and whether additional or alternative passage or restoration measures should be considered.

Justification

Atlantic salmon historically occupied the West Branch Penobscot River, which contains a substantial amount of historically accessible and high-value rearing habitat. Federal analyses have estimated approximately 28,000 rearing habitat units in the West Branch Penobscot River and have identified the subwatershed as potentially important to future recovery. However, access to that habitat under current conditions would require adults and outmigrating smolts to encounter multiple hydroelectric developments. Penobscot studies and NMFS modeling demonstrate that dam-related mortality and migration delay are cumulative and can materially reduce survival, while also recognizing the recovery value of higher-quality upper-watershed habitat. Under the existing Medway Atlantic Salmon Species Protection Plan framework, NMFS has previously concluded that operation without upstream salmon passage was consistent with then-current recovery objectives because the West Branch Penobscot River is not designated critical habitat. MDMR therefore does not recommend transporting or providing volitional passage of Atlantic salmon into the West Branch Penobscot River at this time. A targeted off-site or watershed-based restoration obligation provides a means to address the continuing habitat-access and cumulative passage effects while directing conservation investment toward actions that can provide a present net benefit to Atlantic salmon. The periodic consultation requirement preserves the ability to revisit this balance as recovery strategies, passage conditions, and climate-related habitat needs evolve. In this circumstance, requiring mitigation that improves salmon survival, habitat access, production, or

resilience elsewhere within the same Penobscot population is a more biologically targeted response than requiring passage that could presently reduce overall survival.

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6.0 Appendix A. Penobscot River Cumulative Impacts Analysis for American eel

In 2022, MDMR and the USFWS conducted a cumulative impacts analysis for American eel on the Penobscot River in Maine. The purpose of the cumulative impacts analysis is to estimate American eel escapement out of the watershed based on measured and assumed (95%) survival rates at each project. Project-specific survival is based on study results at each project. Survival estimates are separated into “MDMR” and “Licensee” categories because there is disagreement on the true survival estimate for several projects. The analysis assumes that American eel distribute evenly throughout the available habitat in the drainage. Area (m²) is used as a proxy for American eel habitat upstream of each dam and was derived using GIS analyses based on NHD flowline and waterbody data. Escapement is calculated by multiplying the proportional area multiplied by the survival estimates for downstream dams under each survival category (i.e., MDMR, Licensee, assumed 95%). Watershed wide escapement is the sum of project-specific escapement rates. Using measured survival estimates results in a watershed wide escapement below 50% while using an assumed survival of 95% per project results in a watershed wide escapement greater than 75%. Regardless of the scenario, eels originating upstream of McKay Station will be the most afflicted, having to pass 9 dams on their downstream migration, with a 63.0% escapement even under the 95% survival scenario (0.95⁹ or Escapement/Proportional Area [0.195/0.3094]). American eels originating from these upstream habitats are likely large females, which are especially important to reproductive potential and long-term viability of the species’ panmictic population, because of their greater fecundity (Goodwin and Angermeier, 2003; Vélez-Espino and Koops, 2009).

Table 1. Total and habitat-specific estimated eel escapement using an measured downstream survival estimates and an assumed 95% downstream survival estimate at each hydroelectric project on the mainstem Penobscot River (Table 1). Eels are assumed to distribute evenly throughout the available habitat such that the proportional habitat area is equal to the proportion of the eel population that occupies that habitat. There is disagreement on the true survival estimate for several projects, so survival is separated into MDMR and Licensee categories.

Downstream Dam	Area (m ²)	Survival (MDMR)	Survival (Licensee)	Proportional Area (%)	Escapement (MDMR; %)	Escapement (Licensee; %)	Escapement (if 95%)
Milford	29,131,486	0.86	0.86	9.58	8.24	8.24	9.10
West Enfield	106,943,890	0.848	0.911	35.16	25.64	27.54	31.73
Mattaceunk	22,838,044	0.833	0.912	7.51	4.56	5.36	6.44
Medway	983,097	0.68	0.925	0.32	0.13	0.21	0.26
East Millinocket	938,894	0.621	0.621	0.31	0.08	0.13	0.34
Dolby	11,365,970	0.49	0.049	3.74	0.47	0.75	2.75
Millinocket Stn.	27,749,849	0.621	0.621	9.12	0.71	1.14	6.05
North Twin	10,117,508	0.536	0.536	3.33	0.14	0.22	2.32
McKay Station	94,127,428	0.629	0.629	30.94	0.81	1.30	19.50
Total	304,196,166			1.0000	40.78	44.90	78.39

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