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United States Department of the Interior
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IN REPLY REFER TO:
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Debbie Anne Reese, Acting Secretary
Federal Energy Regulatory Commission
888 First Street, N.E., Room 1A
Washington, DC 20426

**Subject: COMMENTS, RECOMMENDATIONS, TERMS AND CONDITIONS, AND PRESCRIPTIONS**
**Application Ready for Environmental Analysis**
**Vernon Hydroelectric Project, FERC No. 1904-078; Bellows Falls Hydroelectric Project, FERC No. 1855-050; and Wilder Hydroelectric Project, FERC No. 1892-030**

Dear Acting Secretary Reese:

This letter provides the U.S. Department of Interior's (Department) response to the Federal Energy Regulatory Commission's (FERC or Commission) Notice of Application Ready for Environmental Analysis, issued on February 22, 2024, for the proposed relicensing of the Vernon, Bellows Falls, and Wilder Hydroelectric Projects (collectively, the Projects). All three projects are owned by Great River Hydro, LLC (GRH). The Vernon Project is located in Franklin County, Massachusetts, Cheshire County, New Hampshire, and Windham County, Vermont. The Bellows Falls Project is located in Cheshire and Sullivan counties, New Hampshire, and Windsor and Windham counties, Vermont. The Wilder Hydroelectric Project is located in Orange and Windsor counties, Vermont, and Grafton County, New Hampshire.

These comments have been prepared by the Department's National Park Service (NPS) and U.S. Fish and Wildlife Service(Service or USFWS) and are submitted in accordance with the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the National Environmental Policy Act, as amended (42 U.S.C. 4321-4347); the Federal Power Act (FPA), as amended (16 U.S.C. 791a-828c); and the Endangered Species Act of 1973 (ESA), as amended (16 U.S.C. 1531 et seq.).

## U.S. FISH AND WILDLIFE SERVICE COMMENTS

### BACKGROUND

GRH filed a Memorandum of Understanding (MOU) on proposed operations at the Projects on

December 7, 2020.[1] The Department, through the Service, was a signatory to the MOU as well as a Settlement Agreement for Fish Passage (Agreement) that GRH filed with the FERC on August 2, 2022.[2]

**PROJECT DESCRIPTIONS**

The FERC's REA Notices[3] describe the Projects' facilities, infrastructure, and capacities.

**PROJECT PROPOSALS**

The Amended Final License Applications (AFLA) filed by GRH contain proposed protection, mitigation, and enhancement (PME) measures that include converting the Projects from peaking operations to an Alternative Operations (AO) protocol (detailed below) and providing a continuous flow of no less than 300 cubic feet per second (cfs) to the Bellows Falls bypass reach.[4] The AO protocol represents a consensus-based proposal developed by GRH in consultation with the Service and others that seeks to:

- create more stable water surface elevation in the impoundments;
- reduce the magnitude and frequency of sub-daily changes in discharge from the stations,
- increase the amount of time that the project is operated as inflow equals outflow[5] (IEO) and at full impoundment;
- reduce the magnitude and rate of change in flows downstream of the dams; and
- reduce the average frequency, average duration, and average range of impoundment fluctuation under conditions when inflow to a Project at the dam is within the range of the Project's powerhouse hydraulic capacity.[6]

Relative to fish passage PME measures contained in the AFLAs, GRH proposed continuing to maintain and operate existing fish passage facilities; operating the fishways as requested in Schedule of Operations letters issued annually by the Connecticut River Salmon Restoration Commission (CRASC); and operating the ladders from April 1 through July 15 to support upstream passage of resident fish that spawn in early spring and diadromous species.[7] The AFLAs also acknowledged fish passage discussions with fisheries agencies had been initiated, with a goal of identifying appropriate structural and operational improvements to existing or new facilities for safe, efficient upstream and downstream passage of migratory fish species at the Projects.[8] Upon reaching agreement on fish passage requirements, passage study needs, designs,

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[1] FERC Accession Number 20201207-5219; Attachment B to the Amended Final License Applications.
[2] FERC Accession Number 20220803-5124.
[3] FERC Accession Number 20240222-3015 (Vernon Project); FERC Accession Number 20240222-3017 (Bellows Falls Project); and FERC Accession Number 20240222-3023 (Wilder Project).
[4] FERC Accession Number 20201207-5219; Exhibit E.
[5] Inflow Equals Outflow (IEO) Operation is defined as follows: (a) when the Project maintains discharge through the powerhouse equal to inflow at the dam by maintaining a stable target water surface elevation together with any required non-generation flow (e.g., Bellows Falls bypass flow, fish passage related flow); or, (b) when inflow exceeds the maximum station generating capacity and all inflow is passed via a combination of spillage and discharge through the powerhouse, or if the station were out of service, via spillage alone.
[6] FERC Accession Number 20201207-5219; Exhibit A of Attachment B.
[7] Refer to Footnote 4.
[8] Refer to Footnote 4.

and implementation plans and schedules, GRH proposed implementing the agreement under the terms of the new licenses.[9]

## SETTLEMENT AGREEMENT

Shortly after submitting the AFLA, GRH initiated fish passage settlement negotiations. The Department, through the Service, actively participated in these negotiations, which concluded in July 2022 when consensus on settlement provisions was reached. That Agreement, filed with the Commission by GRH on August 2, 2022, was signed by GRH, the Service, the New Hampshire Fish and Game Department (NHFGD), and the Vermont Fish and Wildlife Department (VTFWD).[10] The fish passage measures contained in the Agreement, include:

### Vernon Fish Passage and Protection Measures[11]

- Provide downstream fish passage measures based on the outcome of a hydraulic study or suitable alternative to inform passage/design options.
- Modify the existing Vernon fish ladder to improve effectiveness for passage of American eel (*Anguilla rostrata*) and sea lamprey (*Petromyzon marinus*).
- Provide interim upstream eel passage facilities until permanent facilities are operational.
- Operate new permanent upstream eel passage facilities annually between July 16 through November 15.
- Identify and implement modifications to the existing Vernon fish ladder and collection gallery below the powerhouse for improved effectiveness for American shad (*Alosa sapidissima*) passage.

### Bellows Falls Passage and Protection Measures[12]

- Provide downstream American eel passage measures based on the outcome of a hydraulic study or suitable alternative to inform passage/design options.
- Monitor the existing Bellows Falls fish ladder and undertake potential modifications to improve effectiveness for passage of American eel and sea lamprey.
- Provide interim upstream eel passage facilities until dedicated upstream eel passage facilities are operational.
- Operate new permanent upstream eel passage facilities annually between July 16 through November 15.
- Undertake an eel survey in the Bellows Falls Bypass Reach to determine the need for upstream eel passage, and provide permanent upstream eel passage facilities, if necessary.

### Wilder Passage and Protection Measures[13]

- Provide downstream American eel passage measures based on the outcome of a hydraulic study or suitable alternative to inform passage/design options.
- Monitor the existing Wilder fish ladder and undertake potential modifications to improve

[9] Refer to Footnote 4.
[10] FERC Accession Number 20220803-5124.
[11] FERC Accession No. 20220803-5124, Executive Summary.
[12] Refer to Footnote 10.
[13] Refer to Footnote 10.

effectiveness for passage of American eel and sea lamprey.
- Undertake an eel survey in the vicinity of the Wilder powerhouse and spillway to inform siting of new permanent upstream eel passage facilities.

**Effectiveness Testing of Passage & Protection Measures at all Projects[14]**
- Develop and implement studies to test the effectiveness of newly modified/constructed fish passage facilities relative to identified performance standards.

**Fish Passage Facilities Operations and Maintenance Plan[15]**
- Develop a plan detailing how and when fishways will be operated and maintained.

The Department supports the Agreement and recommends the Commission include license conditions that are consistent with it, such that all of the measures contained in Section 3 of the Agreement, and the implementation schedules provided in Appendix A of the Agreement, are enforced by the FERC.[16] We provide detailed background and justification for the Agreement provisions related to fish passage in our Preliminary Prescription for Fishways (PPF; Attachment D), hereby submitted by the Service, through the Department, pursuant to Section 18 of the FPA.[17] Provisions of the PPF are consistent with the Agreement. The Administrative Record for Attachment D is being filed under separate cover.

In addition, to the extent that any of the Agreement measures are not incorporated as license articles, or the FERC determines the measures are not enforceable, the Department requests that the FERC expressly identify each measure that is not enforceable in its licensing order. Any Settlement measure not so expressly identified by the FERC as unenforceable will be deemed, by all signatories to the Agreement, as enforceable by the FERC. The Department expects that the agreement of the Parties to consult with one another before undertaking various actions before the FERC (i.e., certain amendment applications) will be enforced by the FERC to the extent of requiring evidence of compliance before accepting such applications. Retention of settlement terms such as these, as enforceable license conditions, is a necessary and a bargained-for part of the Agreement.

## COMMENTS AND RECOMMENDATIONS

This section contains the Department's supporting rationale for our recommendations provided pursuant to sections 10(a) and 10(j) of the FPA.

### Alternative Operations at Vernon, Bellows Falls, and Wilder

Presently, GRH operates the Projects as daily peaking facilities when flows are within the hydraulic capacities of the stations. Table 1 summarizes the minimum flows, maximum

[14] Refer to Footnote 10.
[15] Refer to Footnote 10.
[16] FERC Accession No. 20220803-5124.
[17] On August 4, 2022, the Commission issued a notice soliciting comments on the Agreement (FERC Accession Number 20220804-3045). Our PPF includes a response to comments submitted in response to the Commission's notice.

generation capacities, and allowable impoundment ranges under the current licenses for the three Projects.

During relicensing, GRH undertook an Instream Flow Study at the Projects to analyze the effect of project operations on the quantity and persistence of habitat for a suite of resident riverine and migratory fish species (Study 9).[18] Results showed that for the majority of species/life stage combinations evaluated, the quantity of habitat decreased as generation flows increased. Table 2 summarizes the change in the amount of habitat between base and peak flows at each project.

In addition to influencing the amount of habitat available to target species, project operations affect the persistence of that habitat. Table 3 summarizes the percent loss of persistent habitat based on a dual flow analysis, pairing base flows with peak flows, for sensitive and/or immobile species/life stages at each project. Study results show greater than 80 percent loss of persistent habitat for 12 out of 13 species/life stages at Wilder, 12 out of 14 species/life stages at Bellows Falls, and 10 out of 13 species/life stages at Vernon. The federally endangered dwarf wedgemussel (DWM; *Alasmidonta heterodon*) showed 94 to 97 percent loss of persistent habitat at Wilder and 89 percent loss of persistent habitat at Bellows Falls.

Riparian species also are affected by current operations. The cobblestone tiger beetle (CTB; *Cicindela marginipennis*), which is listed as endangered in New Hampshire and threatened in Vermont, has been documented within the project-affected reach of all three projects. GRH undertook a study to assess potential impacts of project operations on CTB habitat (Study 26).[19] Results of that study showed peaking flows inundate varying amounts of CTB habitat, depending on the site and the modeled water year (Figure 1).[20] Adult CTB have been observed leaving habitat being inundated by rising water levels (M. Winters, personal communication, April 25, 2024), potentially adversely affecting feeding, mating, or oviposition behavior. Likewise, inundation may impact larval beetles by reducing foraging time, which could delay growth.

The magnitude, duration, and frequency of flow fluctuations from peaking operations impact downstream aquatic and riparian habitat, and the associated impoundment fluctuations can dewater littoral habitat in the mainstem river and backwatered tributaries. These littoral areas contain spawning and rearing habitat for many fish species as well as freshwater mussels. Dewatered littoral zones can expose fish nests and mussels, resulting in desiccation and/or predation.

In order to improve habitat persistence for aquatic and riparian species within the project-affected reaches of the Connecticut River, the Service worked with GRH and others to develop an AO proposal, which GRH incorporated into its AFLAs for the Projects. The AO proposal stipulates that the Projects operate in a default mode of IEO, while allowing for periods of flexible operation (Flex Ops) that vary seasonally. The AO proposal also would create more stable impoundment water surface elevations. IEO operation and maintaining stable Project headponds will improve the quantity, quality, and persistence of aquatic and riparian habitat for Service trust resources, including the DWM, the CTB, and migratory fish such as American shad

[18] FERC Accession Number 20190520-5109.
[19] FERC Accession Number 20160617-5204.
[20] Refer to Footnote 19.

and sea lamprey. Flex Ops hours are restricted during the most sensitive ecological periods of spring, summer, and early fall, and expanded during the less critical late fall and winter period.

Table 4 provides a tabular summary of the number of consecutive days the Wilder riverine reach was at IEO for the months of June and August, based on simulated AOs for four water years. Figure 2 compares historical operations to simulated AOs with respect to how many consecutive days at IEO are experienced by DWMs in the Wilder riverine reach during August of 2015. Both figures indicate AOs will reduce the magnitude and frequency of flow fluctuations and increase the percent of time at IEO, which will provide more stable and persistent DWM habitat.

For CTB, the number of days at or below a given flow threshold equating to water surface elevations that would maintain greater than 75 percent uninundated habitat for the months of June and August was quantified for current operations and AOs (IEO and IEO/Flex Ops; Table 5). Figure 3 graphically portrays the tabular data for the Bellows Falls riverine reach for August 2017. Results reveal a substantial increase in the number of days and number of consecutive days meeting the identified thresholds under AOs versus current operations. This increased habitat persistence more closely aligns with a natural (i.e., unregulated) freshwater riverine hydrograph. The Department supports the proposed Alternative Operations proposed for the Vernon, Bellows Falls, and Wilder projects, and requests the FERC include Section 10(j) Recommendation 1 in any new licenses issued for the Projects.

**Bellows Falls: Bypass Flows**

The Bellows Falls bypass reach is 0.7 miles-long. Presently, a barrier dam exists in the lower end of the bypass reach. This dam, known as the Salmon Dam, was constructed to mitigate false attraction to the spillway of Atlantic salmon (*Salmo salar*) during the upstream passage season. The current license for the Bellows Falls Project does not contain provisions for minimum flows to the bypass reach. GRH estimates leakage through the spillway structures to be 100 to 300 cfs.

The bypass reach contains habitat that supports resident riverine fishes. Over 200 fish across 28 species were collected during GRH's fish assemblage study (Study 10).[21] The majority of fish collected were longnose dace (*Rhinichthys cataractae*; 62 percent) and smallmouth bass (*Micropterus dolomieu*; 21 percent), followed by tessellated darter (*Etheostoma olmstedi*; 7 percent) and white sucker (*Catostomus commersonii*; 4 percent). While the Salmon Dam prevents most migratory fish from accessing the upper bypass reach, results of GRH's upstream American eel survey (Study 18) documented eel presence below the spillway,[22] indicating the Salmon Dam is not a complete barrier to eel passage.

GRH undertook an instream flow study to assess impacts of current operations on aquatic resources within the Bellows Falls project-affected area, including the bypass reach.[23] The percent of maximum average weighted suitability (AWS; in square feet per foot) that different test flows provided varied by species, life stage, and location.[24] GRH completed a supplemental

[21] FERC Accession No. 20160301-5231.
[22] FERC Accession No. 20160301-5331.
[23] FERC Accession No. 20170322-5173; Study 9.
[24] Refer to Footnote 23.

analysis on the Study 9 bypass reach data collected during Alternative Operation discussions with the agencies. The original analysis was modified by (1) removing Transect 4, because it was not perpendicular to the flow; (2) removing all spawning life stages of target species, due to the paucity of suitable substrate; and (3) removing pool-dwelling species/life stages, based on that habitat type being relatively insensitive to changes in discharge. Results suggested a flow of 300 cfs would provide 80 percent of the maximum value of limiting AWS. Based on this information, the AO proposal includes providing a continuous flow of no less than 300 cfs to the Bellows Falls bypass reach.

The Department supports the proposed Bellows Falls bypass flow and requests the FERC include Section 10(j) Recommendation 2 in any new license issued for the Project.

**Bald Eagle Protection Plan for Vernon, Bellows Falls, and Wilder**

Bald eagles (*Haliaeetus leucocephalus*) occur within the project areas. Figure 4 shows the upward trend in productivity based on annual count data collected by New Hampshire Audubon.[25] Between 2014 and 2023, the number of territories has more than doubled, the number of active nests has tripled, and the number of young fledged has more than doubled. As part of the license proceeding, GRH undertook a Floodplain, Wetland, Riparian, and Littoral Vegetation Habitats Study (Study 27).[26] Results identified 12 sites with potential suitable winter roosting conditions within the study area, in addition to the one known winter roosting area.[27]

Routine project operations are unlikely to adversely affect eagle nesting and roosting habitat. However, routine, emergency, or other types of maintenance activities undertaken over the course of any new license terms issued for the Projects could potentially impact bald eagles. Therefore, protection measures should be implemented prior to tree clearing or construction activities within the project boundaries or immediately adjacent to the project boundaries. Protection measures should include surveying for eagle nests, performing tree clearing or construction activities in accordance with the National Bald Eagle Management Guidelines if nests are discovered, and prohibiting tree clearing and construction activities during the nesting season pursuant to the National Bald Eagle Management Guidelines.

The Department hereby requests the FERC include Section 10(j) Recommendation 3 in any new licenses issued for the Projects, which requires the Licensee to implement the Bald Eagle Protection Plan provided in Attachment B.

**Bat Protection Measures at Vernon, Bellows Falls, and Wilder**

The northern long-eared bat (NLEB; *Myotis septentrionalis*) was listed as federally threatened under the Endangered Species Act (ESA) by the Service on April 2, 2015 (USFWS 2015). The species was reclassified as endangered on November 29, 2022, with the rule becoming effective March 31, 2023 (USFWS 2022a). NLEBs typically roost singly or in maternity colonies

[25] New Hampshire Audubon data provided to the U.S. Fish and Wildlife Service via email on November 1, 2023. These data do not include productivity data from the Vermont side of the river.
[26] FERC Accession Number 20160801-5232.
[27] Refer to Footnote 26.

underneath bark or in cavities or crevices of live trees and snags (USFWS 2022b). In addition, the tricolored bat (*Perimyotis subflavus*) has been proposed for listing under the ESA.[28] Tricolored bats roost singly or in maternity colonies among live and dead leaf clusters of live or recently dead deciduous hardwood trees.[29]

During the first phase of relicensing, GRH undertook a study to provide information on the type and quantity of wetland, riparian, and upland habitat potentially affected by project operations.[30] Based on results of that study, over 3,400 acres of forested habitat were identified within 200 feet from the Connecticut River shoreline across all three impoundments;[31] therefore, potentially suitable habitat exists for both bat species and routine or other maintenance activities involving tree clearing could negatively impact roosting habitat.

In the AFLA, GRH states that project operations and maintenance are not likely to adversely affect NLEB other than for hazard tree removal or for other incidental tree removal associated with routine facility maintenance, and that, in those instances, the activity will be conducted in accordance with 50 CFR §17.40(o).[32] Since the species was reclassified as endangered, the cited regulation no longer applies.

In order to protect NLEBs and tricolored bats from potential project-related impacts during their active season, the Department recommends GRH limit tree removal to the period of November 1 through April 14. Tree removal is defined herein as cutting down, harvesting, destroying, trimming, or manipulating in any other way trees, saplings, snags, or any other form of woody vegetation likely to be used by northern long-eared bats (i.e., woody vegetation greater than or equal to 3 inches diameter at breast height). This time-of-year restriction does not apply to trees that pose a safety hazard to human life or property.

The Department hereby requests the FERC include Section 10(j) Recommendation 4 in any new licenses issued for the Projects.

**Invasive Species Management Plan for Vernon, Bellows Falls, and Wilder**

During the first phase of relicensing, GRH undertook a study to provide information on the type and quantity of floodplain, wetland, riparian, and littoral habitat potentially affected by project operations.[33] Based on results of the study, 27 invasive plant species and one potentially invasive species were identified (as indicated by the Invasive Species Atlas) within the study area for the three Projects.[34] Over 167 acres of upland, riparian, and emergent invasive stands were mapped. The most widespread invasive species was Japanese knotweed (*Fallopia japonica*); the dominant invasive in scrub-shrub and emergent wetland cover types was Phragmites (*Phragmites*

[28] https://www.federalregister.gov/docwnents/2022/09/14/2022-l8852/endangered-and-threatened-wildlife-and-plants-endangered-species-status-for-tricolored-bat
[29] https://www.fws.gov/species/tricolored-bat-perimyotis-subflavus
[30] FERC Accession Number 20161130-5265; Study 27 Report Supplement.
[31] No all of the identified acreage falls within the Project boundaries. FERC Accession Number 20161130-5265; Study 27 Report Supplement, Table 5.1-2.
[32] FERC Accession No. 20201207-5219; Exhibit E.
[33] FERC Accession Number 20160801-5232; Study 27.
[34] Refer to Footnote 30.

*australis*), with over two thirds of the 35 acres occurring in the Vernon impoundment; and a large stand of the terrestrial Japanese barberry (*Berberis thunbergia*) was found on Stebbins Island below Vernon Dam.[35]

Within the over 900 acres of floating and submerged aquatic vegetation beds mapped, two invasive species were documented: brittle naiad (*Najas minor*) was found in the Bellows Falls and Wilder impoundments; and Eurasian watermilfoil (EWM; *Myriophyllum spicatum*) was present in all three impoundments.[36] Acreages of aquatic invasives were not defined because they were usually intermixed with native species and could not be reliably separated.[37] The presence of these species may ultimately degrade available habitat for fish and wildlife.

GRH has not proposed any protection, mitigation, or enhancement measures relative to invasive species management within the Project areas. Implementing an Invasive Plant Species Management Plan (IPSMP) would help (1) prevent the introduction and/or spread of invasive species through implementation of best management practices and supporting the education of those performing construction, maintenance, and/or operational activities with the project boundaries; (2) restore ecological function by controlling existing invasive aquatic plant infestations; and (3) protect against the potential for establishment of novel invasive plant species through an early detection and rapid response (EDRR) protocol.

The Vermont Department of Environmental Conservation (VTDEC) lists multiple locations along the Connecticut River within, or in proximity to, the Projects as altered by EWM for the designated uses of aquatic biota and wildlife, and aesthetics.[38] Also, according to the New Hampshire Department of Environmental Services' (NHDES) Surface Water Quality Assessment mapper, the reach from Claremont to Charlestown, New Hampshire, is not meeting the designated use of Aquatic Life Integrity due to non-native aquatic plants, including EWM, variable milfoil (*Myriophyllum heterophyllum*), European naiad (aka brittle naiad), and curly-leaf pondweed (*Potamogeton crispus*).

Potentially, all four of the species identified by NHDES can be effectively controlled. For example, the milfoils are extremely susceptible to low dose ProcellaCOR® treatments, and consecutive treatments of curlyleaf pondweed with a contact herbicide like Diquat® in early spring are effective.[39] Therefore, the Department recommends GRH implement an IPSMP that includes undertaking another Projects-wide vegetation survey to provided updated information on the composition, distribution, and abundance of aquatic invasive species within the three Project impoundments. That information would be considered by GRH, the Service, and the state fish and wildlife and water quality agencies in identifying which species in what locations have the best chance for successful control.

An IPSMP also should include an EDRR program, for the purpose of finding and eradicating new invasive infestations before they spread and cause harm to project facilities as well as the

[35] FERC Accession No. 20201207-5219; AFLA, Exhibit E.
[36] FERC Accession No. 20201207-5219; Exhibit E, Table 3.7-2.
[37] Refer to Footnote 36.
[38] State of Vermont List of Priority Surface Waters (2022), Part E: Surface waters altered by aquatic invasive species
[39] Email from Greg Bugbee of the Connecticut Agricultural Experiment Station dated November 3, 2023.

fish and wildlife resources the new alternative operations provisions are designed to protect and enhance. Within the Connecticut River watershed, the highly invasive *Hydrilla verticillata* (hydrilla) was first detected near Glastonbury, Connecticut, in 2016.[40] Surveys conducted in 2019 and 2020 found it had spread nearly 70 miles upstream to Agawam, Massachusetts.[41] The species propagates both sexually and vegetatively, with plant fragments able to sprout roots and establish new populations. According to the U.S. Army Corps of Engineers (ACOE), hydrilla impacts ecological health of aquatic ecosystems by forming dense stands underwater that can alter river flow, shade, or crowd out all other native aquatic plants; replace habitat of sensitive species; alter water chemistry and pH; cause dramatic swings and reduction in dissolved oxygen levels; increase water temperatures; and negatively affect the diversity and abundance of fish populations.[42] Hydrilla also has negative impacts on recreation, including making it more difficult or even potentially dangerous for both boating and swimming due to the denseness of its growth.[43]

The Connecticut River Conservancy and the Connecticut Agricultural Experiment Station have been leaders in educating the public about hydrilla, conducting rigorous monitoring to identify new infestations, and investigating emerging control methods. Given the magnitude of the hydrilla problem in the Connecticut portion of the watershed, the ACOE is undertaking a multi-million dollar project to investigate the plant's growth patterns and water exchange dynamics in the Connecticut River, and evaluate herbicide efficacy in the laboratory in 2023 to inform an operational scale field demonstration in 2024.[44]

The heaviest hydrilla infestations occur in backwater or low velocity areas. The most likely point of entry for hydrilla introduction at the Projects is through recreational boating. Within each project impoundment, there are boat launches and carry-in boat access sites.[45] Without vigilant monitoring, hydrilla could quickly become established at these sites and other low velocity areas. Controlling or eradicating established beds could be difficult, given the number of sensitive plant and invertebrate species that inhabit the impoundments. Therefore, it is imperative GRH include an EDRR program as part of its IPSMP.

Water chestnut is another aggressive invasive species not currently in the Vermont or New Hampshire portions of the River. It forms dense mats that displace native species and interfere with recreational activities (Hummel & Kiviat 2004). The dense mats of vegetation shade out native aquatic plants that provide food and shelter to native fish, waterfowl, and insects; and decomposition of these dense mats reduces dissolved oxygen levels and may kill fish.[46] Because it is an annual plant, it can be effectively controlled if seed formation is prevented through manual, mechanical, or chemical methods.[47]

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[40] https://www.nae.usace.army.mil/Missions/Projects-Topics/Connecticut-River-Hydrilla/#:~:text=Hydrilla%20was%20first%20identified%20in,as%20it%20is%20genetically%20distinct.
[41] Refer to Footnote 40.
[42] Refer to Footnote 40
[43] Refer to Footnote 40
[44] https://www.ctriver.org/get-involved/stopping-an-invasive-species-water-chestnut-2/hyrilla-in-the-ct-river-watershed/
[45] FERC Accession No. 20201207-5219; AFLA, Exhibit E, Table 3.9-1, Table 3.9-7, and 3.9-13.
[46] New York Department of Environmental Conservation water chestnut website. Accessed September 21, 2023.
[47] New York Department of Environmental Conservation water chestnut website. Accessed September 21, 2023.

Attachment D to this letter provides the Department's IPSMP. The Department requests the FERC include in any new license issued for the Projects, Section 10(j) Recommendation 5, which requires the Licensee to implement the IPSMP upon license issuance.

The IPSMP aligns with purposes of the Silvio O. Conte National Fish and Wildlife Refuge Act,[48] which include:

- to conserve, protect, and enhance the Connecticut River valley populations…native species of plants, fish, and wildlife;
- to conserve, protect, and enhance the abundance and diversity of native plant, fish, and wildlife species and the ecosystems on which they depend throughout the Connecticut River watershed; and
- to restore and maintain the chemical, physical, and biological integrity of wetlands and other waters within the refuge.

The IPSMP also addresses goals of habitat conservation and recreation identified in the Silvio O. Conte National Fish and Wildlife Refuge 2017 Comprehensive Conservation Plan:[49] managing invasive species within the Project impoundment boundaries to promote biological diversity, integrity, and resiliency of aquatic ecosystems; and promoting high quality public recreational opportunities in over 97 miles of the Connecticut River.

The Commission's e-library contains many examples of similar requirements in recent FERC license orders, including the Salina Pumped Storage Project (FERC Number 2524-021),[50] the Eagle Crest Pumped Storage Project (FERC Number 13123-014),[51] the Weed Dam Project (FERC Number 2464-015),[52] the Loup River Project (FERC Number 1256-031),[53] and the Oconto Falls Project (FERC Number 2523-018).[54]

**Operations Compliance Monitoring Plans for Vernon, Bellows Falls, and Wilder**

GRH's AO proposal contains impoundment fluctuation limits, bypass flows, and below-project flows that will need to be monitored to ensure compliance at the Projects. GRH acknowledges the need to develop Operations Compliance Monitoring Plans (OCMP).[55] The Department supports a requirement for the Licensee to develop such plans, in consultation with the Service, the NHDES, and the VTDEC, and requests the FERC include Section 10(a) Recommendation 1 in any new licenses issued for the Projects.

The OCMPs should identify the mechanisms and structures used to verify compliance with

[48] https://www.govtrack.us/congress/bills/102/hr794/text/enr
[49] USFWS. 2017. Silvio O. Conte National Fish and Wildlife Refuge Comprehensive Conservation Plan. United States Fish and Wildlife Service, Hadley, MA. https://www.friendsofconte.org/comprehensive-conservation-plan
[50] FERC Accession Number 20151016-3016
[51] FERC Accession Number 20151119-3090
[52] FERC Accession Number 20170207-3028
[53] FERC Accession Number 20170522-3032
[54] FERC Accession Number 20191119-3024
[55] FERC Accession Number 20201207-5219; Exhibit A of Attachment B, page 13.

operational requirements; pertinent set points, gate position(s), and water surface elevations; the level of manual and automatic operation; the methods used for recording data; and the protocol for providing data to resource agencies. At a minimum, all relevant compliance parameters (i.e., headpond elevation, station generation, gate position(s)) should be recorded hourly. Records should be maintained digitally for the term of any new licenses issued for the Projects. Should compliance monitoring records indicate that any Project is not complying with the AO proposal, GRH will consult the Service, the VTDEC, and the NHDES to identify and implement appropriate corrective actions, if necessary.[56]

## SECTION 10(j) RECOMMENDATIONS FOR THE VERNON, BELLOWS FALLS, AND WILDER PROJECTS

Pursuant to section 10(j) of the FPA, as amended, and the Fish and Wildlife Coordination Act, the Service recommends the following protection, mitigation, and enhancement measures for fish and wildlife resources be included in any licenses the Commission issues for the Projects.

### Recommendation 1: Alternative Operation Proposal

Upon license issuance, the Licensee shall implement the Alternative Operation proposal as described in Attachments A and B of the Projects' AFLAs.[57]

### Recommendation 2: Bellows Falls Bypass Flow

Upon license issuance, the Licensee shall provide a continuous flow at the Bellows Falls Dam of no less than 300 cfs to the Bellows Falls bypass reach.

### Recommendation 3: Bald Eagle Protection Plan

Upon license issuance, the Licensee shall implement the Bald Eagle Protection Plan provided in Attachment B.

### Recommendation 4: Bat Protection Measures

During the term of any new licenses issued for the Projects, the Licensee shall limit tree removal to the period of November 1 through April 14. Tree removal is defined herein as cutting down, harvesting, destroying, trimming, or manipulating in any other way trees, saplings, snags, or any other form of woody vegetation likely to be used by northern long-eared bats (i.e., woody vegetation greater than or equal to 3 inches diameter at breast height). This time-of-year restriction does not apply to trees that pose a safety hazard to human life or property.

[56] Refer to Footnote 55.
[57] FERC Accession Number 20201207-5219.

**Recommendation 5: Invasive Plant Species Management Plan**

Upon license issuance, the Licensee shall implement the Invasive Plant Species Management Plan provided in Attachment C.

**SECTION 10(a) RECOMMENDATIONS FOR VERNON, BELLOWS FALLS, AND WILDER**

**Recommendation 1: Project Operations Compliance Monitoring Plans**

Within 120 days of license issuance the Licensee shall file Operations Compliance Monitoring Plans (OCMP) for each Project with the FERC that include, at a minimum:

a. a description of the type of manual and automatic operation of the Project, including on-site and remote operation;
b. a detailed description of how the Projects will be operated under normal operating conditions as well as during low flow, high flow, maintenance, and emergency conditions to maintain compliance with the flow and impoundment level management requirements;
c. a description of the mechanisms and structures, including type, location, and accuracy of all flow and impoundment elevation monitoring equipment and gauges, to be used for maintaining compliance with operational requirements;
d. procedures for maintaining and calibrating monitoring equipment;
e. rating curves and calculations for all methods of releasing flow downstream;
f. procedures for collecting, recording, and maintaining continuous data (i.e., no less frequently than hourly and preferably every 15 minutes) on inflow, flow releases at the Projects (i.e., bypass reach flows, spillage, and turbine discharge), and impoundment levels; and
g. the protocol for providing data to resource agencies.

The OCMPs shall provide for the collection of information sufficient to determine if project operations are complying with the AO proposal (see Recommendation 1). The OCMPs also shall acknowledge that, should compliance monitoring records indicate that any of the Projects are not in compliance with the AO proposal, the Licensee will consult the Service, the VTDEC, and the NHDES to identify and implement appropriate corrective actions, if necessary. If, after evaluating operations data pursuant to the OCMPs, the relevant resource agencies observe instances where operations do not appear to (1) adequately represent the simulations discussed in the AO proposal, (2) attain the five objectives identified in the AO proposal, or (3) attain CTB and DWM management goals described in the AO proposal at levels suggested by GRH simulations, GRH will, if requested, meet with the agencies to discuss their concerns and possible corrective actions.[58]

The OCMPs, including any proposed revisions, shall be developed in consultation with the USFWS, the NHDES, and the VTDEC. The OCMPs shall be implemented upon approval by the FERC. The OCMPs shall be updated, as necessary, to reflect current operations of the Projects.

[58] Refer to Footnote 55.

The Licensee shall submit any revised OCMPs to the resource agencies for review and comment prior to filing with the FERC.

**Recommendation 2: Department Notification of Amendments and Appeals**

The Department recommends that the Commission include in any licenses issued for the Projects:

> Prior to or at the time of filing with the Federal Energy Regulatory Commission, the Licensee shall serve all representatives of the Department of the Interior on the service list with a copy of any request the Licensee may file for amendments of license, amendments or appeals of any fish and wildlife-related license conditions, or extensions of time requests for project construction or implementation of license article provisions.

**SECTION 18 FISHWAY PRESCRIPTION FOR THE VERNON, BELLOWS FALLS, AND WILDER PROJECTS**

A. Reservations of Authority to Prescribe Fishways

In order to allow for the timely implementation of fishways, including effectiveness measures, the Department requests that the FERC include the following condition in any licenses it may issue for the Vernon Project, the Bellows Falls Project, or the Wilder Project:

> Pursuant to Section 18 of the Federal Power Act, the Secretary of the Interior herein exercises their authority under said Act by reserving that authority to prescribe fishways during the term of the License and by prescribing the fishways described in the Department of Interior's Prescription for Fishways for the Projects.

B. Preliminary Prescription for Fishways

For the Vernon, Bellows Falls, and Wilder projects, the Department, through the Service, is preliminarily prescribing, pursuant to Section 18 of the Federal Power Act (16 U.S.C., Section 811), that such new or modified fishways be designed, constructed, operated, and maintained as are necessary to accomplish safe, timely, and effective upstream and downstream fish passage; and such measures as are necessary to determine the effectiveness of those fishways during the term of the licenses.

Attachment D provides the details of our preliminary prescription, including procedural instructions concerning where and how to file comments, requests for trial-type hearings, and proposed alternative prescriptions.

## NATIONAL PARK SERVICE COMMENTS

**NPS Statement of Interest**

The Appalachian Trail (AT) crosses the Connecticut River above the Wilder impoundment from Norwich, Vermont via the Ledyard Bridge on Route 10A into Hanover, New Hampshire. The

2,190-mile-long Appalachian National Scenic Trail Appalachian National Scenic Trail (U.S. National Park Service) (nps.gov) is a unit of the National Park System.

The Saint Gaudens National Historical Park (SAGA) is located on the Connecticut River just north of Cornish NH in Sullivan County - approximately 13 river miles above the Bellows Falls dam. The General Management Plan/Environmental Impact Statement was completed in 1996 and recommended expansion of the park's boundary to include the core of Blow-Me-Down Farm, as well as other historically related adjacent properties. The Blow-Me-Down Farm property extends to the river and was purchased by the NPS in 2010. The Foundation Document was approved in June of 2015, and SAGA was formally designated as an NPS Unit On March 12, 2019. The Cultural Landscape Report for the Farm was completed in 2022.

NPS Olmsted Center View from The Farm to the southwest (2022).

**CT River Paddlers Trail**

Among the significant regional resources in the three-project area is The Connecticut River Paddlers Trail (CRPT). The water-based trail extends along the length of the Connecticut River in Vermont and New Hampshire, offering multiple public access points and primitive campsites, including island locations. As with most long-distance paddling trails, portages are a critical element to ensure safe and convenient passage around the dams.

Wilder

On river right, the canoe portage includes a gravel access road and parking area just downstream of the dam, but parking can be limited due to temporary staging for river debris from the dam. GRH regularly removes debris from the powerhouse intakes and stores it at this location. Public notice (web based) for when parking will be limited would be especially helpful if any event is held on the river, such as the annual Source to the Sea Cleanup.

GRH staff use the parking lot adjacent to the Lebanon picnic area and associated hiking trail for storage of large equipment, which discourages public use. If there is another option instead of using that location for storage, it should be considered. Several visitors to Wilder reported dissatisfaction due to the presence of trash, lack of toilets, and poor condition of the access road and ramp.[59]

Bellows Falls

Since the final Recreation Facility Inventory and Use & Needs Assessment report was prepared and submitted to the FERC, GRH renovated the Charleston boat launch parking and picnic area, replaced the wood parking ties with boulders, re-graded the parking area, and converted the trailered boat launch to a hand-carry boat launch due to safety. During the field study, the concrete blocks that form the boat ramp were broken and had a few large potholes, which had made it underutilized. In addition, both the Pine Street and Herrick's Cove boat launches were dredged after Study 30 concluded.

Vernon

Below Vernon at the Governor Hunt Recreation Area and boat launch (which has one of the longest beaches along the Connecticut River within the three Project areas) GRH has completed improvements, including cutting down several dead trees, using the trunks to designate the limits of the parking area, and re-grading the parking area. The CRPT website notes that the portage on river left across the neck is difficult with many ups and downs and rocks. The Applicant does not propose to improve that option; however, the FERC should consider an improvement at that site, as it is a good alternate route for many paddlers.

GRH plans to incorporate three canoe campsites (currently non-project recreation areas on GRH-owned land abutting the project boundaries): Lower Meadow Campsite in Charlestown, NH (Bellows Falls Project); the Wantastiquet-Hinsdale canoe rest area in North Hinsdale, NH; and Stebbins Island in Hinsdale, NH (Vernon Project).

**West River Trail**

The NPS supports the three requests of the Friends of the West River Trail set out in their filing

[59] Accession Number 20160301-5331, Study 30.

dated September 21, 2022,[60] and recommends that the FERC give these requests due consideration. If implemented by or facilitated through GRH, they would add important links to a valuable resource associated with a popular recreational feature in the area of the three projects; and are directly connected to the Connecticut River.

**Conclusion**
Undertaking these mitigation elements prior to license issuance is commendable, especially in the current relicensing when multiple annual licenses have been received.

Thank you for this opportunity to review and provide comments on this notice. If you have any questions regarding U.S. Fish and Wildlife Service comments, please contact Melissa Grader via phone at (413) 239-2138, or email at melissa_grader@fws.gov. For questions regarding National Park Service comments, please contact Kevin Mendik via phone at (617) 320-3496, or email at kevin_mendik@nps.gov. Please contact me at (617) 223-8565 if I can be of further assistance.

Sincerely,

ANDREW RADDANT

Digitally signed by ANDREW RADDANT
Date: 2024.05.16 10:51:49 -04'00'

Andrew L. Raddant
Regional Environmental Officer

Enclosures

Electronic distribution: https://ferconline.ferc.gov/FERCOnline.aspx

[60] Accession Number 20221014-5013.

cc (via email): Service List
FAC/CRFWCO, Ken Sprankle
FAC/ROENG, Jessica Pica
TNC, Katie Kennedy
NHFGD, Michael Dionne
NHFGD, Matt Carpenter
NHDES, Judith Houston
VTDFW, Lael Will
VTDEC, Jeff Crocker
VTDEC, Eric Davis
VTDEC, Betsy Simard
CRC, Kathy Urffer
CRC, Kate Buckman
BER

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USFWS. (2022a, November 30). Endangered and Threatened Wildlife and Plants; Endangered Species Status for Northern Long-Eared Bat. *Federal Register*. 87 FR 73488.

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# ATTACHMENT A

## TABLES AND FIGURES

Table 1. Summary of the minimum flows, maximum generation capacities, and allowable impoundment ranges under the current licenses for the Vernon, Bellows Falls, and Wilder projects.

| Project | Minimum Flow (cfs) | Maximum Generation (cfs) | Headpond Range (feet NGVD29)* |
|---|---|---|---|
| Vernon | 1,250 | 15,400 | 213.13-220.13 |
| Bellows Falls | 1,083 | 11,400 | 288.63-291.63 |
| Wilder | 675 | 11,700 | 380.0-385.0 |

*GRH does not typically utilize the full operating range. NGVD29 refers to the datum National Geodetic Vertical Datum 1929.

Table 2. Change in the amount of Area Weighted Suitability provided at base and peak generation flows at the Wilder, Bellows Falls, and Vernon Projects for target species/life stages. Values were derived from data provided in Study 9 (FERC Accession Number 20190520-5109; Tables 6.3.1-2, 6.3.1-5, and 6.3.1-9).

| Species/Life Stage | Percent Change in AWS | | |
|---|---|---|---|
| | Wilder | Bellows Falls | Vernon |
| Walleye juvenile | -64.25 | -57.81 | -63.78 |
| Walleye adult | -61.62 | -41.78 | -67.27 |
| Fallfish juvenile | -83.38 | -81.38 | -65.02 |
| Fallfish adult | -67.17 | -48.24 | -52.73 |
| White Sucker adult/juvenile | -83.12 | -76.81 | -78.31 |
| Longnose Dace juvenile | -88.95 | -87.46 | -81.48 |
| Longnose Dace adult | -86.54 | -83.97 | -81.97 |
| Tessellated Darter adult | -85.62 | -84.24 | -64.71 |
| Smallmouth Bass juvenile | -65.07 | -51.55 | -41.15 |
| Smallmouth Bass adult | -70.59 | -56.73 | -57.84 |
| Walleye fry | -69.01 | -86.22 | -83.08 |
| Fallfish fry | -88.73 | -90.32 | -81.05 |
| White Sucker fry | -81.51 | -72.91 | -83.81 |
| Longnose Dace fry | -88.73 | -88.71 | -82.16 |
| Smallmouth Bass fry | -90.82 | -91.69 | -83.23 |
| Walleye spawning | 163.24 | 32.02 | 241.86 |
| Fallfish spawning | -92.09 | -89.51 | -84.02 |
| White Sucker spawning | -79.61 | -76.26 | -75.00 |
| Smallmouth Bass spawning | -90.20 | -90.71 | -85.19 |
| Sea Lamprey spawning | -40.89 | -52.13 | 44.51 |
| Macroinvertebrates | 155.79 | 34.67 | 6577.78 |
| Dwarf Wedgemussel | -91.24 | -81.64 | |
| Co-occurring mussels | -67.08 | -51.21 | -58.89 |
| American Shad juvenile | | -23.31 | -14.35 |
| American Shad adult | | 66.00 | 45.75 |
| American Shad spawning | | 80.31 | 120.30 |

Table 3. Percent loss of persistent AWS for the dual flow analyses pairing current base flows and peak generation flows at the Wilder, Bellows Falls, and Vernon Projects for sensitive and/or immobile target species/life stages. Data are synthesized from tables provided in Appendices K, M, and N of Study 9 (FERC Accession Number 20190520-5109).

| Species/Life Stage | % Loss Persistent AWS | | |
|---|---|---|---|
| | Wilder* | Bellows Falls | Vernon** |
| Tessellated Darter adult | 100 | 100 | 100 |
| Walleye fry | 98 | 100 | 95-98 |
| Fallfish fry | 100 | 100 | 99-100 |
| White Sucker fry | 90 | 81 | 88-89 |
| Longnose Dace fry | 100 | 100 | 100 |
| Smallmouth Bass fry | 100 | 100 | 97-100 |
| Walleye spawning | 82 | 94 | 53-96 |
| Fallfish spawning | 100 | 100 | 99-100 |
| White Sucker spawning | 100 | 100 | 100 |
| Smallmouth Bass spawning | 99 | 99 | 95-99 |
| Sea Lamprey spawning | 100 | 100 | 100 |
| Macroinvertebrates | 61-62 | 28 | 16-57 |
| Dwarf Wedgemussel | 94-97 | 89 | N/A |
| American Shad spawning | N/A | 16 | 4-9 |

*Ranges represent seasonal variations in loss of persistent AWS.

**Ranges represent values at two Turners Falls Dam water surface elevations.

Table 4. Summary of the number of days and percent of time consecutive-day periods (at least 3) at Inflow Equals Outflow (IEO) were attained within the Wilder riverine reach for four water years.

| Consecutive Days (min 3) at IEO | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| June | | | | | | | | | | | | |
| 2009 | | | 2015 | | | 2016 | | | 2017 | | | |
| # Days | Start | End | # Days | Start | End | # Days | Start | End | # Days | Start | End | |
| 19 | 1-Jun 0:00 | 20-Jun 10:00 | 21 | 1-Jun 0:00 | 21-Jun 12:00 | 7 | 1-Jun 0:00 | 7-Jun 11:00 | 12 | 1-Jun 0:00 | 12-Jun 11:00 | |
| 4 | 27-Jun 8:00 | 30-Jun 23:00 | 8 | 22-Jun 18:00 | 30-Jun 23:00 | 7 | 8-Jun 15:00 | 15-Jun 13:00 | 16 | 14-Jun 20:00 | 30-Jun 23:00 | |
| | | | | | | 12 | 16-Jun 9:00 | 28-Jun 13:00 | | | | |
| 77% | | | 96% | | | 86% | | | 92% | | | |
| August | | | | | | | | | | | | |
| 2009 | | | 2015 | | | 2016 | | | 2017 | | | |
| # Days | Start | End | # Days | Start | End | # Days | Start | End | # Days | Start | End | |
| 10 | 1-Aug 0:00 | 10-Aug 12:00 | 10 | 4-Aug 7:00 | 14-Aug 14:00 | 11 | 1-Aug 0:00 | 12-Aug 10:00 | 5 | 4-Aug 7:00 | 9-Aug 15:00 | |
| 5 | 12-Aug 6:00 | 17-Aug 14:00 | 6 | 19-Aug 11:00 | 25-Aug 13:00 | 14 | 18-Aug 1:00 | 31-Aug 23:00 | 3 | 11-Aug 8:00 | 14-Aug 16:00 | |
| 10 | 22-Aug 8:00 | 31-Aug 23:00 | 5 | 27-Aug 12:00 | 31-Aug 23:00 | | | | 8 | 24-Aug 10:00 | 31-Aug 23:00 | |
| 82% | | | 70% | | | 85% | | | 54% | | | |

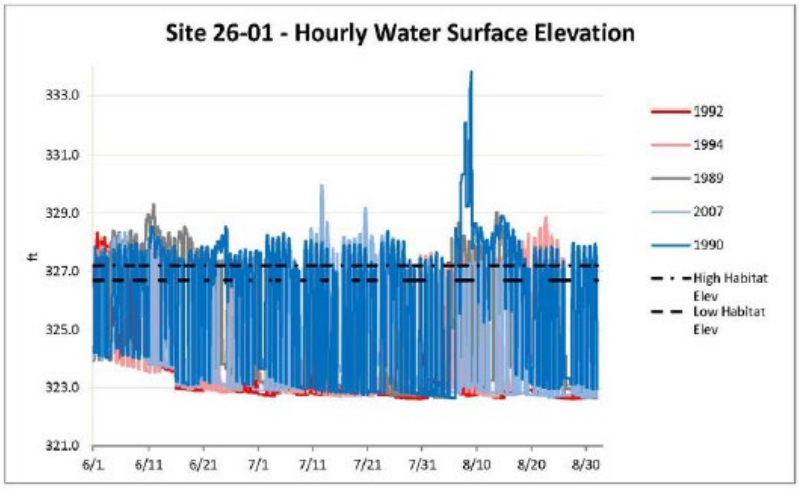
may extend into next/previous month

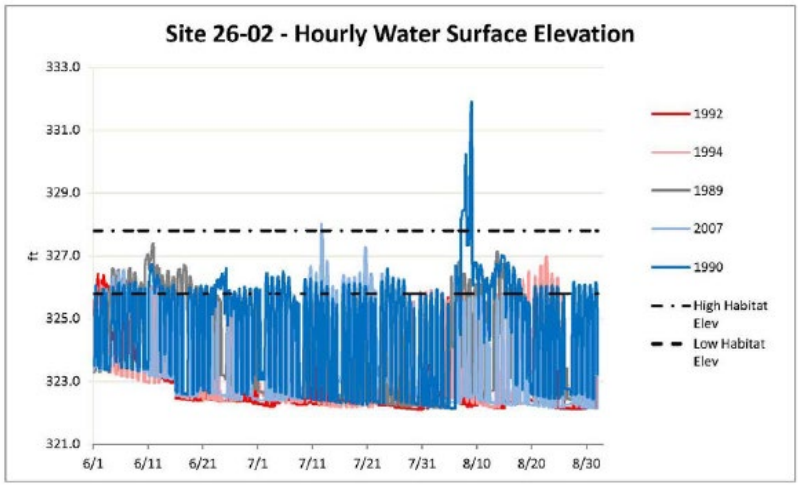
Table 5. Comparison of the number of days flows met defined thresholds in the Wilder and Bellows Falls riverine reaches each week during June and August of four water years under current operations, IEO, and IEO with Flex Ops. Green cells represent achievement of the goal to maintain multiple consecutive day periods (at least 3) at or below the flow thresholds.

| | | | # of Days Flows <5,000 below Wilder | | | # of Days Flows <7,5000 below BF | | |
|---|---|---|---|---|---|---|---|---|
| Year | Month | Week | Current | IEO atten | Att IEO Flex | Current | IEO atten | Att IEO Flex |
| 2017 | June | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2 | 0 | 1 | 1 (2 flex) | 1 | 0 | 0 |
| | | 3 | 0 | 5/5 | 5/5 | 0 | 3 | 3/3 |
| | | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 5 | 0 | 0 | 0 | 0 | 0 | 1 |
| | Aug | 1 | 0 | 7 | 6 (1, 5) | 3 | 7 | 5/5 |
| | | 2 | 0 | 7 | 4 (1, 3) | 3 | 7 | 5/5 |
| | | 3 | 0 | 7 | 3 (2, 1) | 2 | 7 | 5 (4, 1) |
| | | 4 | 0 | 6/6 | 5/5 | 3 | 7 | 6/6 |
| | | 5 | 1 | 3/3 | 3/3 | 1 | 3 | 3/3 |
| 2015 | June | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 3 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 4 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 5 | 0 | 0 | 0 | 0 | 0 | 0 |
| | Aug | 1 | 1 | 4 (2, 2) | 4 (1, 3) | 2 | 7 | 7/7 |
| | | 2 | 0 | 5/5 | 5/5 | 3 (1, 2) | 7 | 6/6 |
| | | 3 | 0 | 5 (2, 3) | 4 (1, 3) | 6 (3, 3) | 7 | 4 (1, 2, 1) |
| | | 4 | 0 | 6 (4, 2) | 4 (3, 1) | 5 | 7 | 4 (3, 1) |
| | | 5 | 0 | 3/3 | 3/3 | 3 | 3 | 3/3 |
| 2009 | June | 1 | 1 | 2 | 2 | 0 | 2 | 3/3 |
| | | 2 | 0 | 4 (1, 3) | 4 (1, 3) | 1 | 5/5 | 4/4 |
| | | 3 | 0 | 1 | 0 | 0 | 0 | 0 |
| | | 4 | 0 | 7 | 3 (1, 2) | 1 | 4/4 | 4/4 |
| | | 5 | 0 | 0 | 0 | 0 | 1 | 0 |
| | Aug | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 2 | 0 | 0 | 0 | 0 | 0 | 0 |
| | | 3 | 0 | 2/2 | 0 | 1 | 3/3 | 2/2 |
| | | 4 | 1 | 4/4 | 5/5 | 0 | 3/3 | 3/3 |
| | | 5 | 1 | 3/3 | 2/2 | 0 | 2 | 2/2 |
| 2016 | June | 1 | 0 | 4/4 | 4/4 | 5/5 | 4/4 | 3/3 |
| | | 2 | 0 | 6/6 | 6/6 | 6/6 | 7 | 7 |
| | | 3 | 0 | 5/5 | 5/5 | 7 | 7 | 7 |
| | | 4 | 3/3 | 7 | 6/6 | 7 | 7 | 7 |
| | | 5 | 0 | 2 | 2 | 2 | 2 | 2 |
| | Aug | 1 | 7 | 7 | 7 | 7 | 7 | 7 |
| | | 2 | 3 (1, 1, 1) | 7 | 6/6 | 7 | 7 | 7 |
| | | 3 | 3/3 | 6 (2, 4) | 5/5 | 7 | 7 | 7 |
| | | 4 | 1 | 3 (1, 2) | 3 (1, 2) | 6/6 | 7 | 6 (2, 4) |
| | | 5 | 0 | 2 | 2 | 3 | 3 | 2 |

Normal
Dry
Wet

Key:
6 (1, 5) = 6 days in week meet threshold; one 1-day and one 5-day period
5/5 = 5 days in week meet threshold, all consecutive



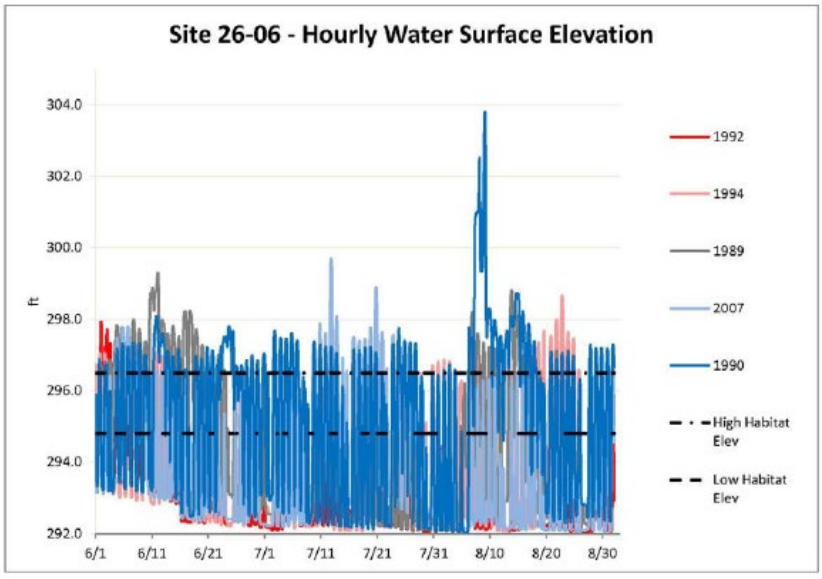
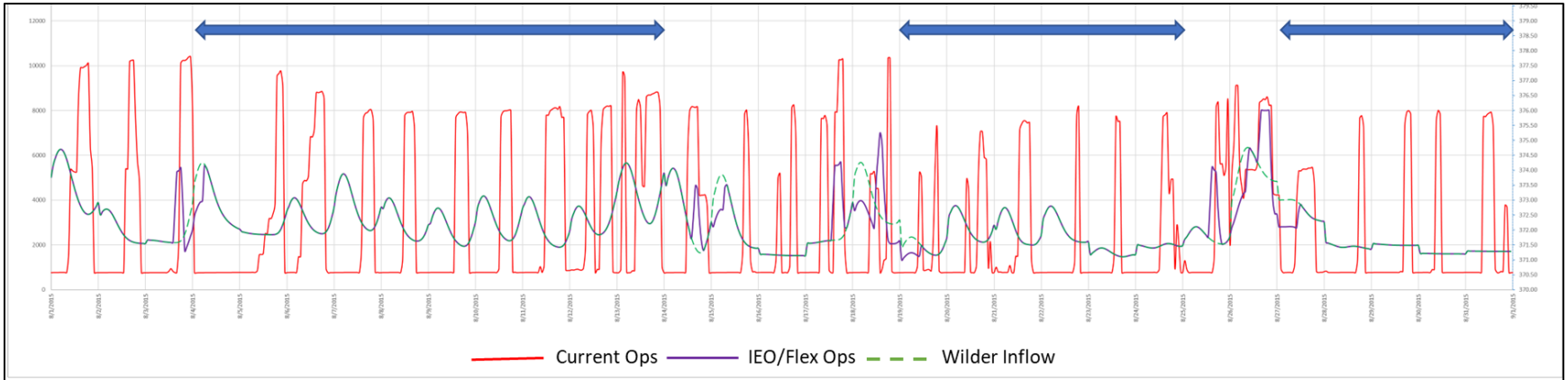




Figure 1. Modeled hourly water surface elevation graphs showing the variability in the amount of Cobblestone Tiger Beetle habitat inundated at three different sites for four different water years (Study 26; FERC Accession Number 20160617-5204).




Key: Blue bars represent consecutive days at IEO under IEO/Flex Ops Scenario

Figure 2. Flow duration graph of current operations, simulated IEO/Flex Ops flows, and modeled inflow to the Wilder Project for August 2015, showing the projected number and duration of Dwarf Wedgemussel rest periods (i.e., the number of consecutive days [at least 3] IEO is provided under IEO/Flex Ops).

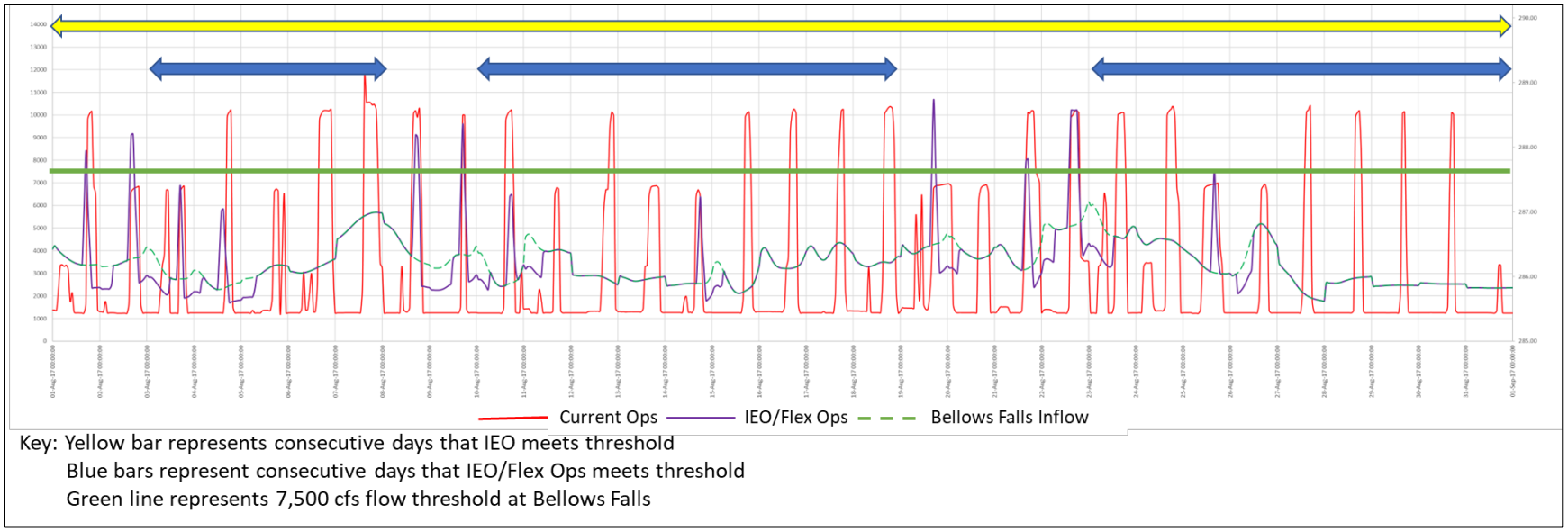



Figure 3. Flow duration graph of current operations, simulated IEO/Flex Ops flows, and modeled inflow to the Bellows Falls Project for August 2017, showing the projected number and duration of Cobblestone Tiger Beetle (CTB) rest periods (i.e., the number of consecutive days [at least 3] where IEO/Flex Ops did not exceed the threshold flow equating to maintaining at least 75 percent of uninundated CTB habitat).

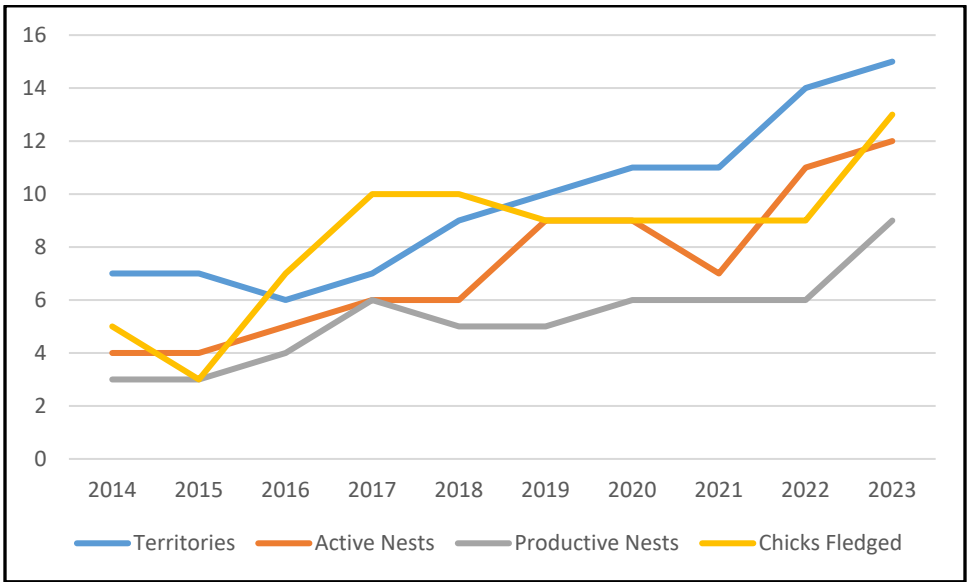



Figure 4. Bald eagle productivity data for the Connecticut River from Haverhill to Hinsdale, New Hampshire, for the period 2014 through 2022.

ATTACHMENT B

# BALD EAGLE PROTECTION PLAN FOR THE VERNON PROJECT (P-1904); THE BELLOWS FALLS PROJECT (P-1855); AND THE WILDER PROJECT (P-1892)

# 1 BACKGROUND

The purpose of this plan is to guide the Licensee's management and maintenance of lands at the Vernon, Bellows Falls, and Wilder Hydroelectric Projects (Projects) over the new license terms for the protection of bald eagles (*Haliaeetus leucocephalus*).

Although bald eagles have been removed from the endangered species list, bald and golden eagles are still protected under multiple federal laws and regulations including the Bald and Golden Eagle Protection Act (16 U.S.C. §668–668c) and the Migratory Bird Treaty Act (50 CFR §10.13).

Bald eagles occur within the project areas. Between 2014 and 2023, in the Haverhill to Hinsdale, New Hampshire reach of the Connecticut River, the number of bald eagle territories has more than doubled, the number of active nests has tripled, and the number of young fledged has more than doubled. Further, the Licensee has identified 12 sites with potential suitable winter roosting conditions within the study area, in addition to the one known winter roosting area.

# 2 PROTECTION MEASURES

Although routine Project operations are not anticipated to adversely affect bald eagles, in the event that tree removal or construction activities are necessary at the Vernon, Bellows Falls, or Wilder Projects, the Licensee shall implement the conservation measures described below to avoid effects to bald eagles.

Prior to any tree clearing within the Project boundary or areas immediately adjacent to the Project boundary by the Licensee or its contractors, the area to be cleared will be observed for bald eagle nests by the Licensee. If practicable, the Licensee should also survey for nests within 660 feet of the proposed clearing because nests adjacent to the clearing may also be indirectly affected, and consult the NH Natural Heritage Bureau DataCheck Tool and the Vermont Atlas to determine if there are records of new eagle nests for the subject area not observed during the Licensee's surveys. If such nests are documented or discovered, the Licensee shall consult the U.S. Fish and Wildlife Service (USFWS), the New Hampshire Fish and Game Department (NHFGD), and the Vermont Fish and Wildlife Department (VTDFW), as appropriate, prior to tree-clearing activities; and the tree-clearing activities shall be performed in accordance with the applicable regulations and guidance (i.e., the National Bald Eagle Management Guidelines, USFWS 2007, or as amended).

During the nesting season (January 1 through September 30), no tree clearing will occur within 330 feet of, and no construction activities will occur within 660 feet of, any known bald eagle nests by the Licensee or its contractors. The National Bald Eagle Management Guidelines advise against conducting external construction and land clearing activities within 660 feet of bald eagle nests during the breeding season. Additionally, the Guidelines recommend maintaining a year-round buffer between nests and tree clearing of at least 330 feet and a year-round buffer between external construction and nests of either 330 or 660 feet, depending on the construction's size, visibility, and local precedence. For any project-related

construction activities, work that requires blasting or other activities that produce extremely loud noises within 1/2 mile of active nests will be avoided. The Licensee shall consult with the USFWS, NHFGD, and VTDFW (as appropriate) regarding tree clearing or construction activities that cannot meet these conditions.

ATTACHMENT C

# INVASIVE PLANT SPECIES MANAGEMENT PLAN FOR THE VERNON PROJECT (P-1904); THE BELLOWS FALLS PROJECT (P-1855); AND THE WILDER PROJECT (P-1892)

# 1 PROPOSED MONITORING MEASURES FOR INVASIVE AQUATIC PLANTS

## 1.1 Updated Baseline Invasive Aquatic Plant Survey

The first full summer following license issuances, the Licensee will conduct intensive invasive aquatic plant surveys of the Vernon, Bellows Falls, and Wilder impoundments, totaling approximately 97 miles.

The survey methodology should follow methods used in Study 27, as modified through consultation with the United States Fish and Wildlife Service (USFWS), the New Hampshire Fish and Game Department (NHFGD), the New Hampshire Department of Environmental Services (NHDES), the Vermont Department of Environmental Conservation (VTDEC), and the Vermont Fish and Wildlife Department (VTFWD). The survey will be conducted by boat in the late summer (August/September) to facilitate identification of any invasive aquatic plants by means of floristic attributes. The survey methodology will be sufficient to estimate the size and species composition of invasive aquatic beds within the impoundments (including coves and other backwater areas). Estimates of stand width will be made in three meter intervals (1-3, 3-6, 6-9, and >10 m). Estimates of length will be made to the nearest foot. Each observation of invasive aquatic plants will be assigned a cover descriptor category.

The location of the invasive aquatic plants will be recorded using Geographic Positioning System (GPS) technology for later upload into a GIS map to define baseline or current conditions, and will include Site ID number, the invasive plant species found (color coded in a legend), and the percent cover.

By February 1 of the year after completing the intensive field survey, the Licensee will provide a report to the USFWS, NHFGD, NHDES, VTDEC, and VTFWD for review and comment (including providing the geospatial data in kml/kmz format). The Licensee will meet (remotely or in-person) with USFWS, NHFGD, NHDES, VTDEC, and VTFWD to discuss study results, identify areas warranting control work, and determine appropriate control approach(es). The Licensee will update the report (if necessary) and file it with the Federal Energy Regulatory Commission (FERC), along with the consultation record, no later than May 1.

## 1.2 Early Detection and Rapid Response Protocol (EDRR)

The purpose of the EDRR protocol is to find and eradicate new invasive plant infestations before they spread and cause harm.

Starting the year after completing the updated baseline survey, the Licensee will undertake annual early detection surveys throughout the project areas. Surveys will focus on highly aggressive, invasive aquatic species known to occur elsewhere in the watershed. The Licensee will consult with USFWS, NHFGD, NHDES, VTDEC, and VTFWD to identify project areas most likely to experience infestations first and to determine the most appropriate survey methodology to use, with the default method following the rapid response guidance provided by

the Massachusetts Department of Conservation and Recreation.[1]

Should any new invasive species be detected, the Licensee shall immediately notify the USFWS, NHFGD, NHDES, VTDEC, and VTFWD; consult with those agencies on the appropriate rapid response approach(es); and implement rapid response measures identified by the agencies. These early detection surveys and rapid response measures (as needed) will continue annually for the duration of the licenses.

By February 1 of the year after completing the early detection surveys, the Licensee will provide a summary memorandum to the USFWS, NHFGD, NHDES, VTDEC, and VTFWD for review and comment (including providing the geospatial data in kml/kmz format if new infestations were detected). The Licensee will meet with USFWS, NHFGD, NHDES, VTDEC, and VTFWD to discuss survey results, any control work undertaken, and any modifications to the early detection survey protocol that may be warranted for the upcoming field season. The Licensee will provide a meeting summary to the agencies no later than May 1 and submit the memorandum, including any responses provided by the agencies, to the FERC no later than July.

### 1.3 Cyclical Monitoring of Existing Invasive Aquatic Plants

The purpose of cyclical monitoring is to assess the success of control measures and guide where future control measures should occur.

Starting in the fifth year after completing the baseline survey (Section 1.1), the Licensee will conduct targeted monitoring of invasive aquatic plants on a rotating basis. The Licensee will develop a monitoring methodology in consultation with USFWS, NHFGD, NHDES, VTDEC, and VTFWD.

Although aquatic invasive plants were not quantified by species in Study 27,[2] qualitative assessment of aquatic bed polygons (i.e., beds of both native and invasive species) contained in the cover type maps provided in Appendix D of the study report suggest decreasing abundance moving upstream.[3] Given this, the proposed rotation will be:

- Year 6 - Vernon Impoundment; approximately 26 miles
- Year 7 - Bellows Falls Impoundment, approximately 26 miles
- Area 8 - Wilder Impoundment, approximately 45 miles

After Year 8, the cyclical surveys would be repeated in the same sequence as shown above or as agreed upon with USFWS, NHFGD, NHDES, VTDEC, and VTFWD, on a five-year rotating basis.[4] By February 1 of the year following a given area being surveyed, the Licensee will provide a summary memorandum of its findings (including tables, maps, and geospatial data in kml/kmz or other standard format) to the USFWS, NHFGD, NHDES, VTDEC, and VTFWD.

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[1] MADCR. 2004. Rapid Response Plan for Hydrilla (*Hydrilla verticillata*) in Massachusetts. Massachusetts Department of Conservation and Recreation, Boston, MA. https://www.mass.gov/doc/hydrilla-0/download

[2] FERC Accession Number 20190520-5109.

[3] FERC Accession Number 20190520-5109, Study 27.

[4] For example, for the Vernon Impoundment, surveys would occur in years 6, 11, 16, 21, 26, 31, 36, etc.

The Licensee will meet with the USFWS, NHFGD, NHDES, VTDEC, and VTFWD to discuss survey results, any control work undertaken since the previous survey of that area, and any modifications to the monitoring protocol that may be warranted for that area or other areas in future surveys; identify areas warranting control work; and determine appropriate control approach(es).

The cyclical section survey memorandum can be combined with the annual early detection report (Section 3.2) and both can be discussed during the same annual agency consultation meeting.

# 2 CONTROL MEASURES FOR EXISTING INVASIVE INFESTATIONS

The purpose of undertaking active management and control measures is to eradicate, reduce, or contain (as feasible) invasive aquatic plant beds at select locations for certain species where there is a reasonable expectation of success based on the best available science.

Beginning the first summer after license issuances, and continuing annually for the duration of the licenses,[5] the Licensee shall implement invasive plant control measures based on information obtained through the baseline (Section 1.1) and cyclical (Section 1.3) surveys and agency consultation on survey results. By February 1 of the year following the control work, the Licensee will provide a summary memorandum, including locations, methods, amount and percent of total invasive plants removed or treated, maps, and geospatial data (in kml/kmz format) to the USFWS, NHFGD, NHDES, VTDEC, and VTFWD. The Licensee will meet with NHFGD, NHDES, VTDEC, and VTFWD to discuss control work undertaken the previous year, and any recommended modifications to the control approach(es) for the current year. The control activity memorandum can be combined with the annual early detection report (Section 1.2) and both can be discussed during the same annual agency consultation meeting.

Additional locations and/or invasive species may be added to known locations and target species for future control work based on information obtained through the baseline (Section 1.1) and cyclical (Section 1.3) surveys, in consultation with the USFWS, NHFGD, NHDES, VTDEC, and VTFWD.

# 3 ACTIVITIES TO PREVENT THE SPREAD OF INVASIVE PLANTS

The following activities will be performed by the Licensee in order to assist in preventing the establishment, and/or spread, of terrestrial and aquatic invasive plant species.

## 3.1 Activities Associated with Daily Operations and Routine Maintenance

1. The Licensee will continue to maintain Project grounds in a manner that helps prevent the introduction and spread of invasive plant species within the Project boundary, as provided below.
2. The Licensee will not actively plant any terrestrial plants listed under the noxious weeds in the United States Department of Agriculture's Natural Resources Conservation

[5] Annual control activities may be reduced, eliminated, or suspended, based on monitoring data and agency concurrence.

Service Plants Database, which incorporates plants listed by the Vermont Invasive and Exotic Plant Advisory Committee and the New Hampshire Invasive Species Committee.

3. The Licensee will monitor areas of disturbance caused by routine operation or maintenance activities within the Project areas to ensure that invasive plant species do not out-compete native or non-invasive vegetation during the reestablishment phase. Where invasive species have been found to outcompete native or non-invasive vegetation during reestablishment, the Licensee will treat infestations, as necessary, to eliminate or reduce the invasive population(s).
4. The Licensee will instruct its work personnel to visually inspect all of the Licensee's exposed boating equipment for attached invasive plant or animal species.
5. The Licensee will clean and dry its boats and trailers that come in contact with the water following removal from the water. The Licensee will remove any visible plants or animals before entering the water or leaving the site. Invasive plants and animals are to be discarded in an upland area.
6. The Licensee will post signage explaining the threats of nonnative aquatic species and steps to prevent the spread at formal and informal recreation sites[6] within the Project areas.
7. The Licensee will participate in watershed-scale invasive species management groups and disseminate information and recommendations developed by the group to the public widely via the company website, press releases, etc.

## 3.2 Activities Associated with Construction or Major Maintenance

### 3.2.1 Prior to Construction or Major Maintenance Activities

1. The Licensee will consult with the NHFGD, NHDES, VTDEC, and VTDFW regarding the best management practices (BMP) to be employed and implement activity specific BMPs to help prevent the introduction and/or spread of invasive plant species within the area associated with the activity to be performed.
2. Workers will clean, drain, and dry boats and trailers that come in contact with the water following removal from the water.
3. Workers will remove visible plants or animals before entering the water or leaving the site. Invasive plants and animals are to be discarded in an upland area.

### 3.2.2 During Construction

1. Workers will be trained to identify invasive plants and informed of the importance of infestation prevention.
2. Construction equipment will be surveyed and equipment entering the work area will be cleaned/washed before allowing the equipment to enter an invasive-free area.
3. Invasive plants that could potentially be spread by construction equipment or workers will be removed. Along access roads, invasive plants will be identified and controlled to avoid introducing them into invasive-free areas.
4. Gravel and fill will come from invasive-free sources to avoid introducing invasive vegetation to the construction site, whenever practicable.

[6] Recreation sites include boat launches, environmental education facilities, picnic areas, trailheads, etc.

5. Certified invasive-free straw, mulch, fiber rolls, and sediment logs will be used for erosion and sediment control, whenever practicable.

3.2.3 During Seeding and Planting

1. Whenever possible, soil amendments (if any) and mulches will be obtained from invasive-free sources.
2. The Licensee will use only native seed mixes for reseeding disturbed areas, whenever possible.
3. Seeding and planting operations and maintenance will be conducted in a manner to promote vigorous growth of native or non-invasive vegetation and discourage invasive species.
4. Bare ground will be seeded as quickly as possible following disturbance.
5. Seeded sites will be monitored for invasive plant species.
6. Identified invasive plant species at monitored sites will be treated in the first full growing season.
7. Mulch will be used to limit the amount of unwanted seed sources reaching bare soil, whenever possible.
8. The Licensee will ensure that all construction contractors are aware of, and comply with, the terms listed above.

3.2.4 Post Construction

1. The Licensee will monitor any areas of disturbance caused by construction activities on lands owned by the Licensee within the Project boundary to ensure that invasive species have not out-competed native or non-invasive vegetation during the reestablishment.
2. Where invasive species have been found to outcompete native or non-invasive vegetation during reestablishment, the Licensee will eliminate or reduce the invasive population(s).

ATTACHMENT D

PRELIMINARY PRESCRIPTION FOR FISHWAYS FOR THE VERNON (P-1904), BELLOWS FALLS (P-1855), AND WILDER (P-1892) PROJECTS

Document Accession #: 20240516-5130 Filed Date: 05/16/2024

**BEFORE THE**

**UNITED STATES OF AMERICA**

**FEDERAL ENERGY REGULATORY COMMISSION**

| | | |
|---|---|---|
| Great River Hydro | ) | Vernon Project; FERC No. 1904-078 |
| | ) | Bellows Falls Project; FERC No. 1855-050 |
| | ) | Wilder Project; FERC No. 1892-030 |

# UNITED STATES DEPARTMENT OF THE INTERIOR

# PRELIMINARY PRESCRIPTION FOR FISHWAYS

# PURSUANT TO SECTION 18 OF THE FEDERAL POWER ACT

Submitted this 9th day of May, 2024

by:

AUDREY MAYER Digitally signed by AUDREY MAYER Date: 2024.05.09 16:33:09 -04'00'

Audrey Mayer

Supervisor

New England Field Office

U.S. Fish and Wildlife Service

United States Department of the Interior

TABLE OF CONTENTS

United States Department of the Interior
Preliminary Prescription for Fishways
Pursuant to Section 18 of the Federal Power Act

## 1. INTRODUCTION

The United States Department of the Interior (Department) hereby submits its Preliminary Prescription for Fishways (Prescription) for the Vernon (FERC No. 1904-078), Bellows Falls (FERC No. 1855-050); and Wilder (FERC No. 1892-030) hydroelectric projects, pursuant to Section 18 of the Federal Power Act (FPA), as amended. The Department is submitting this Prescription to the Federal Energy Regulatory Commission (Commission, FERC) with its supporting administrative record. All three projects are owned by Great River Hydro (GRH, Applicant). The projects are currently undergoing relicensing before the Commission. All projects are located on the Connecticut River: Vernon in Sullivan and Cheshire counties, New Hampshire, and Windsor and Windham counties, Vermont; Bellows Falls in Cheshire County New Hampshire and Windham County, Vermont; and Wilder in Grafton County, New Hampshire and Orange and Windsor counties, Vermont.

The Department developed its Prescription for Fishways through a review process that included consultation among fisheries biologists from the Department's U.S. Fish and Wildlife Service (Service; USFWS), the Vermont Fish & Wildlife Department (VFWD), and the New Hampshire Fish and Game Department (NHFGD).

The Department is also filing an Index to the Administrative Record in this proceeding. The Department has considered the record before the Commission as well as scientific evidence not already included in the record before the Commission or publicly available.

## 2. ADMINISTRATIVE PROCESS, HEARING RIGHTS, AND SUBMISSION OF ALTERNATIVES

This Prescription was prepared, and will be processed, in accordance with the Department's regulations at 43 Code of Federal Regulations (C.F.R.) Part 45. These regulations provide that any party to a license proceeding before the Commission in which the Department exercises mandatory authority is provided both the right to trial-type hearings on issues of material fact and the opportunity to propose alternatives to the terms contained in the Prescription.

Therefore, the Department hereby provides notice that any party to the license application process before the Commission may request a trial-type hearing on any issue of fact material to this Prescription pursuant to, and in conformance with, the regulations of the Department at 43 C.F.R. §45.21. Such a request for a trial-type hearing must be filed with the Office of Environmental Policy and Compliance, Department of the Interior, 1849 C Street, NW, Mail Stop 2629, Washington, DC 20240, within 30 days of the filing of this document with the

Commission. Should any request for trial-type hearing be filed, other parties may file interventions and responses thereto within 20 days of the date of service of the request for a hearing 43 C.F.R. §45.22. Trial-type hearings will be conducted, and a Modified Fishway Prescription developed, in accordance with the terms and time limits of 43 C.F.R. Part 45.

The Department further provides notice that any party to the license application process before the Commission may submit alternatives to the terms contained in the Prescription by filing them pursuant to, and in conformance with, the Department's regulations at 43 C.F.R. §45.71. Any such alternative proposals must be filed with the Office of Environmental Policy and Compliance, Department of the Interior, 1849 C Street, NW, Mail Stop 2629, Washington, DC 20240, within 30 days of the date of the submission of this document to the Commission.

Finally, the Department will accept and consider any comments on the Prescription filed by any member of the public, state or Federal agency, Tribe, the Applicant, or other entity or person. Comments are due within 30 days of this Prescription being filed with the Commission, and should be sent to:

Audrey Mayer, Supervisor
New England Field Office
U.S. Fish and Wildlife Service
70 Commercial Street, Suite 300
Concord, NH 03301
email: audrey_mayer@fws.gov

Pursuant to, and in conformance with, the Department's regulations at 43 C.F.R. §45.73, the Department will submit its Modified Fishway Prescription, with accompanying analysis, within 60 days after the deadline for filing comments on the Commission's draft NEPA document under 18 CFR 5.25(c). If no alternative proposals or comments on the Prescription are received by the Department and the Department does not submit a Modified Fishway Prescription within the specified deadline, the Service, on behalf of the Department, will file a letter with the Commission confirming this Prescription as the Modified Fishway Prescription.

## 3. PROJECT OVERVIEW

Except as otherwise noted, the following descriptions are from the Commission's Scoping Document 1 for the projects, issued December 21, 2012 (FERC Accession No. 20121221-3049).

### 3.1. VERNON

The Vernon Project is located on the Connecticut River at RM 141.9, about 2 miles upstream of the Ashuelot River and 7.4 miles downstream of the West River. The dam is a composite overflow and non-overflow ogee type concrete gravity structure extending across the Connecticut River between Hinsdale, New Hampshire, and Vernon, Vermont. It is 956 feet long with a maximum height of 58 feet, and consists of the integral powerhouse with a sluice gate block section that is about 356 feet long, and a concrete overflow spillway section about 600 feet

long. The maximum dam height is 58 feet. The impoundment extends upstream 26 miles from the dam and has a usable storage capacity of 18,300 acre-feet at an eight-foot drawdown from the normal full pond at elevation 220.1 feet msl, a surface area of approximately 2,550 acres at full pond and a drainage area of 6,266 square miles ($mi^2$). The powerhouse is integral to the dam and contains ten turbine/generators with an authorized installed capacity of 32.4-MW which generated an average of 136,583 MWh annually from 2000 – 2011. The generating units consist of four 2.5-MW vertical Francis turbines with an approximate per unit hydraulic capacity of 1,465 cubic feet per second (cfs) at 35 feet of head, two 6.0-MW vertical Francis turbines with an approximate per unit hydraulic capacity of 2,035 cfs at 34 feet of head, and four 5-MW vertical Kaplan turbines with an approximate per unit hydraulic capacity of 1,800 cfs at 32 feet of head.

The project is operated as a load-following or peaking hydroelectric project, with a capability to utilize 18,300 acre-feet of storage (an 8-foot drawdown) for generation purposes. During generation, downstream flows can vary between the required minimum flow of 1,250 cfs and the facility's approximate full hydraulic capacity of 17,100 cfs. During periods of sustained high flows, project generation is continuous and peaking operations are ceased.

As described in the Amended Final License Application (AFLA; FERC Accession No. 20201207-5219, Exhibit A), the project provides upstream fish passage with an anadromous fish ladder that has Ice Harbor and vertical slot sections. Downstream passage is provided by a partial-depth louver array that guides fish to a pipe discharging 350 cfs to the tailrace. A second downstream passage route is provided by a fish tube located near Unit 10, on the far right side of the powerhouse (looking downstream), that discharges 40 cfs to the tailrace.

### 3.2. BELLOWS FALLS

The Bellows Falls Project is located on the Connecticut River at RM 173.7, about 1 mile upstream of Saxtons River and 3 miles downstream of the Williams River at the upper end of a sharp bend of the Connecticut River at Bellows Falls, Vermont. The dam is a concrete gravity structure extending across the Connecticut River from the town of Rockingham, Vermont to the town of Walpole, New Hampshire and is 643 feet long with maximum height of 30 feet. The impoundment extends upstream 26 miles from the dam and has a usable storage capacity of 7,476 acre-feet at a three-foot drawdown from the normal full pond at elevation 291.6 feet msl, a surface area of approximately 2,804 acres at full pond and a drainage area of 5,414 $mi^2$. The powerhouse contains three generating units with an authorized installed capacity of 40.8 MW which generated an average of 250,249 MWh annually from 2000 – 2011. The generating units consist of three 13.6 MW vertical Francis turbines with an approximate per unit hydraulic capacity of 3,670 cfs at 57 feet of head.

The project is operated as a load-following or peaking hydroelectric project, with a capability to utilize 7,476 acre-feet of storage (a 3-foot drawdown) for generation purposes. During generation, downstream flows can vary between the required minimum flow of 1,083 cfs and the

facility's approximate full hydraulic capacity of 11,400 cfs. During periods of sustained high flows, project generation is continuous and peaking operations are ceased.

As described in the AFLA (FERC Accession No. 20201207-5219), the project provides upstream fish passage with an anadromous vertical slot fish ladder.[1] A barrier dam in the lower end of the bypass reach prevents fish from accessing the upper bypass reach during periods of spill at the dam. Downstream passage facilities consist of a partial-depth diversion boom that guides fish to a forebay sluiceway/skimmer gate. A small auxiliary gate located on the east side of the powerhouse directs fish that may get under the diversion boom to the sluiceway.[2]

### 3.3. WILDER

The Wilder Project is located on the Connecticut River at RM 217.4 approximately 1.5 miles upstream of the White River and 7 miles downstream of the Ompompanoosuc River. The dam is a concrete gravity structure extending across the Connecticut River from Hartford, Vermont, to Lebanon, New Hampshire and includes an earthen embankment about 400 feet long, a non-overflow gravity concrete bulkhead wall 232 feet long, a concrete forebay intake 208 feet long, a gravity concrete spillway about 526 feet long and 59 feet in maximum height, and another earthen embankment about 180 feet long. The impoundment extends upstream 45 miles from the dam and has a usable storage capacity of 13,350 acre-feet at a five-foot drawdown from full pond at elevation 384.5 feet mean sea level (msl), a surface area of 3,100 acres at full pond and a drainage area of 3,375 $mi^2$. The powerhouse contains three generating units with a total authorized installed capacity of 35.6 MW which generated an average of 153,738 MWh annually from 1982 – 2011. The generating units consist of two 16.2-MW adjustable blade Kaplan turbines with an approximate per unit hydraulic capacity of 6,000 cfs at 49 feet of head, and one 3.2-MW vertical Francis turbine with an approximate hydraulic capacity of 700 cfs at 58 feet of head. Water flowing through the project's turbines is discharged via the project's draft tubes into the tailrace immediately below the dam.

The project is operated as a load-following or peaking hydroelectric project, with a capability to utilize 13,350 acre-feet of storage (a 5-foot drawdown) for generation purposes. During generation, downstream flows can vary between the required minimum flow of 675 cfs and the facility's approximate full hydraulic capacity of 10,700 cfs. During periods of sustained high flows, the Project's generation is continuous and peaking operations are ceased.

As described in the AFLA (FERC Accession No. 20201207-5219), the project provides upstream fish passage with an anadromous pool-and-weir fish ladder.[3] Downstream passage was provided

[1] Operation of the Bellows Falls fish ladder is dependent on noted adult salmon passed at the next downstream facility. Since 2013, the Connecticut River Atlantic Salmon Commission (CRASC) has requested the ladder operate either once 100 sea lamprey or one salmon pass the Vernon ladder, whichever occurs first.
[2] Historically, downstream passage facilities at Bellows Falls and Wilder were designed and operated for Atlantic salmon. In 2012, the CRASC voted to terminate the Atlantic salmon program. Salmon fry stocking ceased in 2013 and downstream passage facilities have not been required to operate at either project since 2016.
[3] Operation of the Wilder fish ladder is dependent on noted adult salmon passed at the next downstream facility.

by discharging 512 cfs through the skimmer gate (trash/ice sluice) located between Unit 3 and the fish ladder entrance gallery bay and spillway.[4]

Vernon, Bellows Falls, and Wilder are the third, fourth, and fifth dams on the river, respectively. The second dam is the Turners Falls Hydroelectric Project (FERC No. 1889) and the first dam is the Holyoke Hydroelectric Project (FERC No. 2004). There are six dams on the Connecticut River upstream of Wilder, all FERC-licensed hydroelectric projects.

# 4. RESOURCE DESCRIPTION

## 4.1. CONNECTICUT RIVER

The following description of the Connecticut River basin is taken directly from Exhibit E of the Amended Final License Application for the projects (FERC Accession 20201207-5219):

*"The Connecticut River originates in the Fourth Connecticut Lake in Pittsburg, New Hampshire, near the Canadian border. It flows in a southerly direction for about 407 miles to Long Island Sound (the Sound) at Old Saybrook, Connecticut. The river flows 255 miles between New Hampshire and Vermont and forms the state border from Stewartstown, New Hampshire, and Canaan, Vermont, to the Massachusetts border at Hinsdale, New Hampshire, and Vernon, Vermont. The New Hampshire-Vermont state border is designated as the ordinary low-water mark on the western (Vermont) shore, without reference to extreme droughts and prior to inundation by impoundments of dams after 1933 when the US Supreme Court issued its decision on the state boundary location as a result of boundary lawsuit filed by Vermont against New Hampshire in 1915.*

*The river has a drainage area (DA) of 11,250 square miles (sq. mi.). The upper Connecticut River Basin has a DA of 7,751 sq. mi. and is about 271 miles long. It includes the Wilder, Bellows Falls, and Vernon Project areas and the area downstream to the Turners Falls Project."*

### MIGRATORY FISH OF THE CONNECTICUT RIVER BASIN

#### 4.1.1. Historical Migratory Fisheries Resources

Historically, the Connecticut River Basin was accessible to at least nine species of sea-run migratory fish from Long Island Sound (Gephard and McMenemy 2004). Migratory fish can be classified as either anadromous or catadromous. Adult anadromous fish live in the ocean and migrate to freshwater rivers to spawn. Juvenile anadromous fish stay in freshwater habitats for several months to many years before they return to the ocean and grow to maturity. Catadromy is the reverse life history, whereby a fish spends most of its life rearing in estuarine or fresh water before migrating out to sea to spawn. Of the sea-run migratory fish historically present in the Connecticut River Basin, Atlantic salmon (*Salmo salar*), striped bass (*Morone saxatilis*), Atlantic sturgeon (*Acipenser oxyrinchus*), shortnose sturgeon (*A. brevirostrum*), sea lamprey (*Petromyzon*

[4] Refer to Footnote 2.

*marinus*), American shad (*Alosa sapidissima*), alewife (*A. pseudoharengus*), and blueback herring (*A. aestivalis*) are anadromous; and the American eel (*Anguilla rostrat*a) is catadromous.

American shad, shortnose sturgeon, blueback herring, sea lamprey, Atlantic salmon, and American eel were known to ascend the mainstem Connecticut upstream of the Hadley Falls in Massachusetts. Before construction of dams excluded access, these migratory species, with the exception of shortnose sturgeon, were abundant in mainstem and tributary habitat upstream of the Turners Falls Project, providing important ecological roles and fisheries for native Americans and early settlers (Gephard and McMenemy 2004; Noon 2003).

On the Connecticut River, it is believed sea lamprey historically ranged at least as far upstream as Bellows Falls, Vermont, if not farther (Scarola 1987). American shad and blueback herring were known to ascend the river as far as Bellows Falls, Vermont (Gephard and McMenemy 2004), while records document American eels as far upstream as the Connecticut Lakes in New Hampshire (Warfel 1939) and Atlantic salmon as far upstream as Beechers Falls, Vermont (CRASC 1998).

The construction of dams along the mainstem and many of its tributaries during the Industrial Revolution prevented migratory fish from accessing most freshwater habitat in the watershed. By the 1820s Atlantic salmon had disappeared from the river and the population of American shad had been seriously depleted (Jones 1988).

#### 4.1.2. Present Day Migratory Fisheries Resources

The first fish lift in the United States was built at the Holyoke Project (FERC No. 2004) in 1955 (Haro and Castro-Santos 2012). This was followed by the construction of fish ladders at the next four dams on the Connecticut River: Turners Falls in 1980, Vernon (FERC No. 1904) in 1981, Bellows Falls (FERC No. 1855) in 1982, and Wilder (FERC No. 1892) in 1985 (Figure 4.1). These fish ladders were designed to pass sea-run Atlantic salmon and, in the case of the lower three dams, American shad (Daugherty 1969); however, as summarized in Table 4.1, they also have passed sea lamprey and American eels. The Connecticut River Atlantic salmon restoration program ceased in 2013 and no adult salmon have passed main stem upstream fishways since 2019.

## 4.2. IMPACTS OF DAMS ON FISH MIGRATIONS

Migratory fish have evolved to require specific conditions in river systems and the relatively recent alteration to many river systems by the construction of dams and other impacts has negatively affected migratory fish populations. Dams can impact both upstream and downstream fish migration in river systems (Limburg and Waldman 2009). Dams not only block or impede fish migration, but also alter the hydrology and aquatic habitat in the river. A recent study estimated the available habitat for American shad prior to dam construction in its native range to be 41 percent greater than current levels of accessibility (Zydlewski, et al. 2021). Where water flow is slowed upstream of dams, lake-like conditions prevail, rather than riverine ones. Water

flow downstream of dams can be significantly altered (Limburg and Waldman 2009), particularly at peaking hydroelectric projects, with drastic changes in water depth and velocity occurring over short time periods. Depending on the severity and location of blockages and changes to hydrology, migratory fish populations can be severely reduced or extirpated due to dam impacts (Limburg and Waldman 2009).


Figure 4.1. Map showing the Connecticut River watershed and location of dams referenced in this document.

The degree to which a given dam is an impediment to the upstream movement of juvenile eels depends on a number of factors, including the height of the dam, its surface, whether the surface is wetted or not, and the size of the eels trying to ascend it. Some upstream barriers may be size selective, as the ability of juvenile eels to scale obstacles decreases as they grow in size (Hitt, Eyler, and Wofford 2012). In general, a high dam with a dry, vertical surface represents the greatest barrier. While some portion of eels trying to ascend a given barrier may be successful, studies have shown that the density of eels tends to be higher downstream of a dam and lower upstream of a dam. On the Merrimack River, Hoover (Hoover 1938) reported a great discrepancy in eel abundance above and below the Amoskeag Dam in Manchester, New Hampshire, with much higher densities just below the dam, and Sprankle (2002) reported similar findings with catch rates upstream of the Essex Dam in Lawrence, Massachusetts, much lower than downstream of the dam. High densities below barriers due to limited passage success may have the negative effects of altering natural sex ratios, increasing the transmission of parasites and

diseases, and increasing intraspecific competition for habitat and food resources (Krueger and Oliveira 1999; Oliveira and McCleave 2000).

Table 4.1. Annual counts of key migratory fish species passing fishways at the first five barriers on the main stem Connecticut River for the time period 2001 through 2021.

| Species | Year | Holyoke | Gatehouse | Vernon | Bellows Falls | Wilder |
|---|---|---|---|---|---|---|
| Sea Lamprey | 2001 | 49,306 | 2,144 | 3,184 | | |
| Sea Lamprey | 2002 | 74,979 | 10,160 | 2,201 | | |
| Sea Lamprey | 2003 | 53,030 | | 8,048 | | |
| Sea Lamprey | 2004 | 59,461 | 8,418 | 3,668 | | |
| Sea Lamprey | 2005 | 28,134 | | 3,586 | 229 | |
| Sea Lamprey | 2006 | 17,636 | 3,005 | 2,895 | 256 | |
| Sea Lamprey | 2007 | 39,933 | 15,438 | 17,038 | 705 | |
| Sea Lamprey | 2008 | 57,049 | 32,035 | 22,434 | 2,233 | 2 |
| Sea Lamprey | 2009 | 18,996 | 8,297 | 1,532 | 100 | |
| Sea Lamprey | 2010 | 39,782 | | 3,179 | 393 | |
| Sea Lamprey | 2011 | 19,136 | 2,032 | 329 | 74 | |
| Sea Lamprey | 2012 | 14,089 | 4,503 | 696 | | |
| Sea Lamprey | 2013 | 22,092 | 6,016 | 1,002 | 213 | |
| Sea Lamprey | 2014 | 22,136 | 5,553 | 399 | 212 | |
| Sea Lamprey | 2015 | 22,245 | 8,436 | 2,519 | 971 | 2 |
| Sea Lamprey | 2016 | 35,249 | 15,128 | 5,521 | 1,619 | |
| Sea Lamprey | 2017 | 21,526 | 9,223 | 2,612 | 1,261 | |
| Sea Lamprey | 2018 | 10,238 | 4,010 | 3,124 | 324 | |
| Sea Lamprey | 2019 | 18,347 | 3,700 | 2,315 | 147 | |
| Sea Lamprey | 2020 | 33,739 | 17,525 | 7,290 | 2,142 | |
| Sea Lamprey | 2021 | 20,150 | 11,227 | 7,841 | 2,183 | |
| | | | | | | |
| American Shad | 2001 | 273206 | 1540 | 1616 | | |
| American Shad | 2002 | 374534 | 2870 | 336 | | |
| American Shad | 2003 | 286814 | | 267 | | |
| American Shad | 2004 | 191555 | 2235 | 653 | | |
| American Shad | 2005 | 116511 | 1581 | 167 | 3 | |
| American Shad | 2006 | 154745 | 1810 | 133 | | |
| American Shad | 2007 | 158807 | 2248 | 65 | | |
| American Shad | 2008 | 153109 | 3995 | 271 | | |
| American Shad | 2009 | 160649 | 3947 | 16 | | |
| American Shad | 2010 | 164439 | 16768 | 290 | | |
| American Shad | 2011 | 244177 | 16798 | 46 | 1 | |
| American Shad | 2012 | 490431 | 26727 | 10715 | | |
| American Shad | 2013 | 392967 | 35494 | 18220 | | |
| American Shad | 2014 | 370506 | 39914 | 27706 | | |
| American Shad | 2015 | 412656 | 58079 | 39771 | 44 | |
| American Shad | 2016 | 385930 | 54760 | 35513 | 1973 | |
| American Shad | 2017 | 536670 | 48727 | 28684 | | |
| American Shad | 2018 | 275232 | 43146 | 31724 | 733 | |
| American Shad | 2019 | 314361 | 22649 | 12872 | 3 | |
| American Shad | 2020 | 362423 | 41252 | 13897 | 460 | |
| American Shad | 2021 | 237306 | 21052 | 9701 | 356 | |

| Species | Year | Holyoke | Gatehouse | Vernon | Bellows Falls | Wilder |
|---|---|---|---|---|---|---|
| Atlantic Salmon | 2001 | 24 | | 1 | 1 | |
| Atlantic Salmon | 2002 | 34 | | 3 | | |
| Atlantic Salmon | 2003 | 28 | | 0 | | |
| Atlantic Salmon | 2004 | 45 | | 1 | 1 | 1 |
| Atlantic Salmon | 2005 | 132 | | 4 | 3 | 2 |
| Atlantic Salmon | 2006 | 115 | | 4 | 0 | |
| Atlantic Salmon | 2007 | 107 | | 5 | 3 | |
| Atlantic Salmon | 2008 | 83 | | 8 | 8 | 4 |
| Atlantic Salmon | 2009 | 59 | | 7 | 4 | 1 |
| Atlantic Salmon | 2010 | 42 | | 8 | 4 | 2 |
| Atlantic Salmon | 2011 | 71 | | 9 | 6 | 3 |
| Atlantic Salmon | 2012 | 28 | | 4 | 2 | 2 |
| Atlantic Salmon | 2013 | 69 | | | | |
| Atlantic Salmon | 2014 | | | | | |
| Atlantic Salmon | 2015 | 13 | | | | |
| Atlantic Salmon | 2016 | 3 | | | | |
| Atlantic Salmon | 2017 | 10 | | 2 | 1 | |
| Atlantic Salmon | 2018 | 2 | 2 | 2 | 2 | |
| Atlantic Salmon | 2019 | 3 | 1 | | | |
| Atlantic Salmon | 2020 | 0 | | | | |
| Atlantic Salmon | 2021 | 0 | | | | |
| | | | | | | |
| American Eel | 2001 | | | | | |
| American Eel | 2002 | 2 | | | | |
| American Eel | 2003 | | | | | |
| American Eel | 2004 | | | | | |
| American Eel | 2005 | 8752 | | | | |
| American Eel | 2006 | 5135 | | | | |
| American Eel | 2007 | 5145 | | | | |
| American Eel | 2008 | 13798 | | | | |
| American Eel | 2009 | 6427 | | | | |
| American Eel | 2010 | 4253 | | | | |
| American Eel | 2011 | 9734 | | | | |
| American Eel | 2012 | 39423 | | | | |
| American Eel | 2013 | 13584 | | | | |
| American Eel | 2014 | 49817 | | 124 | 35 | 8 |
| American Eel | 2015 | 20038 | | 1554 | 60 | 46 |
| American Eel | 2016 | 38449 | | -907 | -163 | |
| American Eel | 2017 | 19438 | | 581 | -158 | |
| American Eel | 2018 | 8562 | | -7934 | -444 | |
| American Eel | 2019 | 27505 | | 2307 | | |
| American Eel | 2020 | 17689 | | | | |
| American Eel | 2021 | 12469 | | 15392 | 256 | |

For adult alosines (i.e., American shad, blueback herring, and alewife) migrating to spawning habitat, nearly any dam represents a barrier to migration. Alosines are not leaping fish like salmon. They require streaming flow. Therefore, nearly any differential between headwater and tailwater elevation will prohibit their movement. Adult salmonids are able to leap over some instream obstructions if there is a deep enough pool below it. However, most hydropower dams are high enough to preclude even salmon from passing.

For downstream migration, fish respond to river flow and migrate past dams via different routes, including over dam spillways, down bypass channels, and through hydroelectric turbines (Castro-Santos and Haro 2003; Jansen, Winter, Bruijs, and Polman 2007; Kynard & O'Leary 1993). At hydroelectric dams, large volumes of water can direct out-migrating fish into potential hazards while they attempt to pass the project. Fish may be injured or killed via entrainment through a turbine, discharge through a gate or over a spillway with no adequate plunge pool, impingement on screens and racks, and trauma due to changes in barometric pressure

(barotrauma). Mortality caused by passing downstream, through turbines, at hydroelectric projects can vary greatly depending on species, size, and life stage (adult or juvenile) of fish as well as on turbine design, including turbine flow, tip speed, rotational speed, number of blades/buckets, blade spacing, and runner diameter (Franke, et al. 1997). Twelve percent mortality has been observed for American shad (Heisey, Mathur, Fulmer, and Kotkas 2008) and 100 percent mortality for American eel (Carr and Whoriskey 2008). Generally, fish passing through hydroelectric turbines can be injured or killed due to rapid barotrauma, cavitation, strike, grinding, turbulence, and shear stress (Brown, et al. 2014; Cada and Coutant 1997).

## 4.3. AMERICAN EEL

The American eel serves as an important prey species for many fish, aquatic mammals, and fish-eating birds and become predators themselves as they grow in freshwater systems (USFWS 2015). Restoring eels to freshwater habitats restores the historical ecosystem balance. In some rivers, eels are an important host species for successful reproduction of freshwater mussels (USFWS, 2015). In addition, eels support valuable recreational, commercial, and subsistence fisheries (USFWS 2015).

### 4.3.1. American Eel Biology and Life History

The American eel is a catadromous species that lives in freshwater and migrates downstream to the Sargasso Sea to spawn before dying. Larval eels are transported by ocean currents to rivers along the eastern seaboard of North America. Historically, American eel were abundant in most East Coast streams, often comprising 25 percent or more of the total fish biomass (Haro, et al. 2000). However, beginning in the 1980s, a substantial decline throughout most of their range has occurred (Haro, et al. 2000).

American eels are panmictic, meaning that there is a single spawning site without mating restrictions, neither genetic nor behavioral, upon the population, and therefore random recombination occurs with each new generation of American eel. Thus, there are no unique adaptations to specific regions within the range of American eel from Canada to the Caribbean (Shepard 2015). The spawning location is east of the Bahamas and south of Bermuda in the center of the gyre known as the Sargasso Sea. After spawning, American eel eggs hatch into "leptocephali," a small transparent, larval stage that is passively transported in ocean currents for about 1 year. Leptocephali eventually metamorphose into “glass eels” which leave ocean currents and swim to coastal waters anywhere from the Caribbean to eastern Canada. Within days of reaching coastal waters, glass eels transform into small, fully developed, pigmented eels. They are often called elvers at this stage, an imprecise term that is generally applied to small eels in fresh water that may be of many sizes and ages.

Juvenile eels are usually referred to as yellow eels. Small yellow eels are sexually indeterminate and cannot be differentiated histologically until reaching a length of about 8 inches. Yellow eel upstream movement generally occurs from dusk to dawn (Verdon, Desrochers, and Dumont 2003) in all months of the year with peak movement dependent on temperature and latitude

(Richkus and Whalen 2000).

Upstream movements are to lakes, ponds, and upstream river reaches where they generally encounter fewer yellow eels, less competition, and greater opportunity for eel growth (Lamothe, Gallagher, Chivers, and Moring 2000). Yellow eels in upstream reaches of rivers and inland lakes tend to be older, larger, and female, although it is not known whether eels that will become female tend to move upstream or if the conditions upstream cause eels to become female (Helfman, Facey, Hales, and Bozeman 1987; Oliveira K. 1999). Upstream habitats appear to facilitate the growth and out-migration of the largest and most fecund members of the population, in relation to downstream habitats.

Sexual maturation and silvering begin at ages from 3 years to more than 30 years. Females mature at later ages than males and eels mature at later ages in fresh water, as compared to marine and estuarine waters where growth is more rapid. Age at maturation increases with latitude—for example, silvering in fresh waters of the Chesapeake Bay region occurs at ages from 6 to 16 years (Helfman, Facey, Hales, and Bozeman 1987), but at 8 to 23 years in Canada (Cairns, et al. 2005). The timing of silver eel migration has also been correlated with latitudinal location, occurring in large part in late summer in the north and late winter in the south (Haro 2003). For example, silver eels migrate from the St. Lawrence River in large part from August to November, from Connecticut rivers in September through October, and from Georgia rivers from October through March (ASMFC 2012a). However, the timing of silver eel migration can also vary based on localized triggers such as weather, photoperiod, temperature, streamflow, and other local environmental conditions (Haro 2003) and is an active area of research.

Downstream migration has been commonly perceived as occurring primarily at night. Overall, 81.2 percent of the 293 eel passage events (including yellow eels) at dams on the Shenandoah River occurred during turbine shutdown periods between 1800 and 0600 hours (Eyler, Walsh, Smith, & Rockey 2016). The other 18.8 percent passed during the day or were not detected. Downstream movement from fresh water is accelerated by heavy rains and rises in stream flow (i.e., freshets); two thirds of the 293 eel passage events at dams on the Shenandoah River coincided with high-discharge events (Eyler, Walsh, Smith, & Rockey 2016). Downstream movement of eels has been detected during each month of the year except July, and during day and night (Eyler, Walsh, Smith, & Rockey 2016). Downstream migrants use tidal transport and travel near the surface, but also make vertical movements, especially when encountering dams (Brown, Haro, and Castro-Santos 2009; ASMFC 2012a).

#### 4.3.2. Impacts to American Eel Migration

The Connecticut River supports an American eel population. However, dams throughout the basin, particularly in the major tributaries, block access to much of the eel habitat. Historical records document American eels as far upstream as the Connecticut Lakes in New Hampshire (Scarola 1987); however, long-term monitoring data at existing fishways on the main stem, which were designed to pass anadromous species, reveal that substantial impediments to eel

passage still exist (Table 4.1).[5]

### 4.3.3. Current Status of the American Eel Population

In 2004, the USFWS was petitioned to list American eel under the Endangered Species Act (ESA), but ultimately determined that listing was not warranted (USFWS 2007). The USFWS determined that although the population of American eel had declined and had been extirpated from some areas, it was still widely distributed throughout its historic range and not in immediate threat of extinction. In 2010, the Council for Endangered Species Act Reliability (CESAR) petitioned the USFWS to re-consider listing the American eel under the ESA based on new information (CESAR 2010). The 2010 petition suggested that American eel was currently threatened with extinction due to the present or threatened destruction, modification, or curtailment of its habitat or range, overutilization for commercial and recreational purposes, disease and possibly predation, the inadequacy of existing regulatory mechanisms, as well as global warming, and anthropogenic factors related to electric generation by hydroelectric projects and the spread of swim bladder parasites from ship ballast water (CESAR 2010). In 2015, the USFWS completed the status review and determined that listing was not warranted at this time and that the American eel remains widely distributed throughout its native range (USFWS 2015b).

There is no current formal assessment for American eel abundance available for the Connecticut River. Passage data summarized in Table 4.1 document eels passing upstream of the Wilder Project (FERC No. 1892) in Wilder, Vermont. In addition, Figure 4.2 depicts eel presence recorded from fisheries surveys (circa 1980s onward) undertaken in the watershed.

[5] Currently, the only main stem dam with dedicated eel passage facilities is the Holyoke Project (FERC No. 2004).

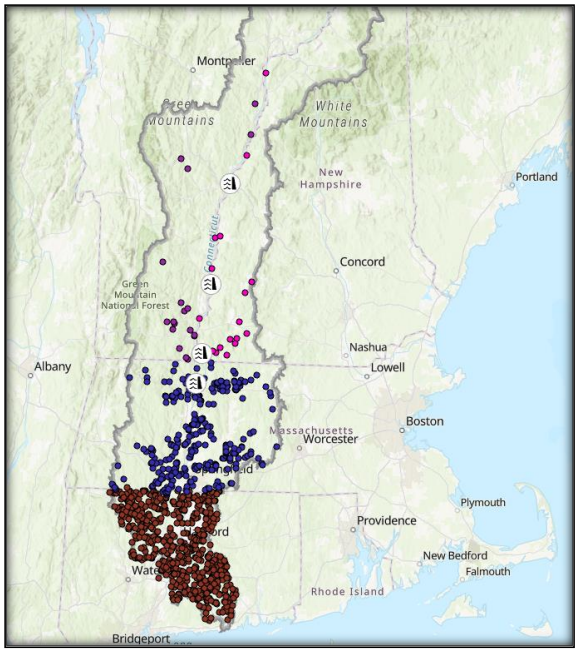


Figure 4.2. Map showing eel presence within the Connecticut River watershed based on fisheries surveys.

### 4.3.4. Resource Management Goals for American Eels

The Comprehensive Resource Management Plans filed at the Commission for eels are listed in Section 10.1 and other Resource Management Plans referenced herein are listed in Section 10.2; the goals and objectives of these plans are outlined here. The decline of eels and the ecological services they provide is a widely held concern among Atlantic Coast states in the Northeast. Management objectives for American eel are outlined in the Interstate Fishery Management Plan (FMP) for American Eel published by the Atlantic States Marine Fisheries Commission (ASMFC) (ASMFC 2000). The FMP's goals are to maintain and enhance the abundance of American eels in inland coastal waters and to contribute to the viability of the adult American eel spawning population at sea. An objective is to provide adequate upstream passage and escapement to inland waters for elvers and juvenile eels, as well as to provide adequate downstream passage and escapement to the ocean for pre-spawn adult eels. Another objective is to restore American eel where they have been extirpated and increase their numbers where they still occur. The FMP identifies the lack of adequate upstream and downstream passage for migrating juvenile and adult eels as an impact on the population.

Since its development in 2000, the FMP has been modified five times. Addendum I (approved 2006) established a mandatory reporting of harvest and effort by commercial fishers and dealers (ASMFC 2006). Addendum II (approved 2008) made recommendations for improving upstream and downstream passage for American eels. The ASMFC recommended special considerations for American eels in Commission hydropower licensing proceedings. These considerations include, but are not limited to, improving upstream passage and downstream passage, and collecting data on both means of passage (ASMFC 2008). In addition, both the 2012 and 2017

Benchmark Stock Assessments (ASMFC 2012a; ASMFC 2017a) found that the American eel population in U.S. waters is at or near historically low levels due to a combination of historical overfishing, habitat loss and alteration, productivity and food web alterations, predation, turbine mortality, changing climatic and oceanic conditions, toxins and contaminants, and disease. Addendum III (ASMFC 2013) contains a recommendation that jurisdictions identify opportunities to work within the Commission's review process and with non-Commission dam owners to improve downstream eel passage and to seek opportunities to improve upstream eel passage through obstruction removal and deployment of eel passage structures. Addendum IV (ASMFC 2014) made changes to the commercial fishery, implementing restrictions on the elver and yellow eel commercial fisheries. Addendum V (ASMFC 2018) implemented additional restrictions on the yellow eel fishery and recommended new triggers for evaluating and addressing the coastwide cap for yellow eels.

The Connecticut River Atlantic Salmon Commission (CRASC) developed the Connecticut River American Eel Management Plan (CRASC 2023). The goal of the plan is to "protect, conserve, and enhance American Eel populations for their intrinsic, ecological, economic, recreational, scientific, and educational values and for public use." Plan strategies to achieve stated objectives include improving access to historical rearing habitats by requiring safe, timely, and effective upstream fish passage at known barriers and increasing survival and fitness of out-migrating silver eels by requiring safe, timely, and effective downstream fish passage at known barriers where eel occur upstream. The Service supports the goals, objectives, and strategies identified in the CRASC Eel Plan.

### 4.3.5. Existing Fish Passage and Restoration Efforts for American Eel

#### 4.3.5.1. Eel Passage at Vernon, Bellows Falls, and Wilder

Upstream

As described in Section 3, all three projects have upstream passage facilities that were designed to pass anadromous species. The VFWD monitors passage at Vernon and Bellows Falls, including American eels (since 2014; Table 4.1). GRH undertook upstream eel surveys at the projects during the license proceedings). The first year of study collected baseline data on eel presence downstream of each dam, to determine where they congregate while attempting to move upstream (Study 18; FERC Accession No. 20160301-5331). At Vernon, 49 percent of the 80 eels observed during the surveys were within the fish ladder, with another 45 percent of all observed eels documented in the vicinity of the submerged flood gates; however, eels near the flood gates did not appear to be moving, whereas eels in the ladder were seen swimming by the window (FERC Accession No. 20160301-5331). Similar surveys conducted at Bellows Falls and Wilder yielded two eel observations and no eels, respectively (FERC Accession No. 20160301-5331). In contrast, a total of 1,545; 60; and 52 eels (net upstream passage) were documented passing the Vernon, Bellows Falls, and Wilder ladders, respectively, during the Upstream Passage of Riverine Fish Species Assessment (Study 17; FERC Accession No. 20160517-5034).

These data document eels are attempting to ascend the anadromous fish ladders. While the fact

that eels have been observed upstream of the projects[6] indicates the ladders provide some level of passage for the species, count data in Table 4.1 suggest substantial drop-back in both modified ice harbor (i.e., lower portion of the Vernon fish ladder) and vertical slot (Bellows Falls ladder) designs. Further, results of a directed study to assess passage efficiency for eels through the Vernon ladder revealed that the probability of an eel moving from the release location to the upper extent of the ladder under normal operating conditions was 0.043, with most attrition occurring in the vertical slot section of the ladder (FERC Accession No. 20200324-5162). In contrast, the Holyoke Project, which has dedicated upstream eel passage facilities, consistently passes thousands of fish annually (Table 4.1). There currently are three eel passage facilities at Holyoke: an eel ladder on the South Hadley side of the Hadley Falls Dam; an eel ramp trap in the Holyoke tailrace; and an eel ramp trap located in the upper stilling basin of the Holyoke fish lift's auxiliary water system (AWS). There is substantial inter-annual variability in eel usage of each facility, underlying the importance of providing multiple routes of upstream passage at a project, if necessary (Table 4.2).

Downstream

As described in Section 3, all three projects have downstream passage facilities designed for anadromous species. GRH undertook eel routing, rate of movement, and survival studies during the license proceedings (Study 19; FERC Accession No. 20170228-5202).

*Wilder*

Study results showed 45 of 50 eels released upstream of Wilder passed the project; of those 45 fish, 84 percent passed through the units, four percent used the trash/ice sluice, and the remaining 11 percent passed via an unknown route (Study 19; FERC Accession No. 20170228-5202). Of the 48 fish that entered the project area, median approach time (from release) was 25 hours, median forebay residency duration was 0.2 hours, and median total project residency was 1.7 hours (FERC Accession No. 20170228-5202). Approximately 75 percent of eels arrived and departed the dam area in less than 24 hours (FERC Accession No. 20170228-5202).

*Bellows Falls*

At Bellows Falls, study results showed 47 of 50 eels released 3 miles upstream of Bellows Falls dam passed the Project; of those 47 fish, 78.7 percent passed through the units, 12.8 percent used the trash/ice sluice, and the remaining 8.5 percent passed over the spillway into the bypass reach (Study 19; FERC Accession No. 20170228-5202). Twenty additional eels were released directly into the Bellows Falls canal. Of those, 95 percent passed via the turbines and five percent used the trash/ice sluice. Another 29 tagged eels from the Wilder release entered the Bellows Falls project area, with 72.4 percent using the turbines, 20.7 percent using the trash/ice sluice, and 6.9 percent passing over the spillway.

[6] Eel were documented below all three dams in Study 18 (FERC Accession No. 20160301-5331) and within the Vernon and Wilder impoundments in Study 10 (FERC Accession No. 20160301-5231).

Table 4.2. Eel count data for the period 2010 through 2022 at the Holyoke Project (Normandeau, 2023).

| Year | % Total Spillway* | % Total Stilling Basin | % Total Tailrace | % Total S. Hadley Ladder | Total |
|---|---|---|---|---|---|
| 2010 | 13 | 4 | 3 | 77 | 4,253 |
| 2011 | 53 | 46 | 0 | 0 | 9,734 |
| 2012 | 51 | 38 | 0 | 11 | 39,423 |
| 2013 | 4 | 82 | 2 | 6 | 13,584 |
| 2014 | 1 | 28 | 72 | 0 | 50,319 |
| 2015 | <1 | 18 | 41 | 22 | 20,038 |
| 2016 | <1 | 4 | 48 | 48.4 | 38,449 |
| 2017 | <1 | 29 | 40 | 31 | 19,438 |
| 2018 | 0 | 36 | 57 | 7 | 8,431 |
| 2019 | <1 | 2 | 50 | 49.8 | 27,505 |
| 2020 | N/A | 3 | 61 | 36 | 17,689 |
| 2021 | N/A | 4 | 80 | 16.0 | 12,945 |
| 2022 | N/A | 17 | 81 | 2 | 8,264 |

* Note the spillway eel ramp was decommissioned in 2020 due to low usage.

Of all tagged eels that entered the project area (i.e., Bellows Falls and Wilder releases combined), median approach time (from release) was 16 hours, median canal residency duration was 0.2 hours, and median total project residency was 1.4 hours (FERC Accession No. 20170228-5202). Approximately 80 percent of eels arrived and departed the study area in less than 24 hours (FERC Accession No. 20170228-5202).

*Vernon*

A total of 120 tagged eels entered the Vernon study area: 50 eels released into the Vernon headpond; 45 eels from the Bellows Falls releases; and 25 eels from the Wilder releases (FERC Accession No. 20170228-5202). Of those 120 fish, 112 passed Vernon; 83 percent went through the turbines; 3.5 percent used the fish pipe; 1.7 percent used the trash/ice sluice; one percent each used the fish tube and fish ladder; and the remainder passed via unknown routes (FERC Accession No. 20170228-5202).

For Vernon-released eels that entered the project area, median approach time (from release) was 49.5 hours, median forebay residency duration for all released eels (i.e., all release groups, all projects) was 0.2 hours, and median total project residency was 1.2 hours (FERC Accession No. 20170228-5202). Approximately 76 percent of eels arrived and departed the study area in less than 24 hours (FERC Accession No. 20170228-5202).

*Survival Analysis – Vernon, Bellows Falls, and Wilder*

The survival analysis portion of Study 19 used balloon tag technology (HI-Z Turb'N Tag©; or HI-Z) and assessed mortality through representative turbines at each project. Table 4.3

summarizes survival and malady-free[7] estimates of the HI-Z study.

Table 4.3. 48-hour survival and malady-free rates through various passage routes at the Vernon, Bellows Falls, and Wilder projects. Values in parentheses represent 90 percent confidence intervals (Study 19; FERC Accession No. 20170228-5202; Table 5.2.1-1 and Table 5.2.4-4).

| | Vernon | | | | Bellows Falls | Wilder |
|---|---|---|---|---|---|---|
| | **Unit 4** | **Unit 8 @ 1,000 cfs** | **Unit 8 @ 1,700 cfs** | **Unit 9** | **Unit 2** | **Unit 2** |
| **Percent Survival** | 93.5 (±6) | 87.5 (±7.8) | 74 (±10.2) | 97.9 (±3.5) | 98 (±3.2) | 62 (±11.3) |
| **Percent Malady-Free** | 68.1 (±13.1) | 73.4 (±12.6) | 74.4 (±12.8) | 96.4 (±9.4) | 90.8 (±10.3) | 60.6 (±13.1) |

At Vernon, results show highest survival through the slowest (75 revolutions per minute [rpm]) single runner vertical Francis turbine (Unit 9), followed by the faster vertical Francis turbine (Unit 4; 133.3 rpm), with lowest survival through the vertical Kaplan turbine (Unit 8) (FERC Accession No. 20170228-5202). The highest survival rate was documented at Bellows Falls, which has the largest (14-foot-diameter [ft.-diam]) and second slowest (85.7 rpm) Francis turbines of all three projects (FERC Accession No. 20170228-5202). The lowest survival rate was through the vertical Kaplan turbine at Wilder (Unit 2), which has a larger diameter and slower speed than Vernon Unit 8, but operates at a much higher discharge (FERC Accession No. 20170228-5202). Unit 3 (vertical Francis) also was evaluated, but testing ceased after the first release group due to high tag loss and the discharge location being associated with the fish ladder attraction water system. Malady-free rates generally paralleled survival rates, with highest malady-free rates through Bellows Falls Unit 2 and Vernon Unit 9 and the lowest malady-free rate through Wilder Unit 2.

### 4.3.6. Actions Necessary to Accomplish Resource Management Goals for American Eel

For the reasons outlined in Section 4.3.5, the existing technical fishways at the Vernon, Bellows Falls, and Wilder projects do not provide safe, timely, or effective fish passage for eels. Lack of efficient upstream fish passage facilities at the projects restricts access to approximately 120 river miles of main stem habitat. Likewise, the lack of ineffective passage and protection at the projects contribute to cumulative mortality of outmigrating, pre-spawn adult eels, which negatively impacts outmigrant production potential of eels reared in upstream habitats.

Given the documented presence of eels upstream and downstream of the projects, dedicated upstream eel passage and downstream passage and protection at Vernon, Bellows Falls, and Wilder is warranted. Providing safe, timely, and effective upstream passage will enhance the

[7] The study report defines malady-free as fish free of visible injuries, having less than 20percent scale loss per side, and free of loss of equilibrium.

abundance and distribution of eels in the Connecticut River watershed. Likewise, providing safe, timely, and effective downstream passage and protection will avoid or minimize mortality of silver phase eels as they migrate out of the freshwater system to spawn in the Sargasso Sea.

The resource management goals outlined in Section 4.3.4 will be achieved through enhancing upstream passage for American eels throughout the Connecticut River basin and increasing survival and escapement of American eels passing barriers and hydroelectric facilities during their downstream spawning migration. The CRASC eel plan (CRASC 2023) establishes an upstream passage performance standard of 95 percent based upon fish present at the entrance of the fishway (or dedicated eelway) for all size classes present, and a downstream passage performance standard of 95 percent for through project survival, inclusive of a less than five percent injury rate, and a time to pass of 24 hours or less for fish actively migrating within one kilometer (km) of a project facility. For downstream migrating silver eels, the plan calls for 95 percent survival at each hydroelectric project on the river to help address cumulative effects of eels having to negotiate multiple hydropower facilities (CRASC 2023). The upstream and downstream passage and protection measures in Section 9 are necessary to achieve identified resource management goals for the species. The performance standards provide a means of verifying constructed facilities provide safe, timely, and effective passage for eels and assist in minimizing cumulative impacts to the species in the freshwater environment.

## 4.4. ALOSINES

### 4.4.1. Alosine Biology and Life History

Alosines are important forage stocks for other marine species (e.g., cod, striped bass, bait for lobster) (Walter, Overton, Ferry, and Mather 2003; Hall, Jordaan, and Frisk 2012). Depleted alosine stocks have negatively impacted other fisheries (Nelson, Chase, and Stockwell 2003; Ames 2004; Hall, Jordaan, and Frisk 2012; Essington, et al. 2015) and impact freshwater predators (Mattocks, Hall, and Jordaan 2017). Historically, river herring and American shad supported important commercial and recreational fisheries. However, due to declines in stock abundance, many states have implemented bans on the harvest of these species (ASMFC 2007b).

The American shad is the largest member of the herring family, averaging between 17 and 24 inches in length and between 3 and 6 pounds in weight at sexual maturity. The American shad's range extends along the East Coast from the St. Lawrence River in Canada to the St. Johns River in Florida (ASMFC 2020). In the marine environment, the American shad is considered to be pelagic and highly migratory, moving between summer feeding areas and overwintering areas (ASMFC 2010). The species exhibits strong homing to its natal river and is capable of migrating long distances (e.g., 204 miles in the Connecticut River) up unimpeded rivers and streams (MEDMR and MDIFW 2008; CRASC 2022b; SRAFRC 2010). Maturation of American shad in the Northeast occurs between 3 to 5 years for males, and 4 to 6 years for females (Collette and Klein-MacPhee 2002). Adult shad begin to congregate along the coast and in estuaries when temperatures range from 3 to 15°C, and spawn when temperatures range between 8 and 26°C (Greene, Zimmerman, Laney, and Thomas-Blate 2009).

American shad require well oxygenated water of 5 milligrams per liter or more for successful spawning and egg and larval development, and generally their spawning habitats are broad shallow water areas of rivers and streams over a clean sand and gravel substrate (Stier and Crance 1985). Shad usually spawn at night or during overcast days. Shad exhibit batch spawning behavior (Greene, Zimmerman, Laney, and Thomas-Blate 2009); in the Connecticut River, female shad were shown to develop and spawn batches of eggs when ready, every few days, for five to six times over the course of a spawning season, with first time spawning females having approximately 300,000 eggs (McBride, Ferreri, Towle, Boucher, and Basilone 2016). In the northern part of their range, shad are capable of spawning more than once and may live up to 10 years (MDMR 2013). Studies show the percentage of repeat spawning occurrence in shad populations increases with latitude (Greene, Zimmerman, Laney, and Thomas-Blate 2009).

Juvenile shad spend the summer in their natal riverine habitat and migrate to the estuary in the fall before entering the ocean (Weiss-Glanz, Stanely, and Moring 1986). American shad size, schooling behavior, and timing of migration (upstream and downstream) are key factors in designing, locating, and timing the operation of any fishway for the species; and have been taken into account in preparing this Prescription.

The blueback herring is an anadromous fish distributed along the Atlantic coast from Nova Scotia, Canada, to Florida (McBride, Harris, Reid Hyle, and Holder 2010). Adults grow to between 10 and 11 inches long, on average. The onset of spawning is related to temperature, and thus, varies with latitude (MRTC 1997). In the southern part of their range, adults were collected as early as January and as late as April during the spawning runs of 2002 through 2005 (McBride, Harris, Reid Hyle, and Holder 2010). In the Connecticut River watershed, a long-term study assessing the river herring population in the lower river collected blueback herring as early as April 7 and as late as June 17 during the spawning runs of 2017 through 2022 (excluding 2020 due to Covid pandemic safety protocols), with peak catch rates typically occurring in mid-May (Sprankle 2017, 2018, 2019, 2021, 2022).

Adults prefer to spawn in swift flowing sections of freshwater tributaries, channel sections of fresh and brackish tidal rivers, and coastal ponds, over gravel and clean sand substrates, especially in northeastern rivers where alewife and blueback herring coexist (MRTC 1997). Blueback herring are iteroparous, meaning they do not die after spawning and will return to spawn again. Spawning consists of males and females broadcasting their gametes simultaneously into the water column and over the substrate (MRTC 1997). Post-spawn adults migrate rapidly downstream after spawning, usually leaving the spawning area within 5 days (Mullen, Fay, and Moring 1986). Larvae begin to feed externally 3 to 5 days after hatching and transform gradually into the juvenile stage. Juveniles remain in freshwater nursery areas feeding mainly on zooplankton (MRTC 1997), growing to a length of 3 to 4 inches before moving downstream to more saline waters and eventually to the sea. In the Connecticut River, a three-year study of juvenile shad and blueback herring outmigration at the Holyoke Project found blueback herring

outmigration began as water temperature declined to 21°C and ended when temperatures reached 10°C (O'Leary and Kynard). Blueback herring mature in 3 to 5 years, whereupon they return to their natal streams to spawn (Mullen, Fay, and Moring 1986). Adult blueback herring are strong swimmers, with abilities comparable to alewives adjusted for body size (Castro-Santos 2005). Generally, blueback herring do not leap or jump over obstacles; they use streaming flow to pass impediments. Blueback herring size, schooling behavior, and timing of migration (upstream and downstream) are key factors in designing, locating, and timing the operation of any fishway for this species and have been taken into account in preparing this Prescription.

#### 4.4.2. Impacts to Alosine Migration

The Connecticut River supports runs of alewife, blueback herring, and American shad. However, dams throughout the basin restrict access to much of the historical spawning and rearing habitat, which has been documented as far upstream as Bellows Falls in Vermont for American shad (Noon 2003) and blueback herring (Gephard and McMenemy 2004).

#### 4.4.3. Current Status of the Alosine Population

Coast-wide stock assessments for American shad found that stocks are currently at all-time lows and do not appear to be recovering (ASMFC 2007a; ASMFC 2020). The identified causes of the decline include overfishing, inadequate fish passage at dams, predation, pollution, water withdrawal, and habitat loss due to dam construction. The 2017 river herring (alewife and blueback herring) benchmark stock assessment found that of 54 stocks, 16 experienced increasing abundance trends, 2 experienced decreasing abundance trends, 8 experienced stable abundance, 10 experienced no discernible trends in abundance due to high variability, and 18 did not have enough data to assess recent abundance trends (ASMFC 2017b). While there was improvement for some river systems, river herring continue to be depleted on a coastwide basis and near historic lows (ASMFC 2017b).

Alewife and blueback herring were petitioned for listing under the ESA in 2011. Although the National Marine Fisheries Service (NMFS) determined in 2013 that listing was not warranted (NMFS 2013), it committed to partnering with the ASMFC and other stakeholders to develop a comprehensive conservation plan for river herring throughout its entire range. In August of 2017, NMFS announced the initiation of a new status review of river herring to determine whether listing either species as endangered or threatened under the ESA is warranted (NMFS 2017). In June of 2019, NMFS completed the status review and found that the listing was not warranted. However, NMFS' Status Review Team acknowledged that alewife are at historical low levels (NMFS 2019).

While the Connecticut River supports an American shad population, the blueback herring run is severely depressed at present (Figure 4.3). Annual blueback herring passage counts peaked in 1985 at 632,255 but average less than 1,000 fish in recent years. Although mainstem dams within the historical range of both species have fish passage facilities (Figure 4.4), long-term monitoring data reveal substantial variability in American shad passage counts both at a given

(mainstem) facility and across facilities (Table 4.1).

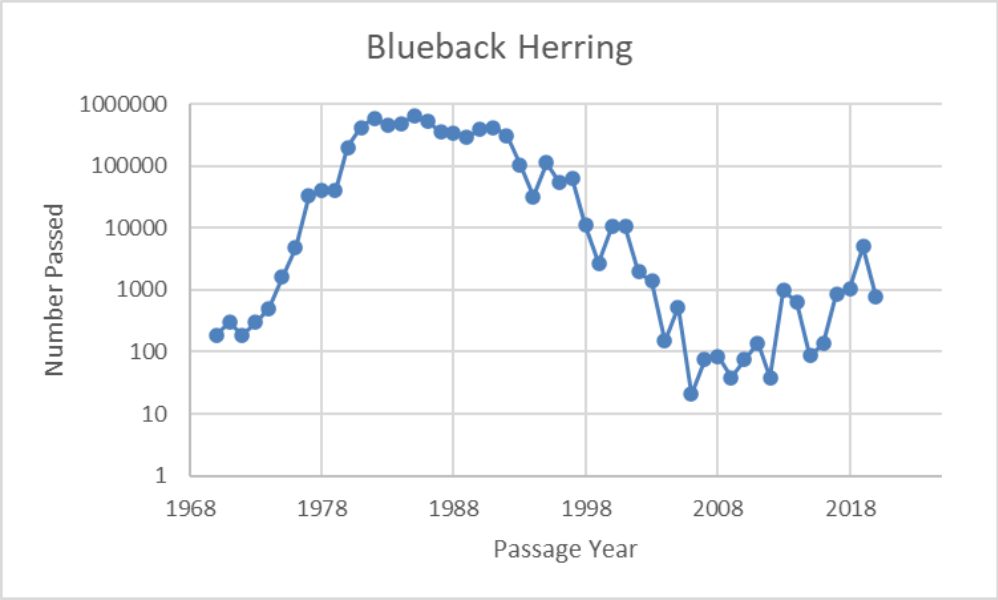


Figure 4.3. Number of blueback herring passing the Holyoke Project (FERC No. 2004) from 1970 through 2020.

### 4.4.4. Resource Management Goals for Alosines

The Comprehensive Resource Management Plans filed at the Commission for alosines are listed in Section 10.1 and other Resource Management Plans referenced herein are listed in Section 10.2; the goals and objectives of these plans are outlined here. The decline of alosines and the ecological services they provide is a widely held concern among Atlantic Coast states in the Northeast. Management objectives for American shad and river herring are outlined in the FMP for anadromous alosine stocks of the eastern United States (ASMFC 1985) and the FMP's amendments (ASMFC 1999; ASMFC 2009; ASMFC 2010).

The goal of Amendment 2 to the FMP is to enhance and restore east coast migratory spawning stocks of, among other alosines, alewife and blueback herring in order to achieve stock restoration and maintain sustainable levels of spawning stock biomass (ASMFC 2009). Objectives of Amendment 2 include preventing further declines in river herring abundance. The FMP states that much of the reduction in river herring stocks along the Atlantic Coast is related to degradation of spawning and nursery habitat by anthropogenic activities, including dam construction (ASMFC 2009). The protection, restoration, and enhancement of river herring habitat is deemed critical for preventing further declines in river herring abundance and to restoring healthy, self-sustaining populations to the East Coast of the United States (ASMFC2009). One strategy identified in the FMP is for each state to develop a plan to improve the quality of, and restore adequate access to, river herring habitat within its area of jurisdiction (ASMFC 2009). Actionable recommendations in the FMP include pursuing installation of passage facilities where dam removal is not feasible and enhancing survival at dams during emigration (ASMFC 2009).

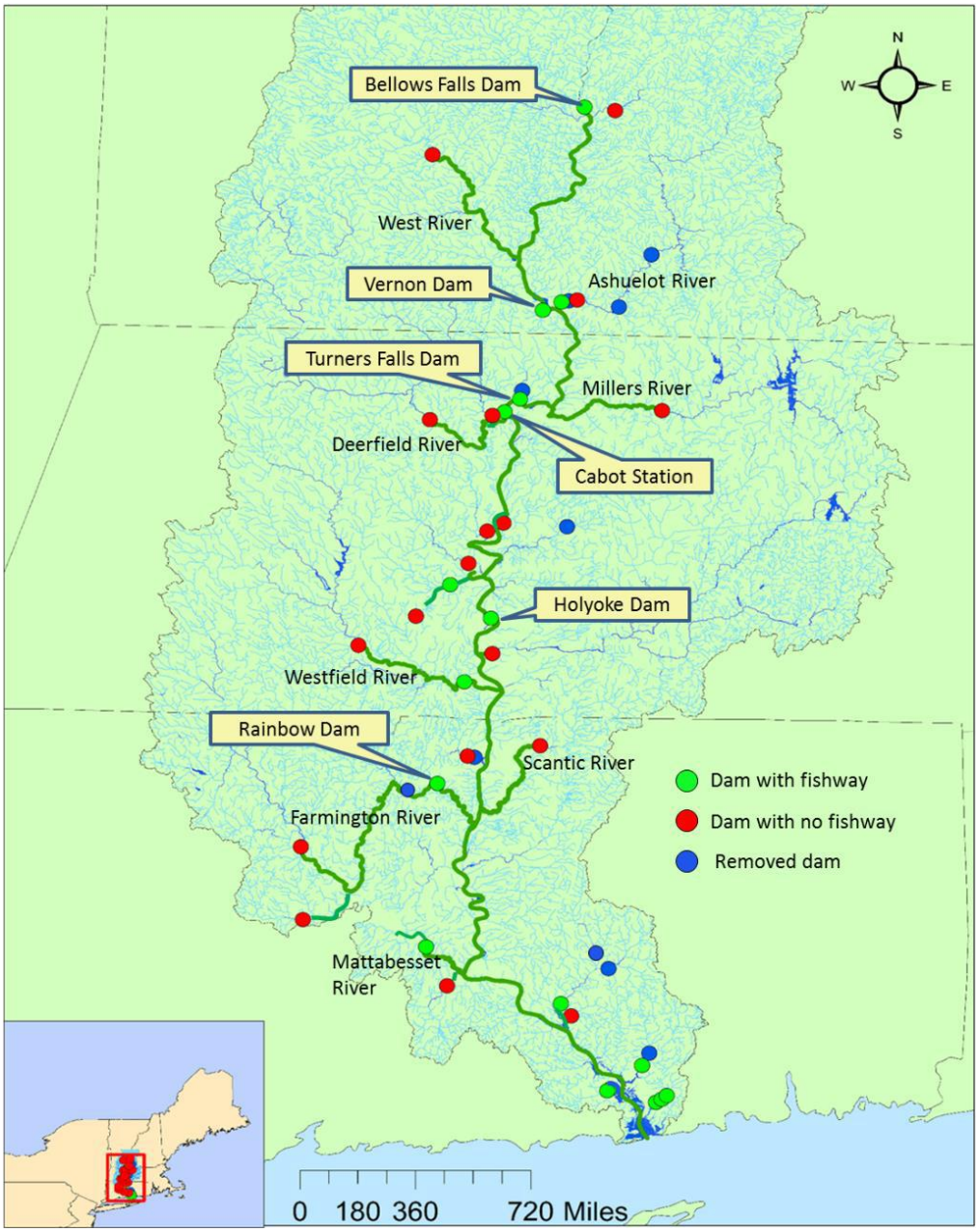


Figure 4.4. The current range of American shad (green line) in the Connecticut River basin. (CRASC, 2022a, p. 3)

The goal of Amendment 3 to the FMP is to protect, enhance, and restore Atlantic Coast migratory stocks and critical habitat of American shad in order to achieve levels of spawning stock biomass that are sustainable, can produce a harvestable surplus, and are robust enough to withstand unforeseen threats (ASMFC 2010). Objectives include maximizing the number of juvenile shad recruits emigrating from freshwater stock complexes, and restoring and maintaining shad spawning stock biomass and age structure to achieve maximum juvenile recruitment (ASMFC 2010). Identified strategies to achieve these objectives include restoring and maintaining access to historical spawning and nursery habitat and achieving river-specific

restoration targets for shad populations, as specified in the recent shad assessment or in existing stock-specific restoration plans (ASMFC 2010).

Per a requirement of Amendment 3 to the FMP, the CRASC developed a habitat plan for the Connecticut River that quantifies potential shad habitat within the watershed, assesses current accessibility of those habitats, identifies threats to shad habitat, and recommends actions to mitigate those threats (CRASC 2022a). Two identified threats relate to hydropower: barriers to upstream and downstream migration; and hydropower impoundment elevation and discharge flow fluctuations (CRASC 2022a).

The CRASC also developed the Connecticut River American Shad Management Plan and Fish Passage Performance Addendum (CRASC 2022b). Plan goals are to restore and maintain a naturally reproducing American shad population to its historical range in the Connecticut River basin; provide and maintain recreational fisheries to the four basin states and the traditional in-river commercial fisheries for the species in Connecticut; and provide for the diverse ecological benefits derived from all life stages of shad in freshwater, estuarine, and marine habitats (CRASC 2022b). The plan (CRASC 2022b) contains seven population objectives, including river reach-specific population targets and an overall Connecticut River American shad population target of 1.7 million entering the mouth of the Connecticut River annually. The plan also identifies fish passage performance standards intended to help achieve restoration goals (CRASC 2022b).

Another river-specific management plan was developed by the CRASC for river herring (CRASC 2004). Objectives of the Management Plan for River Herring in the Connecticut River include: 1) achieve and sustain annual passage of 300,000 – 500,000 adults at the Holyoke fish passage facility; 2) achieve annual passage of 40-60 percent of the spawning run at each successive upstream barrier on the Connecticut River from Holyoke to Bellows Falls, Vermont; 3) maximize outmigrant survival for juveniles and spent adult river herring; 4) support tributary restoration programs (fish passage, barrier removal, and broodstock trap-and-transport); and 6) enhance, restore, and maintain river herring habitat in the Connecticut River basin.

Additionally, the Connecticut Department of Energy and Environmental Protection (CTDEEP) developed the Connecticut River American Shad Sustainable Fishing Plan (SFP) Update (CTDEEP 2017). The plan describes methods for monitoring the shad fishery and stock structure using a stop light style approach. By monitoring fish passage, juvenile recruitment, and pre-spawn adult escapement, the CTDEEP will determine if management action is necessary to maintain the sustainability of the shad fishery (CTDEEP 2017). Similarly, the Massachusetts Division of Marine Fisheries (MADMF) has an updated and approved American shad SFP for the Connecticut River (MADMF 2019), which adopts the CTDEEP SFP stop light protocol, with one minor deviation associated with the threshold for the fish passage metric.

### 4.4.5. Existing Fish Passage and Restoration Efforts for Alosines

#### 4.4.5.1. Alosine Passage at the Vernon Project

Upstream Adult

As described in Section 3, Vernon provides upstream fish passage via an anadromous fish ladder having a lower Ice Harbor section and an upper vertical slot section. Passage through the ladder is monitored by the VFWD. Based on passage counts for the period 2012 through 2022, an average of 56.5 percent of the shad that pass the Turners Falls Project subsequently pass Vernon (Table 4.4).

During the license proceeding, GRH assessed passage efficiency of the Vernon ladder and route-specific migration rates using a combination of Passive Integrated Transponder (PIT) and radio telemetry tagged fish and monitoring detections at in-river, far field, and near field locations, as well as within the ladders (Study 21; FERC Accession No. 20170228-5202). Telemetry data from GRH-released shad as well as shad tagged by FirstLight for its relicensing Study 3.3.2 (FERC Accession No. 20161014-5112) were analyzed. Mean downstream residency of shad from detection within the study area to entry into the fish ladder was 20.8 hours (FERC Accession No. 20170228-5202, Table 5.3-4). Nearfield attraction was calculated to be 58.6 percent, entrance efficiency was 73.5 percent, and internal ladder efficiency was 55.2 percent (FERC Accession No. 20170228-5202). Median ladder residency duration was 2.4 hours, with residency duration being shorter (0.8 hours) in the lower Ice Harbor section than in the upper vertical slot section (1.7 hours); however, the lower section had nearly twice as many forays as the upper section with 38 percent being successful, whereas 73 percent of the forays in the upper section were successful (FERC Accession No. 20170228-5202).

Downstream Adult

Downstream passage is provided at Vernon by a partial-depth louver array that guides fish to a pipe discharging 350 cfs to the tailrace. A second downstream passage route is provided by a fish tube located near Unit 10, on the far right side of the powerhouse (looking downstream), that discharges 40 cfs to the tailrace.

For tagged fish migrating back downstream from the Vernon upper impoundment or Bellows Falls riverine reach, analysis of Study 21 2015 data indicated a median forebay residency duration of 11.1 hours (FERC Accession No. 20170228-5202). Of fish that passed downstream, 12 percent went through the turbines, 19 percent used the fish pipe, 35.7 percent passed over the spillway, and 33.3 percent passed via an unknown route. Due to the high number of fish passing in spill or via an unknown route, GRH undertook a second year of study in 2017 focusing only on downstream passage (FERC Accession No. 20180215-5165). Of fish that passed downstream during 2017, 33.3 percent used the fish pipe, 27.1 percent passed at the spillway, 25 percent passed through the turbines, 6.3 percent used the fish ladder, and 6.3 percent used the debris sluice (FERC Accession No. 20180215-5165). Median forebay residency duration was 11.7 hours, similar to the result from 2015 (FERC Accession No. 20180215-5165).

Table 4.4. American shad annual passage count data for the first three dams on the Connecticut River, for the years 2012 through 2022.

| Year | Holyoke Dam Passed | Turners Falls Dam Passed | % Passed TF | Vernon Dam Passed | % Passed Vernon |
|---|---|---|---|---|---|
| **2012** | 490,431 | 26,727 | 5.4 | 10,386 | 38.9 |
| **2013** | 392,967 | 35,293 | 9.0 | 18,220 | 51.6 |
| **2014** | 370,506 | 39,914 | 10.8 | 27,706 | 69.4 |
| **2015** | 412,656 | 58,079 | 14.1 | 39,771 | 68.5 |
| **2016** | 385,930 | 54,069 | 14.0 | 35,513 | 65.7 |
| **2017** | 536,670 | 48,727 | 9.1 | 28,684 | 58.9 |
| **2018** | 275,232 | 43,146 | 15.7 | 31,724 | 73.5 |
| **2019** | 314,361 | 22,649 | 7.2 | 12,872 | 56.8 |
| **2020** | 362,423 | 41,252 | 11.4 | 13,897 | 33.7 |
| **2021** | 237,306 | 21,052 | 8.9 | 9,701 | 46.1 |
| **2022** | 190,352 | 23,576 | 12.4 | 13,763 | 58.4 |
| | | | | | |
| **Mean** | 360,803 | 37,680 | 10.7 | 22,022 | 56.5 |

Route-specific mortality was assessed in Study 21 using the 2015 downstream passage data at Vernon and detection data from downstream receivers. Results are summarized in Table 4.5. There are several drawbacks with using radio telemetry to estimate survival, including the inability to ascribe a failure to detect a tagged fish to a known passage route at the Project versus to natural post-spawn mortality, predation, etc. In addition, it is possible that a fish that died during passage might still be detected and considered live due to 'dead drift.' For this latter reason, FirstLight undertook Study 3.3.19 *Ultrasound Array Control and Cabot Station Shad*

Table 4.5. The number of adult shad detected by radio telemetry monitoring at Stebbins Island, Northfield Mountain, and Turners Falls following downstream passage at Vernon dam (by passage route), 2015 (FERC Accession No. 20170228-5202, Table 5.4-6).

| Passage Route | No. Passing Vernon | Stebbins Island | | Northfield Mountain | | Turners Falls | |
|---|---|---|---|---|---|---|---|
| | | No. | Percent Detected (%) | No. | Percent Detected (%) | No. | Percent Detected (%) |
| Fish Pipe | 8 | 7 | 88 | 6 | 75 | 6 | 75 |
| Spill | 15 | 14 | 93 | 10 | 67 | 9 | 60 |
| Units 5-8 | 3 | 1 | 33 | 1 | 33 | 1 | 33 |
| Units 9-10 | 2 | 2 | 100 | 2 | 100 | 2 | 100 |
| Unknown | 14 | 9 | 64 | 6 | 43 | 5 | 36 |
| **Total** | **42** | **33** | **79** | **25** | **60** | **23** | **55** |

*Mortality Study: 2019 Study Report* at the Turners Falls Project (FERC Accession No. 20200331-5287). The objective of the adult shad mortality component of the study was to investigate rates of immediate and latent survival for emigrating post-spawn shad using radio telemetry. Detections of released dead radio tagged fish were used to partition true survival from

fish known to be dead and those that emigrated, which substantially lowered the survival rate through Cabot Station (FERC Accession No. 20200331-5287, pp. 4-23 and 4-24).

Another means of cross-checking the telemetry-based survival estimates uses the turbine blade strike model (Franke, et al., 1997), which GRH did as part of Study 23 (FERC Accession No. 20170228-5202). Results of that analysis show an estimated survival (using a lambda of 0.2) of 62.2 percent for units 1 through 4, 58.7 percent for units 5 through 8, and 76.9 percent for units 9 and 10.

Downstream Juvenile

To assess the effectiveness of the existing downstream passage facilities at Vernon for juvenile American shad, GRH undertook migration timing, passage routing, rate of movement, and survival studies during the license proceeding, through a combination of hydroacoustic, radio telemetry, and Hi-Z tagging methodologies (Study 22; FERC Accession Number 20170117-5248).

The hydroacoustic data detected juvenile shad targets in the Vernon forebay from August 17 to October 30, 2015, with several peaks in density occurring on October 3, October 23-24, and October 30 (FERC Accession Number 20170117-5248). Shad target densities were highest during the afternoon and dusk, with fish concentrating from 8 to 21 feet below the surface during the day, then moving toward the surface before and during dusk (FERC Accession Number 20170117-5248).

Eighty-seven percent of the radio tagged juvenile shad released 0.5 miles upstream of Vernon Dam arrived at the Vernon forebay, with a median approach duration of 1.9 hours (FERC Accession Number 20170117-5248). Overall, median forebay residency duration was 0.75 hours: fish that did not pass resided a median of 18.4 hours; while those that did pass resided for a median of 0.6 hours (FERC Accession Number 20170117-5248). Of the fish that passed via a known route, 86.5 percent passed through the turbines, 10 percent used the fish pipe, and less than one percent used the fish tube (FERC Accession Number 20170117-5248).

HI-Z technology was used to assess injury and mortality rates through Vernon Unit 4 and Unit 8. Table 4.6 summarizes results of the study. Results show relatively high 1-hour survival and low injury rates through both turbines. A previous study conducted in 1995 on survival of juvenile shad through Unit 10 documented similarly high immediate survival (94.7 percent) (FERC Accession Number 20170117-5248). Due to the difficulty in holding juvenile clupeids (control or test fish) for longer periods of time, delayed (48-hour) mortality could not be assessed.

Study 22 documented high entrainment of juvenile shad at Vernon, with highest immediate survival through the Kaplan (Unit 8) turbine. These survival rates are somewhat higher than those calculated using the turbine blade strike model (Franke, et al. 1997), which GRH did as part of Study 23 (FERC Accession No. 20170228-5202). Results of that analysis show an

estimated survival (using a lambda of 0.2) of 89.9 percent for units 1 through 4 and 89 percent for units 5 through 8 (FERC Accession No. 20170228-5202). Long-term survival of turbine-passed fish is unknown.

Table 4.6. Summary of juvenile shad immediate (1-hour) survival and malady-free rates through Units 4 and 8 at the Vernon Project. Values in parentheses represent the 90 percent confidence intervals (FERC Accession Number 20170117-5248).

| | Unit 4 | Unit 8 |
|---|---|---|
| **Percent Survival** | 91.7 (±5.5) | 95.2 (±4.7) |
| **Percent Malady-Free** | 97.9 (±5.7) | 99.1 (±5.5) |

#### 4.4.6. Actions Necessary to Accomplish Resource Management Goals for Alosines

For the reasons outlined in subsection 4.4.5, the existing technical fishways at the Vernon Project do not provide safe, timely, or effective passage past the Project. Lack of efficient upstream fish passage facilities at Vernon impedes access to approximately 32 river miles of alosine spawning and rearing habitat. Providing safe, timely, and effective upstream passage will enhance the abundance of alosines in the Connecticut River watershed by providing enhanced access to historical spawning and rearing habitat. Likewise, providing safe, timely, and effective downstream passage and protection will avoid or minimize mortality of alosines when they migrate downstream. In order to enhance and restore the shad and river herring populations to the Connecticut River, the upstream and downstream passage and protection measures in Section 9 are necessary. This is consistent with regional and watershed-specific fishery management goals (ASMFC 2009; ASMFC 2010; ASMFC 1999; CRASC 2022b; CRASC 2004).

## 5. FISH PASSAGE MEASURES PROPOSED BY THE APPLICANT

The AFLA filed by GRH for the Vernon, Bellows Falls, and Wilder projects contains proposed Protection, Mitigation, and Enhancement (PME) Measures (FERC Accession No. 20201207-5219, Exhibit E). Relative to fish passage PME measures, GRH proposes to continue to maintain and operate existing fish passage facilities; operate the fishways as requested in Schedule of Operations letters issued annually by the Connecticut River Salmon Restoration Commission (CRASC); and operate the ladders from April 1 through July 15 to support upstream passage of resident fish that spawn in early spring and diadromous species (FERC Accession No. 20201207-5219, Exhibit E). The AFLA also acknowledged fish passage discussions with fisheries agencies had been initiated, with a goal of identifying appropriate structural and operational improvements to existing or new facilities for safe, efficient upstream and

downstream passage of migratory fish species at each of the Projects (FERC Accession No. 20201207-5219, Exhibit E). Upon reaching agreement on fish passage requirements, passage study needs, designs, and implementation plans and schedules, GRH would implement the agreement under the terms of the new licenses (FERC Accession No. 20201207-5219, Exhibit E).

After submitting the AFLA, GRH and the fisheries agencies continued fish passage negotiations. The Department, through the USFWS, actively participated in those discussions, and an agreement was reached in July of 2022. On August 2, 2022, GRH filed with the Commission an Offer of Settlement signed by GRH, the USFWS, the NHFGD, and the VDFW (FERC Accession No. 20220803-5124). The fish passage measures contained in the Settlement Agreement for Fish Passage: Vernon, Bellows Falls, and Wilder Hydroelectric Projects (Agreement), described in more detail in Section 9, include:

Vernon Fish Passage and Protection Measures (FERC Accession No. 20220803-5124, Executive Summary)

- Provide downstream fish passage measures based on the outcome of a hydraulic study or suitable alternative to inform passage/design options.
- Modify the existing Vernon fish ladder to improve effectiveness for passage of American eel and sea lamprey.
- Provide interim upstream eel passage facilities until permanent facilities are operational.
- Operate new permanent upstream eel passage facilities annually between July 16 through November 15.
- Identify and implement modifications to the existing Vernon fish ladder and collection gallery below the powerhouse for improved effectiveness for American shad passage.

Bellows Falls Passage and Protection Measures (FERC Accession No. 20220803-5124, Executive Summary)

- Provide downstream American eel passage measures based on the outcome of a hydraulic study or suitable alternative to inform passage/design options.
- Monitor the existing Bellows Falls fish ladder and undertake potential modifications to improve effectiveness for passage of American eel and sea lamprey.
- Provide interim upstream eel passage facilities until dedicated upstream eel passage facilities are operational.
- Operate new, permanent, upstream eel passage facilities annually between July 16 through November 15.
- Undertake an eel survey in the Bellows Falls Bypass Reach to determine the need for upstream eel passage, and provide permanent upstream eel passage facilities, if necessary.

Wilder Passage and Protection Measures (FERC Accession No. 20220803-5124, Executive Summary)

- Provide downstream American eel passage measures based on the outcome of a hydraulic study or suitable alternative to inform passage/design options.
- Monitor the existing Wilder fish ladder and undertake potential modifications to improve effectiveness for passage of American eel and sea lamprey.
- Undertake an eel survey in the vicinity of the Wilder powerhouse and spillway to inform siting of new permanent upstream eel passage facilities.

Effectiveness Testing of Passage & Protection Measures at all Projects **(**FERC Accession No. 20220803-5124)

- Develop and implement studies to test the effectiveness of newly modified/constructed fish passage facilities relative to identified performance standards.

Fish Passage Facilities Operations and Maintenance Plan **(**FERC Accession No. 20220803-5124)

- Develop a plan detailing how and when fishways will be operated and maintained.

## 6. FISH PASSAGE ALTERNATIVES CONSIDERED & RESPONSE TO COMMENTS RECEIVED ON THE AGREEMENT

Settlement negotiations focused on fish passage implementation strategies and associated schedules for the three projects. After considering the merits and drawbacks of various alternatives, consensus was achieved for the framework and measures detailed in the Settlement Agreement for Fish Passage: Vernon, Bellows Falls, and Wilder Hydroelectric Projects (Agreement). In response to the Agreement filed by GRH on August 2, 2022 (FERC Accession No. 20220803-5124), the FERC issued a notice soliciting comments (FERC Accession Number 20220804-3045). Four comments were received by the FERC. Herein are the Department's responses to those comments as they relate to measures contained in this Prescription.

### 6.1. FISH PASSAGE IMPLEMENTATION TIMEFRAME TOO LONG

Several commenters expressed dissatisfaction with the proposed timeframes for implementing fish passage measures under the Agreement. Table 6.1.1 summarizes the proposed operational dates of major fish passage measures at the Vernon, Bellows Falls, and Wilder projects.

The Department determined this schedule was reasonable based on the following:

- The general framework for implementing passage at all three projects consists of working in an upstream direction, with timing offset sufficiently to enable information obtained and experience gained at downstream projects to inform implementation of measures at upstream projects. At Vernon and Bellows Falls, interim upstream eel passage is initiated first, followed by upstream ladder improvements, then downstream passage and protection measures, and lastly, permanent upstream eel passage measures.

Table 6.1.1 Operational dates of major fish passage measures at the Vernon, Bellows Falls, and Wilder projects (FERC Accession No. 20220803-5124, Appendix B).

| PROJECT | MEASURE | SPECIES | OPERATIONAL BY |
|---|---|---|---|
| **Vernon** | Interim Upstream Eel Passage | Eel | July 16, YR 3 |
| | Upstream Ladder Improvements | Shad, Eel, Lamprey | April 7, YR 6 |
| | Public Viewing Window Improvements | All | April 7, YR 7 |
| | Downstream Passage & Protection | Shad, Eel | April 7, YR 7 |
| | Permanent Upstream Eel Passage | Eel | July 16, YR 11 or 12 |
| **Bellows Falls** | Interim Upstream Eel Passage | Eel | July 16, YR 4 |
| | Upstream Ladder Improvements | Eel, Lamprey | April 7, YR 9 |
| | Downstream Passage & Protection | Eel | YR 9 or 10 |
| | Permanent Upstream Eel Passage | Eel | July 16, YR 11 or 12 |
| **Wilder** | Upstream Ladder Improvements | Eel, Lamprey | April 7, YR 14 |
| | Permanent Upstream Eel Passage | Eel | July 16, YR 13 or 14 |
| | Downstream Passage & Protection | Eel | August 1, YR 16 |

- Downstream passage at Vernon becomes operational in Year 7 due to the time needed to undertake hydraulic studies, identify the best design, then permit and construct facilities. Based on experience at the Holyoke Project (FERC No. 2004), this iterative process of using hydraulic study results to identify design alternatives, then running those alternatives back through the hydraulic model to refine and identify the preferred design, can take multiple years. Additionally, Vernon is a complicated facility: it is located in an open river (versus a canal); and has many turbines of different types which have differing impacts to fish species that become entrained in them. Should the study and design process at Vernon take less time, GRH has the option of expediting implementation.
- Wilder's implementation schedule differs from Vernon and Bellows Falls, which call for providing interim upstream eel passage early in the new license term. The Wilder schedule is driven by two factors:
  - The over 40 miles of mainstem river, six major tributaries, and dozens of smaller tributaries feeding into the Connecticut River between Bellows Falls and Wilder represent a large amount of eel rearing habitat (FERC Accession No. 20201207-5219, Exhibit E). Some portion of eels passing upstream of Bellows Falls will choose to utilize those habitats versus continuing their upstream migration to Wilder. Delaying upstream passage at Wilder will allow time for juvenile eels to utilize those habitats and build up eel densities below Wilder.
  - The two-year offset between implementing permanent upstream eel passage and downstream passage and protection measures is warranted based on the approach of delaying upstream eel passage, which will maintain low eel numbers upstream of Wilder until dedicated eel passage measures are implemented.
- Juvenile eels were documented using all three existing fish ladders (Study 17; FERC Accession No. 20160517-5034). The implementation schedules in the Agreement and this

Prescription acknowledge this passage route and call for studies to determine ways to improve passage efficiency through the ladders for eels and sea lamprey during the anadromous fish passage season. Outside of the anadromous passage season, eels continue to need a way to access upstream habitat. Therefore, studies to identify the best location(s) and design(s) for dedicated eel passage facilities will be undertaken.

- The Agreement and this Prescription state implementation dates as 'no later than.' This allows flexibility for GRH to complete implementation of a given passage facility/measure in advance of the identified dates.

### 6.2. INTERIM EEL PASSAGE MEASURES AT VERNON

One respondent questioned the time required to implement interim upstream eel passage at Vernon, given that an eel ramp was utilized at Vernon for Study 18 (FERC Accession No. 20180209-5110, Supplement 2). While that ramp trap did collect 123 eels during the period June 1 to November 8, 2017, usage was highest after the Vernon fish ladder was dewatered (FERC Accession No. 20180209-5110). This suggests the ladder may be a more effective location for siting an interim eelway. The implementation schedule acknowledges the time required to identify the best location and design for interim eel passage at Vernon.

### 6.3. BELLOWS FALLS WITHIN-LADDER EEL AND LAMPREY MEASURES

One respondent raised concern over the time to implement within-ladder passage measures for American eel and sea lamprey. As outlined in the Agreement and this Prescription, a study utilizing passive integrated transponder (PIT) tag technology will be used to assess internal passage efficiency of the Bellows Falls ladder for eel and lamprey. This technology was used successfully at Vernon for juvenile eels, but those data cannot be readily transferred to Bellows Falls due to the difference in ladder design. Up to two years of PIT studies will be undertaken, followed by up to two years of hydraulic studies. Both years of study for each element may not be required; need will be based on first year study results. The PIT technology allows for identifying potential passage bottlenecks, which then will inform the hydraulic study design.

### 6.4. FISH PASSAGE DESIGN STUDIES

A number of respondents commented on the timing of fish passage design studies, stating these should have occurred during the pre-filing phase of relicensing. The FERC licensing process only affords two years of studies. The primary purpose of those studies is to assess project effects and provide information sufficient for stakeholders to develop protection, mitigation, and enhancement measures to offset project impacts. Under the Integrated Licensing Process (ILP), the Commission determines which studies the Applicant is required to undertake. In its initial Study Plan Determination (SPD) letter, the FERC adopted all studies requested by stakeholders related to juvenile eel and sea lamprey (FERC Accession No. 20140221-3041). By letter dated September 12, 2016, the FERC issued a subsequent SPD that declined to adopt a new/modified study request to test the effectiveness of the Wilder and Bellows Falls ladders for juvenile eels (FERC Accession No. 20160912-3012).

At Vernon, it took two years to assess project impacts to adult shad and juvenile eels.[8] While desktop evaluations can be completed more quickly, empirical studies are valuable because they serve to confirm (or counter) results of desktop models and provide additional information that models do not take into account (e.g., injury). Hi-Z studies conducted at GRH's projects increased understanding of how the turbine blade strike equation (Franke, et al. 1997) under-estimates survival of eels through large, slow Francis turbines.

In this proceeding, there was insufficient time to perform the project effects studies and passage design studies. However, study results support the need for passage improvements and this Prescription requires studies to identify design alternatives that will provide safe, timely, and effective passage for target species.

### 6.5. INCONSISTENCIES IN AGREEMENT NARRATIVE AND APPENDICES

Commenters expressed confusion over the timing of various elements in the Agreement and potential schedule inconsistencies between Agreement provisions and appendices. The Department acknowledges the complexity of the provisions could lead to confusion and hopes the additional information provided in Section 6 has provided clarity. Any inconsistencies found between the Agreement provisions and appendices have been corrected in this Prescription.

### 6.6. FISH PASSAGE PERFORMANCE STANDARDS

Some respondents stated there should be passage performance standards for American eel and sea lamprey. Quantitative performance standards currently do not exist for sea lamprey. Should this outstanding information need be filled, it will be considered by the agencies, in consultation with the Licensee. Regarding eels, at the time the Agreement was signed there were no formal management plans specifying passage performance standards. However, as described in subsection 4.3.4, an eel management plan has since been developed by CRASC (2023) and submitted to the FERC as a Comprehensive Plan (FERC Accession No. 20230630-5046) on June 30, 2023. The plan includes the following performance goals:

- achieve upstream passage performance of 95 percent (internal structure passage) based upon fish present at the entrance of the fishway (or dedicated eelway) for all size classes present; and
- achieve downstream passage performance of no more than five percent through project mortality and debilitating injury (assessed on a project level basis), and a time to pass of 24 hours or less for fish actively migrating within one kilometer of a project facility.

In its response to comments submitted on the Agreement, GRH stated, "To the extent Management Plans that include performance standards are developed, adopted, and recognized as a comprehensive plan by the FERC, GRH would anticipate the federal and state fish agencies

[8] GRH undertook a third year of juvenile eel study at Vernon that was not required by any Commission Study Plan Determination (FERC Accession No. 20200324-5162).

to use such standards to guide and assess fish passage mitigation performance for the species referenced in the plans" (FERC Accession No. 20220919-5149). The Department agrees with this statement; the USFWS will consider all relevant passage performance standards when reviewing effectiveness testing results.

### 6.7. VERNON PUBLIC VIEWING WINDOW

The Vernon fish ladder has a public viewing window and a second viewing window within the counting house. The counting house viewing window has developed leaks, creating a potential safety hazard for personnel inside the counting room, due to the presence of electrical cords for monitoring equipment. In addition, the counting house window is badly scratched from years of cleaning algae off the surface, which reduces visibility for monitoring. The viewing windows and counting room are integral to the fish ladder.

Two respondents requested more detail regarding the Agreement provision relating to viewing window(s) and counting room improvements. Respondents recommended reconstructing the area to provide a comprehensive visitors center with interpretation. The expectation is that, at a minimum, both viewing windows will be replaced. The primary purpose of the Agreement and the provisions contained in this prescription relates to the operation, maintenance, and monitoring of fish passage facilities to ensure they provide safe, timely, and effective passage. A visitor center and public viewing window lie outside the Department's authority to require under Section 18 of the Federal Power Act, as they are not related to the safe, timely, and effective passage of fish. The Department would not oppose construction of such a facility, as long as it does not interfere with safe, timely, and effective fish passage.

### 6.8. BELLOWS FALLS SALMON DAM

Some respondents stated GRH should be responsible for removing the Bellows Falls Salmon Dam. The salmon dam was constructed at the request of the USFWS to reduce false attraction to spill in the bypass reach and assist in attracting Atlantic salmon to the ladder entrance. There no longer is a restoration program for Atlantic salmon in the upper watershed[9] so there is interest in removing the barrier to enhance aquatic connectivity for resident riverine fish. Although riverine species will benefit from measures in the Agreement, the target species of this Prescription are American shad, sea lamprey, and American eel. Existing data suggest the majority of eels are attracted to the ladder, though some move into the bypass reach, as evidenced by one eel observed below the spillway in Study 18 (FERC Accession No. 20160301-5331). Should post-license juvenile eel surveys indicate higher usage than relicensing studies showed, this Prescription requires GRH to provide dedicated eel passage facilities, with or without the salmon dam.

[9] The Connecticut Department of Energy and Environmental Protection maintains a legacy program on two tributaries to the Connecticut River in the state.

### 6.9. FISH PASSAGE FACILITIES OPERATIONS AND MAINTENANCE PLAN

Two respondents requested the annual Operations and Maintenance (O&M) reports required under the Fish Passage Facilities Operations and Maintenance Plan (FOMP) provision in the Agreement and this Prescription be filed with the Commission. In its response letter to comments received on the Agreement, GRH commits to submitting the O&M reports to the FERC concurrent with providing them to the federal and state fishery agencies (FERC Accession No. 20220919-5149).

## 7. STATUTORY AUTHORITY

Section 18 of the FPA, 16 USCS §811, states in pertinent part:

> *"The Commission shall require the construction, maintenance, and operation by a Licensee at its own expense of …such fishways as may be prescribed by the Secretary of the Interior or the Secretary of Commerce, as appropriate."*

Section 1701(b) of the National Energy Policy Act of 1992, P.L. 102-486, Title XVII, §1701(b), 106 Stat. 3008, states:

> *"The items which may constitute a 'fishway' under Section 18 [16 USCS §811] for the safe and timely upstream and downstream passage of fish will be limited to physical structures, facilities, or devices necessary to maintain all life stages of such fish, and project operations and measures related to such structures, facilities, or devices necessary to ensure the effectiveness of such structures, facilities, or devices for such fish."*

The Prescription herein is issued under authority delegated to the Regional Director from the Secretary of the Interior, the Assistant Secretary for Fish, Wildlife, and Parks, and the Director of the USFWS pursuant to Section 18 of the FPA. (See 64 Stat. 1262; 209 Departmental Manual 6.1; 242 Departmental Manual 1.1A).

## 8. RESERVATION OF AUTHORITY TO PRESCRIBE FISHWAYS

The Department, pursuant to Section 18 of the FPA, herein requests that the Commission include the following reservation of authority in any license issued for the Project:

> *Pursuant to Section 18 of the Federal Power Act, the Secretary of the Interior herein exercises their authority under said Act by reserving that authority to prescribe fishways during the term of the License and by prescribing the fishways described in the Department of Interior's Prescription for Fishways for the Projects.*

## 9. SECTION 18 PRESCRIPTION FOR FISHWAYS – TERMS AND CONDITIONS

*Pursuant to Section 18 of the Federal Power Act, as amended, the Secretary of the Department of the Interior, as delegated to the U.S. Fish and Wildlife Service,*

*hereby exercises their authority to prescribe the construction, operation and maintenance of such fishways as deemed necessary, subject to the procedural provisions contained above.*

To ensure the immediate and timely contribution of the fish passage facilities and measures to fish restoration and enhancement in the Connecticut River, the following are included and shall be complied with by the Licensee to ensure the effectiveness of the fishways pursuant to Section 1701(b) of the 1992 National Energy Policy Act (P.L. 102-486, Title XVII, 106 Stat. 3008).

### 9.1. CONDITION 1: GENERAL FISH PASSAGE OBLIGATIONS OF LICENSEE (AGREEMENT PROVISION 3.1)

The Licensee shall operate the Projects to provide safe, timely, and effective passage for Targeted Migrants, pursuant to the measures and implementation schedules detailed in subsections 9.1 through and including 9.8, and as summarized in Tables 9.4.1-1 through 9.6.2-1 (Appendix A of this Prescription) and as depicted in the Project Specific Fish Passage Implementation Chart (Appendix B of this Prescription).[10] Upstream and downstream passage systems may include physical facilities, spillage plans, reasonable operational modifications, or new (USFWS-approved) technologies as they become available. The schedules provided under this section are stated in terms of License Years based on the Date of License Issuance (DOLI). They do not preclude the Licensee from proactively addressing any element on an expedited timeframe.

For all identified fish passage measures, the first year of operation shall be a shakedown year[11] followed by two years of representative quantitative effectiveness studies. Additional study years may be required in order to achieve two full representative passage seasons. A representative passage season is one where there are no anomalous[12] environmental or operational conditions, or incomplete data (e.g., due to equipment malfunction). Additional study years also may be warranted in response to any fish passage/project modifications made. A single representative study year may suffice should results clearly suggest measures are effective, as agreed to in writing by the Agencies.

The Parties may, by mutual written agreement, modify any time limit to implement the identified fish passage measures, if there is good and substantial reason for the modification. The Parties acknowledge that modifications to time limits under the New Licenses may require FERC approval. Delay in completing one element shall not be justification for a delay in subsequent elements.

[10] In case of inadvertent conflict between Tables in Appendix A or the Gannt Chart in Appendix B and the narrative under Section 9, the narrative under Section 9 shall control.
[11] Shakedown refers to assessing whether all components of the fish passage facility are operating as designed.
[12] Anomalous conditions are those outside the bounds of the 25th to 75th percentile conditions for a given parameter.

Table 9.1. Required fish passage operational periods.

| Project | Direction | Dates | Beginning |
|---|---|---|---|
| Vernon | Upstream | April 1[a] – July 15 | Upon New License issuance |
| | | April 1[a] – November 15 | Upon completion and implementation of enhancements (including interim eel passage) |
| | Downstream | April 7[b] – December 1 | Upon New License issuance |
| Bellows Falls | Upstream | April 1[a] – July 15 | Upon New License issuance |
| | | April 1[a] – November 15 | Upon completion and implementation of enhancements (including interim eel passage) |
| | Downstream | August 1 – December 1 | Upon New License issuance |
| Wilder | Upstream | April 1[a] – July 15 | Upon New License issuance |
| | Downstream | August 1 – December 1 | Upon completion and implementation of enhancements |

a The April 1 start date is to accommodate early spring spawners such as walleye and white suckers only. The fish ladders at Vernon, Bellows Falls, and Wilder shall commence operation as close as possible to April 1 annually, but no later than April 15 as long as ice conditions and/or debris conditions allow for fish ladder inspections and the ladders are fully operational.

b Downstream passage at Vernon is to be operational for Spring American Shad migration and shall commence operation as close as possible to April 7 annually, but no later than April 15 concurrent with the start of upstream American Shad migration season through the Vernon fishway.

The Licensee will develop Fish Passage Management Plans (FPMP) for each of the Projects, in consultation with the Agencies, and will submit each to the Commission for approval within approximately 120 days of the DOLI. The FPMPs will specify the implementation schedules as calendar dates and will identify anticipated subsequent, supplemental fish passage filings to the FERC that may be required dependent upon the scope of the element to be implemented. The FPMP will identify all anticipated consultation with the Agencies in the development of pre-design analyses, design, and effectiveness evaluations, as appropriate. The proposed implementation schedule and deadlines for actions under this Agreement will be discussed further with the Agencies, with timelines/schedules being advanced, where feasible, in light of the actual DOLI, particularly if the DOLI occurs between January 1 and March 31.

### 9.2. CONDITION 2: STUDY PLAN REVIEW (AGREEMENT PROVISION 3.2)

For all study plans under this Agreement, the Licensee shall consult with and reach agreement with the Agencies, addressing their comments and concerns, on study plan design on a schedule that allows sufficient time to procure equipment, materials, etc. necessary to conduct the study during the specified study period. The Licensee shall provide the Agencies with draft study,

survey, and assessment plans associated with provisions under Section 3 (e.g., hydraulic study, Passive Integrated Transponder (PIT) studies, eel surveys, etc.) and provide a minimum of 30 days for review and comment.

### 9.3. CONDITION 3: FISH PASSAGE DESIGN REVIEW (AGREEMENT PROVISION 3.3)

For all provisions under subsections 9.4 through 9.6, design of passage facilities shall occur in consultation with, and require approval by, the Agencies and shall meet USFWS Design Criteria (USFWS 2019, or as modified) to the extent practicable from an engineering perspective. The Licensee shall provide plan sets for review and comment to the Agencies at the 30%, 60%, and 90% level.

### 9.4. CONDITION 4: FISH PASSAGE AND PROTECTION MEASURES AT THE VERNON PROJECT (AGREEMENT PROVISION 3.4)

#### 9.4.1. Downstream Passage and Protection

The Licensee shall undertake a hydraulic study or a suitable alternative, designed to inform downstream passage/design options. The study plan shall be developed in consultation with the Agencies and shall be initiated no later than January 1 of License Year 2; the study initiated, completed, and reported on no later than December 31 of License Year 3. The Licensee will use results of the study to develop design alternatives to provide safe, timely, and effective passage for Targeted Migrants. The Licensee shall initiate design consultation with the Agencies no later than July 1 of License Year 3, and final design plans (sufficient for construction bid purposes) shall be completed no later than December 31 of License Year 4. Construction shall be initiated during License Year 5 and completed no later than December 31 of License Year 6. Approved structural facilities and/or operational measures shall be fully operational no later than April 7 of License Year 7.

Specific passage/protection and effectiveness study requirements and their associated implementation schedules and operational periods are provided in Table 9.4.1-1.

#### 9.4.2. Upstream American Eel and Sea Lamprey Passage

##### 9.4.2.1. Within Ladder Measures for Eel and Lamprey Passage for the period April 7 through July 15

The Licensee shall undertake a hydraulic study within the existing Vernon fish ladder together with an engineering assessment of the ladder to inform potential modifications for improved effectiveness for passage of American eel and sea lamprey (this is the same hydraulic study and engineering assessment discussed under Section 9.4.3). The objectives of the hydraulic study are to determine the hydraulic conditions of the fish ladder and identify hydraulic related barriers to effective eel and sea lamprey ladder passage. The engineering assessment will evaluate the condition of current as-built fish ladder components. The Licensee shall initiate consultation with the Agencies on the hydraulic study design and scope of engineering assessment no later than November 15 of License Year 2. The Licensee shall initiate the study no later than July 16

of License Year 3 and complete and report on the study no later than December 31 of License Year 4.

During the License Year 5 upstream anadromous passage season, the Licensee shall undertake studies using PIT technology to assess passage performance of American eel and sea lamprey within the Vernon fish ladder. Consultation with the Agencies on the PIT study design will be initiated no later than July 1 of License Year 3; and the study will be initiated no later than May 1 and completed and reported on no later than December 31 of License Year 4. Should the Agencies deem results of the study insufficient to determine where passage impediments occur within the Vernon ladder, the study design will be modified through consultation with the Agencies (e.g., additional PIT antennas deployed or moved to different locations) and an additional year of study will take place in License Year 5.

The Licensee will use results of the hydraulic and PIT studies to develop design alternatives to improve eel and lamprey passage through the ladder during the period April 7 through July 15. The Licensee shall initiate design consultation with the Agencies in Year 4 and final design plans (sufficient for construction bid purposes) shall be completed no later than July 15 of License Year 5. Approved eel/lamprey ladder modifications shall be initiated starting on July 16 of License Year 5 and completed no later than April 6 of License Year 6 and be fully operational no later than April 7 of License Year 6. These dates associated with initiating design consultation with the Agencies, finalizing design plans, final design approvals by the Agencies, and date of commencing operation shall be extended 1 year if an additional year of PIT study is necessary.

#### 9.4.2.2. Within Ladder Interim Measures for Eels for the period July 16 through November 15

The Licensee shall design, construct, operate, and maintain interim (possibly temporary) measures approved by the Agencies to pass American eels for the July 16 to November 15 period. The interim upstream eel passage facility shall consist of an eel ramp-trap, or similar design, as specified in USFWS Design Criteria (USFWS 2019, or as modified). The eel ramp-trap will be located below the station, potentially within or near the entrance to the existing fish ladder at a location to be determined in consultation with the Agencies. The Licensee shall initiate design consultation with the Agencies for interim upstream eel passage facilities no later than January 1 of License Year 2, and final design plans shall be completed no later than December 31 of License Year 2. Construction of approved interim upstream eel passage facilities shall be completed by July 15 of License Year 3 and shall be fully operational no later than July 16 of License Year 3. Interim eel passage facilities shall be operated annually until permanent upstream eel passage facilities are operational. The first two years of interim passage operation will include monitoring and reporting eel use and upstream passage. Based on the results of the monitoring, if the interim measure does not appear to pass eels in anticipated and

consistent numbers, the Licensee will consult and reach agreement with the Agencies on the need for further monitoring and/or adjustment to the interim measure (e.g., location or design).

#### 9.4.2.3. Permanent Upstream Eel Passage Measures for the period July 16 through November 15

Based on the PIT and hydraulic studies required pursuant to subsection 9.4.2.1, ladder monitoring results, and upstream interim eel passage data, the Licensee shall consult with the Agencies no later than July 1 of License Year 9 to determine whether existing information is sufficient to identify permanent upstream eel passage measures for the period July 16 through November 15 (i.e., via the interim means, alternate permanent ramps or via the fish ladder), or if additional studies are needed.

Should the Agencies determine additional studies are not warranted, the Licensee shall select, subject to approval by the Agencies, the preferred method of upstream permanent passage no later than January 31 of License Year 10. The Licensee shall initiate design consultation for permanent upstream eel passage facilities with the Agencies no later than February 1 of License Year 10, and the Licensee shall complete final design plans no later than December 31 of License Year 10. Construction of permanent upstream eel passage facilities approved by the Agencies shall be completed such that they are fully operational no later than July 16 of License Year 11. Agencies acknowledge the 6.5-month construction window may be negatively impacted or delayed by weather and river conditions or ability to procure materials.

Should the Agencies determine additional studies are warranted, the Licensee shall undertake them in License Year 10. Consultation with the Agencies on the additional study design will be initiated promptly following notification of additional study requirement and no later than February 15 of License Year 10, with the study initiated, completed, and reported on no later than December 31 of License Year 10. Based on study results, the Licensee shall decide on an Agency-approved preferred method of upstream permanent passage no later than January 31 of License Year 11. The Licensee shall initiate design consultation with the Agencies for permanent upstream eel passage facilities no later than February 1 of License Year 11, and complete final design plans no later than December 31 of License Year 11. Construction of permanent upstream eel passage facilities approved by the Agencies shall be completed such that they are fully operational no later than July 16 of License Year 12. Parties acknowledge the 6.5-month window to construct may be negatively impacted by weather and river conditions or ability to procure materials.

Specific passage and protection requirements and their associated implementation schedules and operational periods are provided in Table 9.4.2-1.

### 9.4.3. Upstream Anadromous Fish Passage

No later than July 16 of License Year 7, the Licensee shall assess if the physical configuration of the collection gallery below the powerhouse could trap American shad. If trapping conditions exist, the Licensee shall identify a solution in consultation with, and requiring approval by, the Agencies. The approved solution shall be fully implemented no later than April 7 of License Year 9.

The Licensee shall design and implement improvements to the counting room and viewing windows. The Licensee shall initiate design consultation with the Agencies during License Year 4, complete final designs by December 31 of License Year 4, initiate the improvements in License Year 5, and complete the improvements no later than April 1 of License Year 6.

The Licensee shall undertake a hydraulic study and engineering assessment of the existing Vernon fish ladder to inform potential modifications for improved effectiveness for American shad passage (this is the same hydraulic study discussed under subsection 9.4.2.1). The objectives of the hydraulic study are to determine the hydraulic conditions of the fish ladder and identify hydraulic related barriers to effective fish ladder passage. The engineering assessment will evaluate the condition of current as-built fish ladder components. The Licensee shall initiate consultation with the Agencies on design of the hydraulic study and scope of the engineering assessment no later than November 15 of License Year 2. The Licensee shall initiate the study no later than July 16 of License Year 3, and complete and report on the study no later than December 31 of License Year 4. The Licensee will use results of the study to develop design modifications to improve shad passage through the Project. The Licensee shall initiate design consultation with the Agencies no later than January 1 of License Year 4 and complete final design plans (sufficient for construction bid purposes) no later than July 15 of License Year 5. The Licensee shall initiate approved shad ladder modifications by July 16 of License Year 5 and complete modifications no later than April 6 of License Year 6. Modifications shall be fully operational no later than April 7 of License Year 6.

The Licensee shall make any necessary repairs to the existing fish trap to achieve full functionality. Fish trap repairs shall be initiated in License Year 8 and completed no later than December 31 of License Year 9.

Specific passage and protection requirements and their associated implementation schedules and operational periods are provided in Table 9.4.3-2.

## 9.5. CONDITION 5: FISH PASSAGE AND PROTECTION MEASURES AT THE BELLOWS FALLS PROJECT (AGREEMENT PROVISION 3.5)

The Licensee shall construct, operate, maintain, and evaluate the effectiveness of fish passage and protection facilities for Targeted Migrants at the Bellows Falls Project.

### 9.5.1. Downstream Passage and Protection

In License Years 3 and 4, the Licensee shall undertake a hydraulic study or a suitable alternative, designed to inform downstream passage/design options to achieve safe, timely, and effective passage for American eel. The Licensee shall initiate consultation with the Agencies on study design no later than January 1 of License Year 6, and complete and report on the study no later than December 31 of License Year 7. The Licensee will use results of the study to develop supplemental or additional operational and/or structural passage and protection measures at the dam and/or in the canal. The Licensee shall initiate design consultation with the Agencies no later than January 1 of License Year 8, and complete final design plans (sufficient for construction bid purposes) no later than December 31 of License Year 9. The Licensee shall initiate construction of approved eel passage and protection measures no later than July 16 of License Year 10 and complete construction by December 31 of License Year 11. Approved structural facilities and/or operational measures shall be fully operational no later than August 1 of License Year 12.

Specific passage and protection requirements and their associated implementation schedules and operational periods are provided in Table 9.5.1-1.

### 9.5.2. Upstream American Eel and Sea Lamprey Passage

#### 9.5.2.1. Within Ladder Measures for Eel and Lamprey Passage for the period April 1 through July 15

The Licensee shall monitor eel and lamprey fish ladder use from April 1 through July 15 during License Years 2 and 3. In License Year 4 the Licensee shall undertake a study using PIT technology to assess passage performance of American eel and sea lamprey within the Bellows Falls fish ladder. The Licensee shall initiate design consultation with the Agencies on the PIT study no later than September 1 of License Year 3. The Licensee shall initiate the field study no later than May 1 of License Year 4, and complete and report on the study no later than December 31 of License Year 4. Should the Agencies deem results of the monitoring or PIT-tag study insufficient to determine where passage impediments occur within the Bellows Falls ladder, the study design will be modified through consultation with the Agencies (e.g., additional PIT antennas deployed or moved to different locations) and an additional year of study will take place in License Year 5.

Should the Agencies determine that hydraulic-based impediments to passage exist within the fish ladder based on results from the PIT-tag study, the Licensee shall undertake a hydraulic study and engineering assessment of the existing Bellows Falls fish ladder to inform potential modifications for improved effectiveness for passage of American eel and/or sea lamprey. The objectives of the hydraulic study are to determine the hydraulic conditions of the fish ladder and identify hydraulic related barriers to effective eel and/or sea lamprey ladder passage. The engineering assessment will evaluate the condition of current as-built fish ladder components. The study and assessment shall be developed in consultation with the Agencies. The Licensee shall initiate consultation with the Agencies on the hydraulic study design and scope of

engineering assessment no later than July 16 of License Year 5; and complete and report on the study no later than December 31 of License Year 6.

The Licensee will use results of these studies to develop design alternatives to improve eel and/or lamprey passage through the ladder for the period April 1 through July 15. The Licensee shall initiate design consultation with the Agencies no later than January 1 of License Year 7 and complete final design plans (sufficient for construction bid purposes) no later than July 15 of License Year 8. Approved eel/lamprey ladder modifications shall be completed by the Licensee no later than April 6 of License Year 9 and be fully operational no later than April 7 of License Year 9. These dates associated with initiating design consultation with the Agencies, finalizing design plans, final design approvals by the Agencies, and date of commencing operation shall be extended 1 year if an additional year of PIT tag study is performed.

#### 9.5.2.2. Within Ladder Interim Measures for Eels for the period July 16 through November 15

The Licensee shall design, construct, operate, and maintain interim (possibly temporary) measures approved by the Agencies to pass American eels upstream for the period July 16 through November 15. The interim upstream eel passage facility shall consist of an eel ramp-trap, or similar design, as specified in USFWS Design Criteria (USFWS 2019, or as modified). The eel ramp-trap will be located below the station, potentially within or near the entrance to the existing fish ladder at a location to be determined in consultation with the Agencies. The Licensee shall initiate design consultation for temporary upstream eel passage facilities with the Agencies no later than July 16 of License Year 2 and complete final design plans no later than December 31 of License Year 3. The Licensee shall complete construction no later than July 15 of License Year 4 and approved interim upstream eel passage facilities shall be fully operational no later than July 16 of License Year 4. Interim eel passage facilities shall be operated annually until dedicated upstream eel passage facilities are operational. The first two years of interim passage operation will include monitoring and reporting eel use and upstream passage. Based on the results of the monitoring, if the interim measure does not appear to pass eels in anticipated and consistent numbers, the Licensee will discuss next steps with the Agencies such as further monitoring and/or adjustment to the interim measure (e.g., location or design).

#### 9.5.2.3. Permanent Upstream Eel Passage Measures for the period July 16 through November 15

Based on the PIT and hydraulic studies required pursuant to subsection 9.5.2.1, ladder monitoring results, and upstream temporary eel passage data, the Licensee shall initiate consultation with the Agencies no later than July 1 in License Year 9 to determine whether existing information is sufficient to identify necessary locations for permanent upstream eel passage measures for the period July 16 through November 15 (i.e., via the temporary means, alternate permanent ramps or via the fish ladder), or if additional studies are needed.

Should the Agencies determine additional studies are not warranted, the Licensee shall select, subject to approval by the Agencies, the preferred method of upstream permanent passage no later than January 31 of License Year 10. The Licensee shall initiate design consultation for permanent upstream eel passage facilities with the Agencies no later than February 1 of License Year 10, and complete final design plans no later than December 31 of License Year 10. The Licensee shall complete construction of approved permanent upstream eel passage facilities such that they are fully operational no later than July 16 of License Year 11. Agencies acknowledge the 6.5-month window to construct may be negatively impacted by weather and river conditions or ability to procure materials.

Should the Agencies determine additional studies are warranted, the Licensee shall undertake them in License Year 10. The Licensee shall initiate consultation with the Agencies on the design of additional studies no later than February 15 of License Year 10. Results shall be provided to the Agencies by December 31 of License Year 10. Based on study results, the Licensee shall decide on an Agency-approved preferred method of permanent upstream passage no later than January 31 of License Year 11. The Licensee shall initiate design consultation for permanent upstream eel passage facilities no later than February 1 of License Year 11, and complete final design plans no later than December 31 of License Year 11. The Licensee shall complete construction of approved permanent upstream eel passage facilities such that they are fully operational no later than July 16 of License Year 12. Agencies acknowledge the 6.5-month window to construct may be negatively impacted by weather and river conditions or ability to procure materials.

#### 9.5.2.4. Permanent Upstream Eel Passage Measures in the Bellows Falls Bypass Reach

The Licensee shall initiate consultation with the Agencies on an eel survey study plan no later than July 1 of the year the Salmon Dam is removed or License Year 6, whichever is later. The first passage season after removal of the Salmon Dam or License Year 7, whichever is later, the Licensee shall undertake the upstream eel survey between May and October to determine where juvenile eels congregate (e.g., near the fish ladder, in the tailrace, near the spillway, etc.). The Licensee will report the results and consult with the Agencies upon completion of the study and prior to initiating designs for a permanent upstream eel passage design. Should study results indicate an area of eel concentration in the vicinity of the spillway, the Licensee shall install a single upstream eel passage facility within the bypass reach.

Design of a permanent upstream eel passage facility in the bypass reach, if determined necessary by the Agencies, shall occur in consultation with, and require approval by the Agencies. The Licensee shall initiate design consultation no later than January 1 and complete final design plans no later than December 31 of the year following the results of the upstream eel survey or License Year 8, whichever is later. The Licensee shall complete construction of an approved bypass reach upstream eel passage facility no later than July 31 of the second year

following completion of the upstream eel survey or License Year 9, whichever is later. Agencies acknowledge the 7-month window to construct may be negatively impacted by weather and river (spill conditions in the bypass) conditions or ability to procure materials. If the Licensee successfully completes construction by July 31 of the second year following the results of the upstream eel survey or License Year 9, whichever is later, it will immediately begin operating the permanent bypass eel passage on August 1 of that same year. Otherwise, the Licensee will operate the permanent bypass eel passage no later than May 1 of the following year (i.e., the third year following the results of the upstream eel survey or License Year 10).

Specific passage and protection requirements and their associated implementation schedules and operational periods are provided in Table 9.5.2-1.

## 9.6. CONDITION 6: FISH PASSAGE AND PROTECTION MEASURES AT THE WILDER PROJECT (AGREEMENT PROVISION 3.6)

The Licensee shall construct, operate, maintain, and evaluate the effectiveness of fish passage and protection facilities for American eel and sea lamprey at the Wilder Project.

### 9.6.1. Downstream Passage and Protection

The Licensee shall undertake a hydraulic study or a suitable alternative, designed to inform downstream passage/design options to achieve safe, timely, and effective passage for American eel. The Licensee shall initiate consultation with the Agencies on study design no later than January 1 of License Year 10 and undertake, complete and report on the study no later than December 31 of License Year 11. The Licensee will use results of the study to develop alternatives to provide safe, timely, and effective passage for American eels. The Licensee shall initiate design consultation of the passage and protection system(s) with the Agencies, no later than January 1 in License Year 12 and complete final design plans (sufficient for construction bid purposes) no later than December 31 of License Year 13. The Licensee shall initiate construction of approved eel passage and protection measures no later than July 16 of License Year 14 and complete construction by December 31 of License Year 15. Approved structural facilities and/or operational measures shall be fully operational no later than August 1 of License Year 16.

Specific passage and protection requirements and their associated implementation schedules and operational periods are provided in Table 9.6.1-1.

### 9.6.2. Upstream American Eel and Sea Lamprey Passage

#### 9.6.2.1. Within Ladder Measures for Eel and Lamprey Passage for the period April 7 through July 15

The Licensee shall monitor 2 years of eel and lamprey fish ladder use (number, timing, and size estimation) from April 7 through July 15 during License Years 1 and 3. Monitoring data will be used by the Agencies to determine if fish ladder operational dates need to be adjusted to protect

downstream migrants (i.e., manage the number of eels passing upstream until downstream measures in place).

During License Year 8, the Licensee shall undertake a study using PIT technology to assess passage performance of American eel and sea lamprey within the Wilder fish ladder. The Licensee shall initiate consultation with the Agencies on the PIT study design no later than September 1 of License Year 7. The Licensee shall initiate the study no later than May 1 and complete and report on the study no later than December 31 of License Year 8. Should the Agencies deem results of this study insufficient to determine where passage impediments occur within the Wilder ladder, the study design will be modified through consultation with the Agencies (e.g., additional PIT antennas deployed or moved to different locations) and an additional year of study will take place in License Year 9.

Should the Agencies determine that hydraulic-based impediments to passage exist based on PIT study results, the Licensee shall undertake a hydraulic study and an engineering assessment of the existing Wilder fish ladder to inform potential modifications for improved effectiveness for passage of American eel and/or sea lamprey. The objectives of the hydraulic study are to determine the hydraulic conditions of the fish ladder and identify hydraulic related barriers to effective eel and/or sea lamprey ladder passage. The engineering assessment will evaluate the condition of current as-built fish ladder components. The Licensee shall initiate consultation with the Agencies on the hydraulic study design and scope of engineering assessment no later than July 16 of License Year 9 and complete and report on the study and assessment no later than December 31 of License Year 10.

The Licensee will use results of the PIT study, hydraulic study, engineering assessment, and monitoring study to develop design alternatives to improve eel and/or lamprey passage through the ladder during the upstream anadromous fish passage season. Design of ladder modification(s) shall occur in consultation with, and require approval by, the Agencies. The Licensee shall initiate design consultation no later than January 1 of License Year 11 and complete final design plans (sufficient for construction bid purposes) no later than July 15 of License Year 12. Approved eel/lamprey ladder modifications shall be completed no later than December 31 of License Year 13 and be fully operational no later than April 7 of License Year 14.

#### 9.6.2.2. Permanent Upstream Eel Passage Measures

The Licensee shall undertake an upstream eel survey in the vicinity of the powerhouse and spillway to determine areas of eel concentration at the Project. The Licensee shall initiate study design consultation for the upstream eel survey with the Agencies no later than July 1 of License Year 7. The Licensee shall conduct the study from May through October and provide survey results to the Agencies no later than December 31 in License Year 8.

Based on the PIT and hydraulic studies required pursuant to Section 3.6.2.1, ladder monitoring results, upstream temporary eel passage data, and the upstream eel survey, the Licensee shall consult with the Agencies in License Year 11 to determine whether existing information is sufficient to identify the location for permanent upstream eel passage measures, or if additional studies are needed.

Should the Agencies determine additional studies are not warranted, the Licensee shall decide on an Agency-approved preferred method of upstream permanent passage no later than December 31 of License Year 11. The Licensee shall initiate design consultation for permanent upstream eel passage facilities with the Agencies no later than February 1 of License Year 12, and complete final design plans no later than December 31 of License Year 12. The Licensee shall complete construction of approved permanent upstream eel passage facilities (potentially consistent with eel/lamprey ladder modifications) such that they are fully operational no later than July 16 of License Year 13.

Should the Agencies determine additional studies are warranted, the Licensee shall initiate study design consultation with the Agencies no later than January 1 in License Year 12. Results shall be provided to the Agencies by December 31 of License Year 12. Based on study results, the Agencies shall decide the preferred method of permanent upstream passage no later than January 31 of License Year 13. The Licensee shall initiate design consultation for permanent upstream eel passage facilities with the Agencies no later than February 1 of License Year 13, and complete final design plans no later than December 31 of License Year 13. The Licensee shall complete construction of approved permanent upstream eel passage facilities such that they are fully operational no later than July 16 of License Year 14. Agencies acknowledge the 6.5-month window to construct may be negatively impacted by weather and river conditions or ability to procure materials.

Specific passage and protection requirements and their associated implementation schedules and operational periods are provided in Table 9.6.2-1.

## 9.7. CONDITION 7: FISH PASSAGE FACILITIES OPERATIONS AND MAINTENANCE PLAN (AGREEMENT PROVISION 3.7)

The Licensee shall develop and implement a Fish Passage Facilities Operations and Maintenance Plan (FOMP). The FOMP shall detail how and when the fishways will be operated and describe routine maintenance activities that will occur both during and outside of the fish passage seasons. The FOMP will include a provision to provide annual fishway Operation and Maintenance (O&M) reports that summarize the status of the fish passage facilities, identify needed repairs or equipment replacement, etc. The O&M report shall be submitted to the Agencies by January 31 annually. The FOMP shall be developed in consultation with and require approval by the Agencies prior to submitting the final FOMP to the FERC for approval. The FOMP shall be in place no later than six (6) months from the first fish passage facilities (or

passage facility improvements) coming on-line and shall be updated as needed as new passage facilities, or modifications to existing facilities, are placed into service, and based on information obtained from operation of the facilities pursuant to the annual O&M reports.

### 9.8. CONDITION 8: FISH PASSAGE FACILITIES EFFECTIVENESS TESTING (AGREEMENT PROVISION 3.8)

The Licensee shall conduct a shakedown assessment for each fish passage facility during the first year of operation followed by two years of representative, quantitative effectiveness studies (except as provided in subsection 9.1). No later than six (6) months prior to each identified fish passage facility becoming operational, the Licensee shall file a facility-specific Passage Effectiveness Studies Plan (PESP) for Commission approval. The PESP shall be developed in consultation with and require approval by the Agencies, prior to submitting PESPs to the FERC for approval. The PESP shall detail how the constructed and operational passage facilities will be evaluated for their effectiveness at passing Targeted Migrants. Study results will be used to inform potential remedial measures to improve passage efficiency of the measures designed and constructed under this Agreement. Each PESP may be supplemented based on information obtained from operation of the facilities pursuant to the annual O&M reports and/or previous study results.

American shad performance standards upon which the results of any required effectiveness studies shall be reviewed and compared are summarized in Table 9.8-1.

In addition, given regional management objectives and cumulative effects of downstream passage through multiple hydropower projects, the Agencies have a goal of 95 percent through-project survival for American eels.

Table 9.8-1. Summary of upstream and downstream performance standards for American shad passage facilities at the Vernon Project.

| Facility | Efficiency | Delay |
|---|---|---|
| Downstream Passage and Protection | 95 percent through-Project survival based on the number of test fish that approach within one kilometer (km) of a project area [(# passed alive/# arrive)*100]. | Test fish that pass the project do so within 24 hours of arriving within 1 km of the project area. |
| Upstream Anadromous Passage | 75 percent upstream efficiency based on the number of test fish that approach within 1 km of the project area [(# passed/# arrive)*100]. | Test fish that pass the project do so within 48 hours of arriving within 1 km of the project area. |

### 9.9. CONDITION 9: AGENCY ACCESS AND INSPECTION

The Licensee shall provide USFWS personnel, and other USFWS-designated representatives, timely access to the fish passage facilities at the Projects and to pertinent Project operational records for the purpose of inspecting the fishways to determine compliance with this Prescription.

### 9.10. CONDITION 10: FISHWAY MAINTENANCE AND REPAIR

The Licensee shall keep the fishways in proper order. To the extent possible, and considering impacts to fishway operation, the Licensee shall keep the trashracks and fishway areas clear of leaves, trash, logs, and any material that can increase impingement and cause injury or hinder passage. Anticipated maintenance shall be performed when necessary, in accordance with the Fish Passage Facilities Operations and Maintenance Plan (see Condition 7), and the fishway will operate effectively during the identified migratory periods.

### 9.11. CONDITION 11: EXCEPTIONS

In the event of any operating emergency beyond the control of the Licensee, the Licensee may curtail or suspend fish exclusion and/or passage measures for only the time period necessary to rectify such an emergency. The Licensee shall notify the USFWS as soon as possible, but no later than 5 business days after any such operating emergency. The Licensee shall notify the Commission in writing within 10 days after any such operating emergency, or by any period as established by the Commission.

### 9.12. CONDITION 12: APPROVAL OF EXTENSIONS

The Licensee shall (1) notify, and (2) obtain approval from, the USFWS for any extensions of time to comply with the provisions included in the USFWS's Prescription.

## 10. REFERENCES CITED

### 10.1. COMPREHENSIVE RESOURCE MANAGEMENT PLANS FILED AT THE COMMISSION

The following published regional resource management plans recognized by the Commission's Licensing Process contain management goals that pertain to alosines and American eel:

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### 10.2. INDEX TO THE ADMINISTRATIVE RECORD

Evidence to support the USFWS's Prescription for Fishways is contained in the Administrative Record before the Commission, and in the citations to the extant record provided herein:

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Filed under a separate cover.

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* * * * *

Any written inquiries, comments, or other correspondence related to this Prescription for the Project should be sent to:

Supervisor, New England Field Office

U.S. Fish and Wildlife Service

70 Commercial Street, Suite 300

Concord, NH 03301

# APPENDIX A

# FISH PASSAGE IMPLEMENTATION TABLES FOR THE VERNON, BELLOWS FALLS, AND WILDER PROJECTS

**Table 9.4.1-1. VERNON DOWNSTREAM PASSAGE & PROTECTION**

| Item | Measure | Implementation Schedule | Operation Period | Effectiveness Studies |
|---|---|---|---|---|
| 1 | Hydraulic study above the dam to inform downstream passage design/options. | • Initiate Study Design Consultation no later than (NLT) 1/1 of License Year 2.<br>• Initiate and Complete Study NLT 12/31 in License Year 3. | | |
| 2 | Design, construct, operate, maintain, and study effectiveness of measures to pass eels and alosines downstream. | • Design consultation initiated by 7/1 of License Year 3; design completed NLT 12/31 License Year 4.<br>• Initiate construction/modifications (mods) in License Year 5 and complete no later than Dec. 31 of License Year 6.<br>• Operate no later than April 7 of License Year 7. | April 7 to December 1[A] | Year (Yr) 1: shakedown[B]; Yr 2: quantitative effectiveness study[C]; Yr 3: additional study year, if needed (i.e., Yr 2 anomalous[D], incomplete, etc. or issues found/mods made); Yr 4: additional study year, if needed (Yr 3 anomalous, incomplete, etc. or issues found/mods made). |

A. Downstream passage initiated concurrent with upstream passage for shad. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating as designed.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

| Table 9.4.2-1. VERNON UPSTREAM AMERICAN EEL & SEA LAMPREY PASSAGE (continued) | | | | |
|---|---|---|---|---|
| **Item** | **Measure** | **Implementation Schedule** | **Operation Period[A]** | **Effectiveness Studies** |
| 3a | Undertake fish ladder hydraulic study. | • Initiate Study Design Consultation NLT 11/15 in License Year 2.<br>• Initiate Study NLT 7/16 in License Year 3.<br>• Complete Study NLT 12/31 in License Year 4. | | |
| 3b | Conduct upstream Eel/Lamprey passage study using Passive Integrated Transponder technology. | • Initiate Study Design Consultation NLT 7/1 in License Year 3.<br>• Conduct PIT study from May through July 15 in License Year 4 (during License Year 5, if needed). | May 1 to July 15 | |
| 3c | Design, construct, operate, maintain, and study effectiveness of permanent upstream ladder improvement measures to pass eels and lamprey upstream. | • Initiate design consultation in License Year 4 and complete design consultation NLT 7/15 in License Year 5.<br>• Initiate construction of permanent upstream ladder improvement measures NLT 7/16 in License Year 5 and complete improvement measures NLT 4/6 in License Year 6.<br>• Operate permanent upstream ladder improvement measures NLT 4/7 in License Year 6.<br>• All deadlines stated above extended 1 year if additional study under 3b required in License Year 6. | May 1 to July 15 | Yr 1: shakedown[B]; Yr 2: quantitative effectiveness study[C]; Yr 3: additional study year, if needed (i.e., Yr 2 anomalous[D], incomplete, etc. or issues found/mods made); Yr 4: additional study year, if needed (Yr 3 anomalous, incomplete, etc. or issues found/mods made). |
| 4a | Design, construct, operate, maintain, and monitor interim, possibly temporary, measures to pass eels upstream after the anadromous passage season. | • Initiate design consultation in License Year 2.<br>• Complete construction of interim eel passage measures NLT 7/15 in License Year 3.<br>• Operate interim eel passage measures NLT 7/16 in License Year 3. | July 16 to November 15 | Yr 1: shakedown.[B] |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

| Table 9.4.2-1. VERNON UPSTREAM AMERICAN EEL & SEA LAMPREY PASSAGE (continued) | | | | |
|---|---|---|---|---|
| **Item** | **Measure** | **Implementation Schedule** | **Operation Period[A]** | **Effectiveness Studies** |
| 4b | Permanent upstream eel passage outside of anadromous passage season. | • Consultation and determination on need for additional studies regarding permanent eel passage measures initiated NLT 7/1 in License Year 9 and completed NLT 1/31 in License Year 10.<br>• If no additional studies required:<br>o Design Consultation initiated 2/1 of License Year 10 and Completed by 12/31 in License Year 10.<br>o Complete construction NLT 7/15 in License Year 11.<br>o Operate measure NLT 7/16 in License Year 11.<br>• If additional studies are required:<br>o Study design consultation initiated NLT 2/15 in License Year 10 and completed NLT 1/1 in License Year 11.<br>o Initiate design consultation in February of License Year 11 and complete design consultation by 12/31 in License Year 11.<br>o Complete construction of permanent upstream eel passage measures NLT 7/15 in License Year 12.<br>o Operate permanent eel passage measure NLT 7/16 in License Year 12. | July 16 – November 15 | |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

| Table 9.4.3-2. VERNON UPSTREAM ANADROMOUS | | | | |
|---|---|---|---|---|
| **Item** | **Measure** | **Implementation Schedule** | **Operation Period[A]** | **Effectiveness Studies** |
| 5a | Evaluate whether fish are trapped behind collection gallery below powerhouse. | Complete by 7/16 in License Year 7. | | |
| 5b | Design and implement solution if fish are trapped behind collection gallery. | Construct or implement mitigation solutions NLT 12/31 in License Year 8 in order to have no issues during the fish passage season starting 4/7 in License Year 9. | April 7 to July 15 | |
| 6 | Design and implement improvements to counting window and room. | • Design Consultation initiated in License Year 4 and completed by 12/31 in License Year 4.<br>• Initiate construction of improvements during License Year 5 and complete NLT 4/1 in License Year 6.<br>• All improvements in place to operate and function NLT 4/7 in License Year 6. | | |
| 7a | Undertake fish ladder hydraulic study and engineering assessment. | • Initiate Study Design Consultation NLT 11/15 in License Year 2.<br>• Initiate study and assessment NLT 7/16 in License Year 3.<br>• Complete Study NLT 12/31 in License Year 4. | | |
| 7b | Additional fish ladder modifications (mods): consult/design, install, operate, maintain, and study effectiveness of mods. | • Initiate design consultation in License Year 4 and complete design consultation NLT 7/15 in License Year 5.<br>• Construct additional ladder modifications NLT 7/16 in License Year 5 and complete NLT 4/6 in License Year 6.<br>• Operate additional ladder modifications NLT 4/7 in License Year 6. | April 7 to July 15 | Yr 1: shakedown[B]; Yr 2: quantitative effectiveness study[C]; Yr 3: additional study year, if needed (i.e., Yr 2 anomalous[D], incomplete, etc. or issues found/mods made); Yr 4: additional study year, if needed (Yr 3 anomalous, incomplete, etc. or issues found/mods made). |
| 7c | Fish trap repair. | Initiate overhaul of Vernon Fish ladder trapping facility in License Year 8 and complete overhaul NLT 12/31 in License Year 9. | | |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

**Table 9.5.1-1. BELLOWS FALLS DOWNSTREAM PASSAGE & PROTECTION**

| Item | Measure | Implementation Schedule | Operation Period[A] | Effectiveness Studies |
|---|---|---|---|---|
| 8a | Hydraulic study above the dam to inform downstream passage design/options. | • Initiate Study Design Consultation NLT 1/1 of License Year 6.<br>• Initiate and Complete Study NLT 12/31 of License Year 7. | | |
| 8b | Design, construct, operate, maintain, and study effectiveness of measures to pass eels downstream. | • Design consultation initiated NLT 1/ 1 of License Year 8; design completed NLT 7/15 of License Year 10.<br>• Initiate construction/modifications (mods) NLT 7/16 in License Year 10 and complete no later than 12/31 of License Year 11.<br>• Operate no later than 4/7 of License Year 12. | August 1 to December 1 | Yr 1: shakedown[B]; Yr 2: quantitative effectiveness study[C]; Yr 3: additional study year, if needed (i.e., Yr 2 anomalous[D], incomplete, etc. or issues found/modifications made); Yr 4: additional study year, if needed (Yr 3 anomalous, incomplete, etc. or issues found/modifications made). |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

**Table 9.5.2-1. BELLOWS FALLS UPSTREAM AMERICAN EEL & SEA LAMPREY PASSAGE**

| Item | Measure | Implementation Schedule | Operation Period[A] | Effectiveness Studies |
|---|---|---|---|---|
| 9a | Monitor fish ladder use by American eel (eel) and Sea Lamprey (lamprey). | Monitor during License Years 2 and 3. | May 1 – July 15 | |
| 9b | Upstream eel/lamprey passage studies (PIT tag study of ladder). | • Initiate Study Design Consultation NLT 9/1 in License Year 3.<br>• Conduct PIT study from May through July 15 in License Year 4 (during License Year 5, if needed). | May 1 to July 15 | |
| 9c | Undertake fish ladder hydraulic study and engineering assessment, if necessary. | • Initiate Study Design Consultation NLT 7/16 in License Year 5.<br>• Conduct study and assessment NLT 12/31 in License Year 6. | | |
| 9d | Consultation, design, and construction of upstream fish ladder modifications for eel and lamprey during the anadromous fish passage season. | • Initiate design consultation in License Year 7 and complete design consultation NLT 7/15 in License Year 8.<br>• Construct permanent upstream ladder improvement measures NLT 7/16 in License Year 8 and complete NLT 4/6 in License Year 9.<br>• Operate permanent upstream ladder improvement measures NLT 4/7 in License Year 9.<br>• All deadlines stated above extended 1 year if additional study under 9b required in License Year 5. | May 1 to July 15 | Yr 1: shakedown[B]; Yr 2: quantitative effectiveness study[C]; Yr 3: additional study year, if needed (i.e., Yr 2 anomalous[D], incomplete, etc. or issues found/mods made); Yr 4: additional study year, if needed (Yr 3 anomalous, incomplete, etc. or issues found/mods made). |
| 10a | Design, construct, operate, maintain, and monitor interim, possibly temporary, measures to pass eels upstream after the anadromous passage season (excluding the bypass reach). | • Initiate design consultation NLT 7/16 in License Year 2 and complete design consultation NLT 12/31 in License Year 3.<br>• Complete construction of interim eel passage measures NLT 7/15 in License Year 4.<br>• Operate interim eel passage measures NLT 7/16 in License Year 3. | July 16 to November 15 (until permanent measures become operational) | |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

| Table 9.5.2-1. BELLOWS FALLS UPSTREAM AMERICAN EEL & SEA LAMPREY PASSAGE (continued) | | | | |
|---|---|---|---|---|
| **Item** | **Measure** | **Implementation Schedule** | **Operation Period[A]** | **Effectiveness Studies** |
| 10b | Permanent upstream eel passage outside of anadromous passage season (excluding the bypass reach). | • Consultation and determination on need for additional studies regarding permanent eel passage measures initiated NLT 7/1 in License Year 9 and completed NLT 1/31 in License Year 10;<br>• If no additional studies required:<br>○ Design consultation initiated 2/1 of License Year 10 and completed by 12/31 in License Year 10<br>○ Complete construction NLT 7/15 in License Year 11<br>○ Operate measure NLT 7/16 in License Year 11<br>• If additional studies are required:<br>○ Study design consultation initiated NLT 2/15 in License Year 10 and completed NLT 1/1 in License Year 11<br>○ Initiate design consultation in February of License Year 11 and complete design consultation by 12/31 in License Year 11<br>○ Complete construction of permanent upstream eel passage measures NLT 7/15 in License Year 12<br>○ Operate permanent eel passage measure NLT 7/16 in License Year 12 | July 16 to November 15 | |
| 10c | Undertake upstream eel survey in bypass reach. | • Study design consultation initiated NLT 7/1 in License Year 6 or year fish barrier dam is removed, whichever is later.<br>• Conduct eel survey study from May through October in License Year 7 or in first year following barrier dam removal, whichever is later. | May 1 to November 15 | |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

| Table 9.5.2-1. BELLOWS FALLS UPSTREAM AMERICAN EEL & SEA LAMPREY PASSAGE (continued) | | | | |
|---|---|---|---|---|
| **Item** | **Measure** | **Implementation Schedule** | **Operation Period[A]** | **Effectiveness Studies** |
| 10d | Consultation, design, and construction of additional upstream eel passage facilities in bypass reach. | • Initiate design consultation in February of License Year 8 and complete design consultation by 12/31 in License Year 8 or the year following the completion of the eel survey study, whichever is later.<br>• Complete construction of permanent upstream eel passage measure in bypass NLT 7/31 in License Year 9 or in the second year following the completion of the eel survey study, whichever is later.<br>• If the Licensee successfully completes construction by 7/31 of the second year following the results of the upstream eel survey or License Year 9, whichever is later, it will immediately begin operating the permanent bypass eel passage on August 1 of that same year. Otherwise, the Licensee will operate the permanent bypass eel passage NLT 5/1 of the following year. | May 1 to November 15 | Yr 1: shakedown[B]; Yr 2: quantitative effectiveness study[C]; Yr 3: additional study year, if needed (i.e., Yr 2 anomalous[D], incomplete, etc. or issues found/mods made); Yr 4: additional study year, if needed (Yr 3 anomalous, incomplete, etc. or issues found/mods made). |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

| Table 9.6.1-1. WILDER DOWNSTREAM PASSAGE & PROTECTION | | | | |
|---|---|---|---|---|
| **Item** | **Measure** | **Implementation Schedule** | **Operation Period[A]** | **Effectiveness Studies** |
| 11a | Hydraulic study above the dam to inform downstream passage design/options | • Initiate study design consultation NLT 1/1 of License Year 10.<br>• Initiate and complete study NLT 12/31 of License Year 11. | | |
| 11b | Design, construct, operate, maintain, and study effectiveness of measures to pass eels downstream. | • Design consultation initiated NLT 1/1 of License Year 12; design completed NLT 12/31 of License Year 13.<br>• Initiate construction/modifications (mods) NLT 7/16 in License Year 14 and complete NLT 12/31 of License Year 15.<br>• Operate NLT 8/1 of License Year 16. | August 1 to December 1 | Yr 1: shakedown[B]; Yr 2: quantitative effectiveness study[C]; Yr 3: additional study year, if needed (i.e., Yr 2 anomalous[D], incomplete, etc. or issues found/mods made); Yr 4: additional study year, if needed (Yr 3 anomalous, incomplete, etc. or issues found/mods made). |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

| Table 9.6.2-1. WILDER UPSTREAM AMERICAN EEL & SEA LAMPREY PASSAGE | | | | |
|---|---|---|---|---|
| **Item** | **Measure** | **Implementation Schedule** | **Operation Period[A]** | **Effectiveness Studies** |
| 12a | Monitor fish ladder use by American eel (eel) and Sea Lamprey (lamprey). | Monitor during License Years 1 and 3. | April 7 to July 15 | |
| 12b | Upstream eel/lamprey passage studies (PIT tag study of ladder). | • Initiate study design consultation NLT 9/1 in License Year 7.<br>• Conduct PIT study from May through July 15 in License Year 8 (during License Year 9, if needed). | April 7 to July 15 | |
| 12c | Undertake fish ladder hydraulic study and engineering assessment, if necessary. | • Initiate study design consultation NLT 7/16 in License Year 9.<br>• Conduct study and assessment NLT 12/31 in License Year 10. | | |
| 12d | Consultation, design, and construction of upstream fish ladder modifications for eel and lamprey during the anadromous fish passage season. | • Initiate design consultation in License Year 11 and complete design consultation NLT 7/15 in License Year 12.<br>• Construct permanent upstream ladder improvement measures NLT 7/16 in License Year 12 and complete NLT 12/31 in License Year 13.<br>• Operate permanent upstream ladder improvement measures NLT 4/7 in License Year 14.<br>• All deadlines stated above extended 1 year if additional study under 12b required in License Year 9. | May 1 to July 15 | Yr 1: shakedown[B]; Yr 2: quantitative effectiveness study[C]; Yr 3: additional study year, if needed (i.e., Yr 2 anomalous[D], incomplete, etc. or issues found/mods made); Yr 4: additional study year, if needed (Yr 3 anomalous, incomplete, etc. or issues found/mods made). |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

**Table 9.6.2-1. WILDER UPSTREAM AMERICAN EEL & SEA LAMPREY PASSAGE (continued)**

| Item | Measure | Implementation Schedule | Operation Period[A] | Effectiveness Studies |
|---|---|---|---|---|
| 13a | Undertake upstream eel survey in the vicinity of the powerhouse and along the spillway. | • Eel survey study design consultation initiated NLT 7/1 in License Year 7.<br>• Conduct eel survey study from May through October in License Year 8. | May 1 to November 15 | |
| 13b | Consultation, design, and construction of dedicated upstream eel passage facilities. | • Consultation and determination on need for additional studies regarding dedicated eel passage measures initiated NLT 7/1 in License Year 11 and completed NLT 12/31 in License Year 11.<br>• If no additional studies required:<br>○ Design consultation initiated 2/1 of License Year 12 and completed by 12/31 in License Year 12.<br>○ Complete construction NLT 7/15 in License Year 13.<br>○ Operate measures NLT 7/16 in License Year 13.<br>• If additional studies are required:<br>○ Initiate study design consultation NLT 1/1 in License Year 12 and complete study NLT 12/31 in License Year 12.<br>○ Initiate design consultation in February of License Year 13 and complete design consultation by 12/31 in License Year 13.<br>○ Complete construction of permanent upstream eel passage measures NLT 7/15 in License Year 14.<br>○ Operate permanent eel passage measures NLT 7/16 in License Year 14. | May 1 to November 15 | Yr 1: shakedown[B]; Yr 2: quantitative effectiveness study[C]; Yr 3: additional study year, if needed (i.e., Yr 2 anomalous[D], incomplete, etc. or issues found/mods made); Yr 4: additional study year, if needed (Yr 3 anomalous, incomplete, etc. or issues found/mods made). |

A. Future refinement of the timing may be made by the Agencies as information on the behavior of migrants at the Project is documented.
B. Shakedown refers to assessing whether all components of the upstream fish passage facility are operating correctly.
C. Quantitative effectiveness studies are based on a study design that allows for numeric, objective assessments of data collected.
D. Anomalous conditions are those outside the bounds of 25th to 75th percentile conditions for a given parameter (e.g., flow, temperature, etc.).

# APPENDIX B

# PROJECT SPECIFIC FISH PASSAGE IMPLEMENTATION CHART

# Appendix B - Project Specific Fish Passage Implementation Chart

| Project and Fish Passage Mitigation Measure | License Issue Year 0 | LICENSE YEAR (Year Following License Issuance or Year 0) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **VERNON** | *MONITOR* | *STUDY* | *DESIGN* | *CONSTRUCT* | *OPERATE* | | | | |
| 9.4.2.1 Design and Complete Vernon Ladder Hydraulic Study for eels/lamprey (NLT): design, perform, report | | | *Initiate study design NLT 11/15 Y2* | *Initiate study NLT 7/16 Y3* | *complete NLT 12/31 Y4* | | | | |
| 9.4.3 Hydraulic and Engineering Assessment of Ladder - shad passage same as 3.2.2.1 | | | | | | | | | |
| 9.4.2.1 Complete Vernon Ladder PIT Study for eels/lamprey: design, perform, and report | | | | *Initiate study design NLT 7/1 Y3* | *complete NLT 12/31 Y4** | | | | |
| 9.4.2.1 Design Consultation and Final Design on Upstream ladder passage measures | | | | | *Initiate Y4* | *Complete NLT 7/15 Y5* | | | |
| 9.4.3 Design Consultation and Final Design - shad related ladder passage measures | | | | | *Initiate 1/1 Y4* | *Complete NLT 7/15 Y5* | | | |
| 9.4.2.1. Construction of Permanent Upstream Eel/Sea Lamprey Ladder improvements | | | | | | *Initiate NLT 7/16 Y5* | *Complete NLT 4/6 Y6* | | |
| **9.4.2.1 OPERATE PERMANENT UPSTREAM EEL/SEA LAMPREY LADDER IMPROVEMENTS** | | | | | | | *NLT 4/7 Y6* | | |
| 9.4.3 Construction of Permanent Upstream Ladder shad related measures | | | | | | *Initiate NLT 7/16 Y5* | *Complete NLT 4/6 Y6* | | |
| **9.4.3 OPERATE PERMANENT UPSTREAM SHAD LADDER IMPROVEMENTS** | | | | | | | *NLT 4/7 Y6* | | |
| 9.4.2.2 Design Consultation and Final Design for Interim In-ladder eel passage (7/16-11/15) | | | *initiate NLT 1/1 complete NLT 12/31 Y2* | | | | | | |
| 9.4.2.2 Construction of Interim In-ladder eel passage (7/16-11/15) | | | | *complete NLT 7/15 Y3* | | | | | |
| **9.4.2.2 OPERATE INTERIM IN-LADDER EEL PASSAGE** | | | | *NLT 7/16 Y3* | | | | | |
| **9.4.2.2 MONITOR INTERIM IN-LADDER EEL PASSAGE** | | | | *7/16-11/15* | *7/16-11/15* | | | | |
| 9.4.2.3 Study info determination for permanent eel passage measures (7/16-11/15) | | | | | | | | | |
| 9.4.2.3 IF NO FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | | | | | | | |
| 9.4.2.3 IF NO FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | | | | | | |
| **9.4.2.3 IF NO FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE 7/16-11/15** | | | | | | | | | |
| 9.4.2.3 IF FURTHER STUDY: Design, Perform and Report additional study | | | | | | | | | |
| 9.4.2.3 IF FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | | | | | | | |
| 9.4.2.3 IF FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | | | | | | |
| **9.4.2.3 IF FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | | | | | | | |
| 9.4.1 Hydraulic Study or Alternative above dam for downstream passage: design, perform, report | | | *initiate study design NLT 1/1 Y2* | *complete & report on study NLT 12/31 Y3* | | | | | |
| 9.4.1 Design Consultation and Final Design on Downstream passage measures | | | | *Initiate NLT 7/1 Y3* | *complete NLT 12/31 Y4* | | | | |
| 9.4.1. Construction of Shad/Eel Downstream measures | | | | | | *Initiate Y5* | *complete NLT 12/31 Y6* | | |
| **9.4.1 OPERATE PERMANENT DOWNSTREAM SHAD/EEL MEASURES** | | | | | | | | *NLT 4/7 Y7* | |
| 9.4.3 Complete overhaul and repairs to existing fish trap | | | | | | | | | *Initiate Y8* |
| 9.4.3 Evaluate, determine and report if fish are trapped behind collection gallery | | | | | | | | *Complete NLT 7/16 Yr 7* | |
| 9.4.3 IF TRAPPED: Implement Prevention Solution | | | | | | | | | *complete NLT 12/31 Y8* |
| 9.4.3 Design improvements to public viewing and counting windows | | | | | *complete NLT 12/31 Y4* | | | | |
| 9.4.3 Make and complete improvements to public viewing and counting windows | | | | | | *Initiate Y5* | *complete NLT 4/1 Y6* | | |
| 9.4.3 Complete improvements to public viewing and counting windows | | | | | | | *NLT 4/7 Y6* | | |

# Project Specific Fish Passage Implementation Chart (Continued)

| Project and Fish Passage Mitigation Measure | License Issue Year 0 | LICENSE YEAR (Year Following License Issuance or Year 0) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **BELLOWS FALLS** | *MONITOR* | *STUDY* | *DESIGN* | *CONSTRUCT* | *OPERATE* | | | | |
| 9.5.2.1 Monitor eel and lamprey fish ladder use | | | *4/1 - 7/15 Y2* | *4/1 - 7/15 Y3* | | | | | |
| 9.5.2.1 Complete Bellows Falls Ladder PIT Study for eels/lamprey: design, perform, report | | | | *Initiate study design NLT 9/1 Y3* | *complete NLT 12/31 Y4** | | | | |
| 9.5.2.1 Design and Complete Ladder Hydraulic Study for eels/lamprey if needed | | | | | | *Initiate NLT 7/16 Y5* | *complete NLT 12/31 Y6* | | |
| 9.5.2.1 Design Consultation and Final Design on Upstream ladder passage measures | | | | | | | | *Initiate NLT 1/1 Y7* | *complete NLT 7/15 Y 8* |
| 9.5.2.1. Construction of Permanent Upstream Eel/Sea Lamprey Ladder improvements | | | | | | | | | *Initiate NLT 7/16 Y8* |
| **9.5.2.1 OPERATE PERMANENT UPSTREAM EEL/SEA LAMPREY LADDER IMPROVEMENTS** | | | | | | | | | |
| 9.5.2.2 Design Consultation and Final Design for Interim In-ladder eel passage (7/16-11/15) | | | *Initiate NLT 7/16 Y2* | *complete NLT 12/31 Y3* | | | | | |
| 9.5.2.2 Construction of Interim In-ladder eel passage (7/16-11/15) | | | | | *complete NLT 7/15 Y 4* | | | | |
| **9.5.2.2 OPERATE INTERIM IN-LADDER EEL PASSAGE (7/16-11/15)** | | | | | *NLT 7/16 Y4* | | | | |
| **9.5.2.2 MONITOR INTERIM IN-LADDER EEL PASSAGE (7/16-11/15)** | | | | | *7/16-11/15* | *7/16-11/15* | | | |
| 9.5.2.4 Survey Bypass Reach for where juvenile eels congregate 1 Yr after barrier dam is out: design, perform, report | | | | | | | *Initiate Survey design NLT 7/1 Y6* | *Initiate study May - Oct Y7 Earliest* | |
| 9.5.2.4 Consultation and Finalize Design for permanent bypass reach eel passage facility | | | | | | | | | *initiate NLT 1/1 complete NLT 12/31 Y8 Earliest* |
| 9.5.2.4 Construction of permanent bypass reach eel passage facility | | | | | | | | | |
| **9.5.2.4 OPERATE PERMANENT BYPASS EEL PASSAGE (end of spring runoff-11/15)** | | | | | | | | | |
| 9.5.2.3 Study info determination for permanent eel passage measures (7/16-11/15) | | | | | | | | | |
| 9.5.2.3 IF NO FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | | | | | | | |
| 9.5.2.3 IF NO FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | | | | | | |
| **9.3.2.3 IF NO FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | | | | | | | |
| 9.5.2.3 IF FURTHER STUDY: Design, Perform and Report additional study | | | | | | | | | |
| 9.5.2.3 IF FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | | | | | | | |
| 9.5.2.3 IF FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | | | | | | |
| **9.5.2.3 IF FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | | | | | | | |
| 9.5.1 Hydraulic Study or Alternative above dam for downstream passage: design, perform, report | | | | | | | *initiate study design NLT 1/1 Y6* | *complete NLT 12/31 Y7* | |
| 9.5.1 Design Consultation and Final Design on Downstream passage measures | | | | | | | | | *Initiate NLT 1/1 Y8* |
| 9.5.1. Construction of Eel Downstream measures | | | | | | | | | |
| **9.5.1 OPERATE PERMANENT DOWNSTREAM EEL/SEA LAMPREY MEASURES** | | | | | | | | | |

*These dates associated with initiating design consultation with the Agencies, finalizing design plans, final design approvals by the Agencies, and date of commencing operation shall be extended 1 year if an additional year of PIT study is necessary.

# Project Specific Fish Passage Implementation Chart (Continued)

| Project and Fish Passage Mitigation Measure | License Issue Year 0 | LICENSE YEAR (Year Following License Issuance or Year 0) | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
| **WILDER** | *MONITOR* | *STUDY* | *DESIGN* | *CONSTRUCT* | *OPERATE* | | | | |
| 9.6.2.1 Monitor eel and lamprey fish ladder use | | *4/7 - 7/15* | | *4/7 - 7/15* | | | | | |
| 9.6.2.1 Complete Wilder Ladder PIT Study for eels/lamprey (NLT): design, perform, report | | | | | | | | *Initiate study design NLT 9/1 Y7* | *Complete NLT 12/31 Y8 ** |
| 9.6.2.1 Design and Complete Ladder Hydraulic Study for eels/lamprey (NLT) if needed: design, perform, report | | | | | | | | | |
| 9.6.2.1 Design Consultation and Final Design on Upstream ladder passage measures | | | | | | | | | |
| 9.6.2.1. Construction of Permanent Upstream Eel/Sea Lamprey Ladder improvements | | | | | | | | | |
| **9.6.2.1 OPERATE PERMANENT UPSTREAM EEL/SEA LAMPREY LADDER IMPROVEMENTS** | | | | | | | | | |
| 9.6.2.2 Survey tailrace and spillway for where juvenile eels congregate: design, perform, report | | | | | | | | *Survey design initiate NLT 7/1 Y7* | *Complete NLT 12/31 Y8* |
| 9.6.2.2 Study info determination for permanent eel passage measures (7/16-11/15) | | | | | | | | | |
| 9.6.2.2 IF NO FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | | | | | | | |
| 9.6.2.2 IF NO FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | | | | | | |
| **9.6.2.2 IF NO FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | | | | | | | |
| 9.6.2.2 IF FURTHER STUDY: Design, Perform and Report additional study | | | | | | | | | |
| 9.6.2.2 IF FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | | | | | | | |
| 9.6.2.2 IF FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | | | | | | |
| **9.6.2.2 IF FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | | | | | | | |
| 9.6.1 Hydraulic Study or Alternative above dam for downstream passage: design, perform, report | | | | | | | | | |
| 9.6.1 Design Consultation and Final Design on Downstream passage measures | | | | | | | | | |
| 9.6.1. Construction of Eel Downstream measures | | | | | | | | | |
| **9.6.1 OPERATE PERMANENT DOWNSTREAM EEL/SEA LAMPREY MEASURES** | | | | | | | | | |

*These dates associated with initiating design consultation with the Agencies, finalizing design plans, final design approvals by the Agencies, and date of commencing operation shall be extended 1 year if an additional year of PIT study is necessary.

# Project Specific Fish Passage Implementation Chart (continued)

| Project and Fish Passage Mitigation Measure | LICENSE YEAR (Year Following License Issuance or Year 0) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| **VERNON** | *MONITOR* | *STUDY* | *DESIGN* | *CONSTRUCT* | *OPERATE* | | | |
| 9.4.2.1 Design and Complete Vernon Ladder Hydraulic Study for eels/lamprey (NLT): design, perform, report | | | | | | | | |
| 9.4.3 Hydraulic and Engineering Assessment of Ladder - shad passage same as 3.2.2.1 | | | | | | | | |
| 9.4.2.1 Complete Vernon Ladder PIT Study for eels/lamprey: design, perform, and report | | | | | | | | |
| 9.4.2.1 Design Consultation and Final Design on Upstream ladder passage measures | | | | | | | | |
| 9.4.3 Design Consultation and Final Design - shad related ladder passage measures | | | | | | | | |
| 9.4.2.1. Construction of Permanent Upstream Eel/Sea Lamprey Ladder improvements | | | | | | | | |
| **9.4.2.1 OPERATE PERMANENT UPSTREAM EEL/SEA LAMPREY LADDER IMPROVEMENTS** | | | | | | | | |
| 9.4.3 Construction of Permanent Upstream Ladder shad related measures | | | | | | | | |
| **9.4.3 OPERATE PERMANENT UPSTREAM SHAD LADDER IMPROVEMENTS** | | | | | | | | |
| 9.4.2.2 Design Consultation and Final Design for Interim In-ladder eel passage (7/16-11/15) | | | | | | | | |
| 9.4.2.2 Construction of Interim In-ladder eel passage (7/16-11/15) | | | | | | | | |
| **9.4.2.2 OPERATE INTERIM IN-LADDER EEL PASSAGE** | | | | | | | | |
| **9.4.2.2 MONITOR INTERIM IN-LADDER EEL PASSAGE** | | | | | | | | |
| 9.4.2.3 Study info determination for permanent eel passage measures (7/16-11/15) | *Consult: initiate NLT 7/1/ Y9* | *Complete NLT 1/31 Y10* | | | | | | |
| 9.4.2.3 IF NO FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | *Initiate NLT 2/1 complete NLT 12/31 Y10* | | | | | | |
| 9.4.2.3 IF NO FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | *complete NLT 7/15 Y11* | *Complete by 7/15 if needed* | | | | |
| **9.4.2.3 IF NO FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE 7/16-11/15** | | | *NLT 7/16 Y11* | | | | | |
| 9.4.2.3 IF FURTHER STUDY: Design, Perform and Report additional study | | *Initiate NLT 2/15 complete by NLT 12/31 Y10* | | | | | | |
| 9.4.2.3 IF FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | *Initiate NLT 2/1 complete NLT Dec 31 Y11* | | | | | |
| 9.4.2.3 IF FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | *complete NLT 7/15 Y12* | *Complete by 7/15 if needed* | | | |
| **9.4.2.3 IF FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | | *NLT 7/16 Y12* | | | | |
| 9.4.1 Hydraulic Study or Alternative above dam for downstream passage: design, perform, report | | | | | | | | |
| 9.4.1 Design Consultation and Final Design on Downstream passage measures | | | | | | | | |
| 9.4.1. Construction of Shad/Eel Downstream measures | | | | | | | | |
| **9.4.1 OPERATE PERMANENT DOWNSTREAM SHAD/EEL MEASURES** | | | | | | | | |
| 9.4.3 Complete overhaul and repairs to existing fish trap | *Complete NLT 12/31 Y9* | *NLT 4/7 Y10* | | | | | | |
| 9.4.3 Evaluate, determine and report if fish are trapped behind collection gallery | | | | | | | | |
| 9.4.3 IF TRAPPED: Implement Prevention Solution | *NLT 4/7 Y9* | | | | | | | |
| 9.4.3 Design improvements to public viewing and counting windows | | | | | | | | |
| 9.4.3 Make and complete improvements to public viewing and counting windows | | | | | | | | |
| 9.4.3 Complete improvements to public viewing and counting windows | | | | | | | | |

# Project Specific Fish Passage Implementation Chart (continued)

| Project and Fish Passage Mitigation Measure | LICENSE YEAR (Year Following License Issuance or Year 0) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| **BELLOWS FALLS** | *MONITOR* | *STUDY* | *DESIGN* | *CONSTRUCT* | *OPERATE* | | | |
| 9.5.2.1 Monitor eel and lamprey fish ladder use | | | | | | | | |
| 9.5.2.1 Complete Bellows Falls Ladder PIT Study for eels/lamprey: design, perform, report | | | | | | | | |
| 9.5.2.1 Design and Complete Ladder Hydraulic Study for eels/lamprey if needed | | | | | | | | |
| 9.5.2.1 Design Consultation and Final Design on Upstream ladder passage measures | | | | | | | | |
| 9.5.2.1. Construction of Permanent Upstream Eel/Sea Lamprey Ladder improvements | *Complete NLT 4/6 Y9* | | | | | | | |
| **9.5.2.1 OPERATE PERMANENT UPSTREAM EEL/SEA LAMPREY LADDER IMPROVEMENTS** | *NLT 4/7 Y9* | | | | | | | |
| 9.5.2.2 Design Consultation and Final Design for Interim In-ladder eel passage (7/16-11/15) | | | | | | | | |
| 9.5.2.2 Construction of Interim In-ladder eel passage (7/16-11/15) | | | | | | | | |
| **9.5.2.2 OPERATE INTERIM IN-LADDER EEL PASSAGE (7/16-11/15)** | | | | | | | | |
| **9.5.2.2 MONITOR INTERIM IN-LADDER EEL PASSAGE (7/16-11/15)** | | | | | | | | |
| 9.5.2.4 Survey Bypass Reach for where juvenile eels congregate 1 Yr after barrier dam is out: design, perform, report | | | | | | | | |
| 9.5.2.4 Consultation and Finalize Design for permanent bypass reach eel passage facility | | | | | | | | |
| 9.5.2.4 Construction of permanent bypass reach eel passage facility | *complete NLT 7/31 Y9 Earliest* | | | | | | | |
| **9.5.2.4 OPERATE PERMANENT BYPASS EEL PASSAGE (end of spring runoff-11/15)** | *Y9 Earliest if operational before 8/1* | *If needed NLT 5/1 Y10 Earliest* | | | | | | |
| 9.5.2.3 Study info determination for permanent eel passage measures (7/16-11/15) | *Consult: initiate NLT 7/1/ Y9* | *Complete NLT 1/31 Y10* | | | | | | |
| 9.5.2.3 IF NO FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | *Initiate NLT 2/1 complete NLT 12/31 Y10* | | | | | | |
| 9.5.2.3 IF NO FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | *complete NLT 7/15 Y11* | *complete by 7/15 if needed* | | | | |
| **9.5.2.3 IF NO FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | *NLT 7/16 Y11* | | | | | |
| 9.5.2.3 IF FURTHER STUDY: Design, Perform and Report additional study | | *Initiate NLT 2/15 complete NLT 12/31 Y10* | | | | | | |
| 9.5.2.3 IF FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | *Initiate NLT 2/1 complete NLT 12/31 Y11* | | | | | |
| 9.5.2.3 IF FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | *complete NLT 7/15 Y12* | *complete by 7/15 if needed* | | | |
| **9.5.2.3 IF FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | | *NLT 7/16 Y12* | | | | |
| 9.5.1 Hydraulic Study or Alternative above dam for downstream passage: design, perform, report | | | | | | | | |
| 9.5.1 Design Consultation and Final Design on Downstream passage measures | *complete NLT 12/31 Y9* | | | | | | | |
| 9.5.1. Construction of Eel Downstream measures | | *Initiate NLT 7/16 Y10* | *complete NLT 12/31 Y11* | | | | | |
| **9.5.1 OPERATE PERMANENT DOWNSTREAM EEL/SEA LAMPREY MEASURES** | | | | *NLT 8/1 Y12* | | | | |

# Project Specific Fish Passage Implementation Chart (continued)

| Project and Fish Passage Mitigation Measure | LICENSE YEAR (Year Following License Issuance or Year 0) | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 |
| **WILDER** | *MONITOR* | *STUDY* | *DESIGN* | *CONSTRUCT* | *OPERATE* | | | |
| 9.6.2.1 Monitor eel and lamprey fish ladder use | | | | | | | | |
| 9.6.2.1 Complete Wilder Ladder PIT Study for eels/lamprey (NLT): design, perform, report | | | | | | | | |
| 9.6.2.1 Design and Complete Ladder Hydraulic Study for eels/lamprey (NLT) if needed: design, perform, report | *Initiate NLT 7/16 Y9* | *complete NLT 12/31 Y10* | | | | | | |
| 9.6.2.1 Design Consultation and Final Design on Upstream ladder passage measures | | | *Initiate NLT 01/01 Y11* | *complete NLT 7/15 Y12* | | | | |
| 9.6.2.1. Construction of Permanent Upstream Eel/Sea Lamprey Ladder improvements | | | | *Initiate NLT 7/16 Y12* | *Complete NLT 12/31 Y13* | | | |
| **9.6.2.1 OPERATE PERMANENT UPSTREAM EEL/SEA LAMPREY LADDER IMPROVEMENTS** | | | | | | *NLT 4/7 Y14* | | |
| 9.6.2.2 Survey tailrace and spillway for where juvenile eels congregate: design, perform, report | | | | | | | | |
| 9.6.2.2 Study info determination for permanent eel passage measures (7/16-11/15) | | | *Consult and Determination NLT 12/31 Y11* | | | | | |
| 9.6.2.2 IF NO FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | | *Initate NLT 2/1 complete NLT 12/31 Y12* | | | | |
| 9.6.2.2 IF NO FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | | *complete NLT 7/15 Y13* | | | |
| **9.6.2.2 IF NO FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | | | *NLT 7/16 Y13* | | | |
| 9.6.2.2 IF FURTHER STUDY: Design, Perform and Report additional study | | | | *initiate NLT 1/1 complete NLT 12/31 Y12* | | | | |
| 9.6.2.2 IF FURTHER STUDY: Design for permanent eel passage systems (7/16-11/15) | | | | | *Initiate NLT 2/1 complete NLT 12/31 Y13* | | | |
| 9.6.2.2 IF FURTHER STUDY: Construction of Permanent eel passage (7/16-11/15) | | | | | | *complete NLT 7/15 Y14* | | |
| **9.6.2.2 IF FURTHER STUDY: OPERATE PERMANENT EEL PASSAGE (7/16-11/15)** | | | | | | *NLT 7/16 Y14* | | |
| 9.6.1 Hydraulic Study or Alternative above dam for downstream passage: design, perform, report | | *initiate study design NLT 1/1 Y10* | *complete NLT 12/31 Y11* | | | | | |
| 9.6.1 Design Consultation and Final Design on Downstream passage measures | | | | *Initiate NLT 1/1 Y12* | *complete NLT 12/31 Y13* | | | |
| 9.6.1. Construction of Eel Downstream measures | | | | | | *Initiate NLT 7/16 Y14* | *complete NLT 12/31 Y15* | |
| **9.6.1 OPERATE PERMANENT DOWNSTREAM EEL/SEA LAMPREY MEASURES** | | | | | | | | *NLT 8/1 Y16* |

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