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September 21, 2022

Via E-Filing

Kimberly D. Bose, Secretary
Federal Energy Regulatory Commission
888 First Street, N.E.
Washington, D.C. 20426

Subject: **Supplement to the Lower Kennebec Species Protection Plan and Draft Biological Assessment for the Lockwood (FERC No. 2574), Hydro Kennebec (FERC No. 2611), and Weston (FERC No. 2325) Projects and the Interim Species Protection Plan and Draft Biological Assessment and Final License Application for the Shawmut Project (FERC No. 2322)**

Dear Secretary Bose,

By letters dated July 9 and July 26, 2021, the Federal Energy Regulatory Commission (FERC) requested the initiation of formal Section 7 consultation under the ESA (16 U.S.C. § 1536) for four hydropower projects on the lower Kennebec River in Maine:

1. the Lockwood Project, which is licensed to The Merimil Limited Partnership;
2. the Hydro-Kennebec Project, which is licensed to Hydro-Kennebec LLC;
3. the Shawmut Project, which is licensed to Brookfield White Pine Hydro LLC (BWPH); and
4. the Weston Project, which is also licensed to BWPH.

The four projects are collectively referred to herein as the "Projects," and The Merimil Limited Partnership, Hydro-Kennebec LLC, and BWPH are collectively referred to herein as the "Licensees."

FERC specifically requested consultation on the following proposals:

1. Relicensing the Shawmut Project;
2. A license amendment to incorporate an Interim Species Protection Plan for the Shawmut Project pending issuance of the new license (Shawmut ISPP);
3. License amendments to incorporate the final Species Protection Plan for the Lockwood, Hydro-Kennebec and Weston Projects (Lower Kennebec SPP) into the current Project licenses.

In doing so, FERC adopted the draft Biological Assessments (BAs) submitted by the Licensees for the Lower Kennebec SPP and Shawmut ISPP without modification. By letter to FERC dated December 8, 2021, the National Marine Fisheries Service (NMFS) indicated that it had all the information it needed to proceed with formal consultation, which began on December 2, 2021.

In the course of conducting its analysis of the Lower Kennebec SPP, Shawmut ISPP and BAs, NMFS asked the Licensees to better address delayed mortality for smolts passing downstream of the first receiver at each of the Projects. In response, the Licensees and NMFS evaluated whether measures already contemplated within the adaptive management plan provisions in Section 9.5 of the Lower Kennebec SPP and Section 9.5 of the SPP previously filed as part of

the Shawmut relicensing could be implemented on an accelerated schedule to minimize and/or mitigate the effects of delayed mortality.

Based on those discussions, the Licensees have selected a suite of measures from the existing Lower Kennebec SPP adaptive management plan (Section 9.5) for the Lockwood, Hydro-Kennebec and Weston Projects to improve immediate and latent survival on spill and through the fishways, as well as reduce entrainment, as appropriate for each of the specific projects. These measures now will be implemented concurrently with or in advance of the other actions proposed in the Lower Kennebec SPP.

For the Shawmut Project, BWPH's proposal in its January 31, 2020 Final License Application for fish passage mirrored that of its original December 31, 2019 SPP, including the adaptive management plan. As a supplement to the FLA, BWPH is also proposing a suite of measures that would reduce entrainment, provide safe downstream passage routes, and improve passage survival conditions for spill, all of which would be implemented adaptively as contemplated in Section 9.5 of the SPP previously filed with the Shawmut FLA.

In addition to project specific improvements, the Licensees are also proposing mitigation measures, including the funding of habitat restoration projects within the Kennebec River watershed and Merrymeeting Bay Salmon Habitat Recovery Unit (SHRU), as discussed in Section 7.5 of the Lower Kennebec SPP, and a commitment to stocking smolts into the Sandy River for up to 6 years to support studies to verify compliance with the proposed upstream and downstream passage standards, as discussed in Sections 7.2 and 7.4 of the SPP. Such stocking efforts also will provide additional benefits toward the recovery of the species through increased Atlantic salmon adult returns.

The attached document outlines the specific proposed supplemental adaptive management actions for the lower Kennebec River Projects, as well as an analysis of the anticipated benefits to immediate and latent survival and to recovery efforts for Atlantic salmon smolt and kelt. The Licensees request that FERC consider the attached supplement to the Lower Kennebec SPP, Shawmut ISPP and FLA, and BAs for the lower Kennebec River Projects and incorporate these measures into the current, active formal Section 7 consultation process for the Lockwood, Hydro-Kennebec, Shawmut and Weston Projects.

Because these measures were contemplated by the proposed adaptive management plans and consistent with the proposals FERC is already evaluating, the Licensees do not anticipate that this supplement will further delay the ongoing environmental analysis of the relicensing and license amendment proceedings. Should FERC staff determine that a separate notice of the supplement is required, the Licensees request that any such notice be issued as expeditiously as possible to enable the ongoing environmental analysis and ESA consultation to continue without interruption. Under the current schedule, NMFS' biological opinion is expected on October 13, 2022.

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If you have any questions, please feel free to contact me at (207) 755-5606 or kelly.maloney@brookfieldrenewable.com.

Sincerely,

Kelly Maloney
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Attachments: Supplement to the Lower Kennebec SPP and Shawmut ISPP and FLA

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BWPH File: 2325, 2322, 2574, 2611|01

SUPPLEMENT TO THE SPECIES PROTECTION PLAN AND INTERIM SPECIES PROTECTION PLAN FOR ATLANTIC SALMON, ATLANTIC STURGEON, AND SHORTNOSE STURGEON

AT THE LOCKWOOD, HYDRO-KENNEBEC, SHAWMUT AND WESTON PROJECTS ON THE KENNEBEC RIVER, MAINE

Prepared by:

Brookfield White Pine Hydro LLC
The Merimil Limited Partnership
and
Hydro-Kennebec LLC

September 21, 2022

SUPPLEMENT TO THE SPECIES PROTECTION PLAN AND INTERIM SPECIES PROTECTION PLAN FOR ATLANTIC SALMON, ATLANTIC STURGEON, AND SHORTNOSE STURGEON LOCKWOOD, HYDRO-KENNEBEC, SHAWMUT AND WESTON PROJECTS

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1.0 INTRODUCTION

On May 31, 2021, the Lower Kennebec Species Protection Plan (SPP) and Draft Biological Assessment (BA) was filed with the Federal Energy Regulatory Commission (FERC) for the purpose of Section 7 Endangered Species Act (ESA) consultation for the:

- Lockwood Project (FERC No. 2574), licensed to The Merimil Limited Partnership (MLP)
- Hydro Kennebec Project (FERC No. 2611), licensed to Hydro Kennebec LLC (HKLLC)
- Weston Project (FERC No. 2325), licensed to Brookfield White Pine Hydro LLC (BWPH, and together with MLP and HKLLC, the "Licensees"[1])

Simultaneously, an Interim Species Protection Plan (ISPP) and Draft BA was filed with the FERC for BWPH's Shawmut Project (FERC No. 2322) for ongoing operations and fish passage activities until the issuance of a new license for the Project.

The Projects are located on the lower Kennebec River in Maine with critical habitat for Atlantic salmon, and, in the case of the Lockwood Project, for Atlantic and shortnose sturgeon. The current FERC licenses for most of the Projects expire in 2036, with the exception of the Shawmut Project, which has a license that expired in 2022 and is operating on annual licenses as it completes the relicensing process.

1.1 Previous Consultation

In 2012 and 2013, the Licensees proactively initiated ESA Section 7 consultation ahead of any pending federal action, by filing ISPPs for the Projects, and began collaborating with State and Federal resource agencies to develop measures to avoid, minimize or mitigate the impacts of Project operations upon the nascent Kennebec River salmon restoration program. The National Marine Fisheries Service (NMFS) issued Biological Opinions (BiOps) for the four Projects in 2012, 2013 and 2017, and concluded that the continued operation of the four lower Kennebec River Projects "may adversely affect but is not likely to jeopardize the continued existence of the (Gulf of Maine Distinct Population Segment) GOM DPS of Atlantic salmon. All of the Projects…are located in designated critical habitat for the GOM DPS of Atlantic salmon. Ongoing operations of the hydroelectric facilities will continue to adversely affect essential features of this habitat over the interim period. However, the proposed action is anticipated to improve the functioning of migratory habitat by constructing three volitional upstream fishways, and by implementing an adaptive management strategy to improve downstream survival of Atlantic salmon smolts and kelts in the Kennebec and Androscoggin Rivers." NMFS agreed with

[1] Each of MLP, HKLLC and BWPH are sometimes referred to herein individually as a Licensee and collectively as the Licensees.

FERC that the proposed action would not lead to adverse modification or destruction of critical habitat.[2,3]

The BiOps included Incidental Take Statements (ITSs) and Reasonable and Prudent Measures (RPMs) necessary to minimize and/or monitor incidental take at the Projects. These measures included the construction of upstream fish passage facilities at Shawmut, Weston and Hydro Kennebec (Lockwood had an existing upstream fishway for which a volitional flume was to be added), and three years of baseline study of downstream passage conditions at all four Projects. FERC issued an Order Approving the Atlantic Salmon ISPP for the Hydro-Kennebec Project on February 28, 2013 and approved a further extension of the ISPP on March 14, 2018. FERC issued an Order Amending License approving the ISPP and the Handling and Protection Plan for Shortnose and Atlantic Sturgeon for the Lockwood, Shawmut and Weston Projects on May 19, 2016. The terms and conditions of NMFS RPMs were incorporated into the respective Project licenses and have been in place since the BiOps were issued.

While the ISPPs and BiOps anticipated that the upstream fishways and the Lockwood volitional flume would be completed by the 2020 fish passage season, several requests for extensions of time, supported by NMFS and the other state and federal resource agencies, were granted by FERC for the purpose of conducting additional testing, siting and design studies. For example, an analysis evaluating various upstream fish passage alternatives for the four Projects was filed with the FERC on July 1, 2019. In addition, the volitional flume at the existing Lockwood lift was deferred in favor of construction of a new upstream fish passage facility located in the Lockwood Project bypass reach, the final designs for which were filed with the FERC on March 10, 2021.

1.2 2019 Species Protection Plan and Biological Assessment

The Licensees filed a final SPP and draft BA (2019 SPP) for all four Projects on December 31, 2019, the date of expiry of the BiOps, describing measures the Licensees would take to avoid and minimize impacts to Atlantic salmon and to Atlantic and shortnose sturgeon, as applicable, for the duration of the licenses - 2036 for Lockwood, Weston and Hydro-Kennebec, and 2022 for Shawmut. Those measures included the operation of the previously-authorized and required upstream fish passage facilities, the implementation of downstream passage improvements at the four Projects, identifying performance standards, monitoring studies, and adaptive management considerations. Further, the SPP included a Sturgeon Handling Plan.

On February 7, 2020, NMFS issued a letter to FERC providing comment on the 2019 lower Kennebec SPP and expressing the following concerns:

1. Adaptive Management – NMFS indicated that while the 2019 SPP included a commitment to " adaptive management and a cooperative approach in implementing its proposed measures," it did not include a discrete framework or specific potential measures in the adaptive plan. NMFS added that, "without any specificity surrounding the proposal for adaptive modifications, we will likely not have enough information to adequately proceed with our assessment of the effects of the action on listed species or critical habitat during formal ESA consultation."

[2] NMFS Biological Opinion for the Lockwood (2574), Shawmut (2322), Weston (2325), Brunswick (2284) and Lewiston Falls (2302) Projects; July 19, 2013.
[3] The same conclusion was reached for the Hydro-Kennebec Project in NFMS Biological Opinions for the Hydro-Kennebec (2611) Project; September 17, 2012 and May 25, 2017.

2. Effects of Construction – NMFS indicated that while the "licenses were previously amended by FERC to require the construction and operation of new upstream fish ways," the fishways at Shawmut and Weston had "not yet been constructed; therefore, the BA must include an assessment of the effects of that new construction." In addition, NMFS noted that "effects that were not considered under the previous consultation from the construction of the recently conceived Lockwood bypass upstream fishway to federally-listed species including Atlantic salmon, Atlantic sturgeon, and shortnose sturgeon" would "involve substantial work downstream of the dam where we would expect three listed species to occur in addition to two critical habitats" and that the "2013 consultation does not assess effects of construction of this new fish way and cannot be relied upon as an assessment of effects to listed species and/or critical habitat."
3. Integration with Concurrent Relicensing Process – NMFS petitioned FERC to consider the Shawmut Project upstream fishway as part of relicensing, even though FERC, in its 2016 Amendment Order approving the ISPP and integrating the terms and conditions of NMFS 2013 BO, had already required the Licensee to install the fishway pursuant to Shawmut's current license.

On July 13, 2020, in response to agency comments, including those submitted by NMFS, the Commission issued a letter rejecting the Licensees' request to amend the Project licenses to include the provisions of the SPP. On that same day, the Commission also issued a second letter indicating that any fish passage measures, and requisite Section 7 ESA consultation, for the Shawmut Project would be considered under its relicensing.

1.3 2021 Interim Species Protection Plan, Species Protection Plan and Biological Assessments

On December 2, 2020, FERC issued a letter requiring a revised SPP and BA for the lower Kennebec River Projects to filed by May 31, 2022. NMFS replied on December 18, 2020 and issued a follow up letter on February 19, 2021 indicating that, in addition to the aforementioned discussion of the effects of fishway construction, any new SPP and BA would need to include:

- "information that considers the effects of the action through 2036,"
- "a robust project description that includes updates to the components of the ISPP that had not been completed as of December 31, 2019,"
- "measures to protect downstream migrating juveniles,"
- "measures to prevent or reduce the entrainment of kelts,"
- "measures to evaluate and/or reduce the impact of hydrosystem delayed mortality" and
- "a discrete adaptive management protocol to be implemented over the life of the project license"

Following a conference call among the Licensees, NMFS, and FERC on April 8, 2021, the Licensees filed a letter with the FERC on April 30, 2021 committing to filing a revised SPP and BA for the Lockwood, Hydro-Kennebec and Weston Projects.[4] During May 2021, four consultation meetings with NMFS were held, during which the parties discussed the above requests for information and recommended measures previously identified by NMFS. Subsequently, the Licensees filed on May 31, 2021 an SPP and draft BA for the Lockwood,

[4] Section 7 consultation for the Shawmut Project would proceed as part of the ongoing relicensing, for which the Final License Application had been submitted for the Project on January 31, 2020.

Hydro-Kennebec and Weston Projects, which responded to and addressed NMFS' requests outlined above which are discussed in greater detail below.

1.3.1 Temporal Scope

The May 31, 2021 BA "considers the effects of the long-term proposed SPP measures to be implemented for the term of the licenses (to 2036) along with near-term (2021-2024) fish passage construction activities that are planned for the previously authorized Weston and Lockwood upstream fish passage facilities and for the proposed downstream fish passage facilities at the Hydro-Kennebec and Weston Projects."

For the Shawmut Project, the temporal scope of the ISPP extends to the issuance of a new license. FERC is currently conducting Section 7 consultation on that relicensing with an anticipated 40-year license term.

1.3.2 Status of Previous ISPPs Measures

In response to NMFS' request to include details on the status of the 2012 and 2013 ISPPs measures, the May 31, 2021 SPP provides the following information:

- detailed project descriptions for the Lockwood, Hydro-Kennebec and Weston Projects (Section 3.0);
- detailed descriptions of the existing fish passage facilities for the Lockwood, Hydro-Kennebec and Weston Projects (Section 4.0);
- discussion of the "Existing Authorized Activities" specific to the components of the previous 2012 and 2013 ISPPs which had not been completed as of the filing of the May 31, 2021 SPP (Section 6.0). These actions primarily include the construction of upstream fish passage facilities at the Lockwood and Weston Projects.

Several sections of the SPP acknowledge the measures of the previous ISPP to be analyzed and implemented as part of the relicensing process for the Shawmut Project. Specifically, the SPP states "While not proposed as part of this SPP, measures for the Shawmut Project, based on preliminary Section 18 fish passage prescriptions and proposed measures incorporated into the FLA, are analyzed in the BA as reasonably certain to occur." And "[a]lthough the Shawmut Project is not part of this Species Protection Plan, the cumulative performance standard and Project specific performance standard targets considered and included in this SPP are based on the reasonable expectation that the Shawmut Project will be relicensed with the fish passage facilities and measures currently proposed or prescribed. These include installation of a new upstream fish lift, improvements to the downstream fish passage facilities proposed by the Licensee, and implementation of preliminary fish passage prescriptions issued by NMFS in August 2020 including a project-specific performance standard of 97% downstream and 96% upstream."

1.3.3 Smolt and Kelt Measures

The May 31, 2021 SPP provided a robust and targeted series of improvements to the existing downstream fish passage facilities, and the BA provided an analysis of these improvements. The SPP included the following measures to improvement downstream passage at the Projects:

- Lockwood Project - Continued operation of the existing fish guidance boom and downstream fish passage facility and intentional spill (up to 50% of inflows) in low flow years.

- Hydro-Kennebec Project - Construction of a new, larger downstream fish passage entrance with an Alden style weir and a bypass flow of 5% of station capacity in an upstream location to be determined in consultation with the agencies and relocation of the fish guidance boom to the new, enlarged downstream fish bypass.
- Weston Project - Continued operation of the existing fish guidance boom and downstream fishway; modification of the existing downstream bypass to dissipate discharge; automation of the left Tainter gate and revised operational prioritization of North Channel gates to avoid discharge onto bypass reach ledges.
- Shawmut Project - Implementation of the FERC Staff Recommended Measures and NMFS and USFWS mandatory Section 18 fish passage prescriptions at the Shawmut Project including continued operation of the downstream fish bypasses (Tainter and sluice gates), installation of a fish guidance boom within the forebay, and installation of 1 inch clear spaced trashracks or overlays at both powerhouses.

In addition to proposed improvements to downstream passage facilities at the lower Kennebec River Projects, the May 31, 2021 SPP included:

- a commitment to achieving a whole station survival cumulative standard of 88.5% (an individual project target of 97% for Lockwood, Hydro-Kennebec and Weston with an anticipated site -specific, individual performance standard of 97% at the Shawmut Project) (Section 8.0) as measured to the first receiver,
- implementation of an adaptive management plan to ensure attainment of the performance standard (Section 9.5) with the identification of potential issues and remediation that could be employed as discussed in further detail below, and
- implementation of additional measures to "protect Atlantic salmon habitat and advance the restoration effort on the Kennebec River" including "supporting agency or university studies of Atlantic salmon, assisting with egg, fry, or smolt stocking in the Sandy River (or other areas in the Kennebec watershed), supporting agency studies of estuarian mortality, and assisting with interim salmon trap and truck efforts from Lockwood, as needed" (Section 7.5).

1.3.4 Hydrosystem Delayed Mortality

During the May 2021 consultation meetings, NMFS noted in the previous SPP a lack of information regarding the effects of hydrosystem delayed mortality in the Kennebec River. As part of NMFS' and the Licensees' deliberations regarding a revised SPP, the parties discussed a request for an evaluation of baseline hydrosystem delayed mortality and identification of potential issues including migratory delay, sub-lethal injury and disorientation that may result from dam passage and contribute to hydrosystem delayed mortality, and how safe, timely and effective passage could address hydrosystem delayed mortality. In addition to improvements to downstream passage conditions at all four Projects, the Licensees committed to conducting a "study investigating dam passage injury on the potential to contribute to delayed mortality (study plan to be developed with agencies)." While NMFS has applied the Stich (2015) model to Penobscot River assets, the Stich model is based on smolt passage data collected prior to the removal of the Great Works and Veazie Dams and the implementation of 1-inch trashracks, improved downstream passage facilities, and spill measures at the lower Penobscot River Projects. In addition, only one year of data collection (2012) occurred on the Stillwater Branch, with a very small sample size of less than 20 fish, and the other year of data collection (2010) at the Milford Project occurred during a maintenance drawdown and closure of the downstream

fishway, resulting in all smolts passed via the powerhouse. As a result, the Stich model likely overestimates hydrosystem delayed mortality and a Kennebec River specific study is appropriate.

1.3.5 Adaptive Management Plan

Licensees added considerable detail and "specificity," as requested by NMFS, to the 2021 SPP. The Licensees are committed to achieving the proposed upstream and downstream performance standards, and will consult with NMFS and the fisheries agencies annually regarding fish passage effectiveness study results and determine what potential adaptive management measures could be employed to attain the performance standard. Table 9-2 of the SPP identifies the mechanisms by which passage issues could be identified, supplemental to the proposed upstream and downstream effectiveness studies, and includes no less than eight upstream and twelve downstream specific potential operational and structural modifications that could be made at the Projects to improve passage conditions. As stated in Section 9.5., "[w]hile it is not known today exactly which facility or measures might be most effective in improving passage performance, there are certain activities or measures that the Licensee and agencies could consider as potential 'tools' in improving passage performance." As further discussed in Section 6.1 and Section 6.3 of the BA, "[t]he proposed fish passage facilities and measures are expected to achieve the performance standards and timing goals. However, the proposed measures are laid out in the SPP within an adaptive management framework, with integration of management and research in order to provide feedback and the ability to adapt measures, as necessary, for further protection and enhancement of Atlantic salmon. Specifically, if, after all facilities and measures have been fully implemented, testing determines that the performance standard has not been achieved, the Licensee and agencies will evaluate the need for any additional potential operational and/or structural measures to be considered for the performance standards to be met or that that may be necessary to reduce adverse effects to the species."

1.3.6 Construction Effects

The Licensees discussed the effects of construction of the upstream fishways at the Lockwood and Weston Projects in Section 6.0 of the May 2021 BA. This discussion included an evaluation of the effects to listed species and critical habitats from construction of access roads and laydown areas, cofferdam installation and removal, bedrock removal, fishway structure fills and demobilization. To supplement the evaluation of construction effects, the Licensees sent NMFS copies of the US Army Corps of Engineers permit applications for the Lockwood and Weston Projects on September 16, 2021.

1.3.7 2021 SPP and ISPP Consultation

After the filing of the revised final SPP for the Lockwood, Hydro-Kennebec, and Weston Projects and the revised final ISPP for the Shawmut Project, on July 9, 2021, FERC requested NMFS engage in for formal consultation on the Shawmut relicensing. On July 26, 2021, FERC issued public notice of the Lower Kennebec SPP and requested comments by August 25, 2021 and requested NMFS engage in formal consultation on the Lower Kennebec SPP and Shawmut ISPP and proposed adopting the two Biological Assessments without modification. On August 10, 2021, NMFS filed a letter with FERC acknowledging request for Section 7 consultation and indicating a desire for a comprehensive process for the four Lower Kennebec Projects. On

August 19, 2021, FERC issued public notice of the Shawmut ISPP and requested comments by September 20, 2021.

On August 25, 2021, NMFS filed a motion to intervene in FERC's review of the Shawmut ISPP and Lower Kennebec SPP reiterating their position that a single consultation for the ISPP, SPP and relicensing would be the most efficient process.

On August 26, 2021, NMFS also filed an additional information request and clarification (AIR) and provided a discussion of the process for completing Section 7 consultation comprehensively for the four Lower Kennebec Projects. On September 16, 2021, the Licensees filed a response to NMFS' AIR, primarily clarifying certain inconsistencies with operational dates for fish passage measures at the Shawmut and Weston Projects between the SPP/ISPP and BAs and construction effects and implementation schedules inherent to the US Army Corps of Engineers' permit applications, which were provided as attachments to the filing. By letter to NMFS dated December 2, 2021, FERC stated "Commission staff has reviewed the additional information provided in the Licensees' September 16, 2021 filing, and believes the Licensees have adequately responded to the additional information you requested in your August 26, 2021 letter. Commission staff, therefore, incorporates the supplemental information into our previously filed BAs and requests formal consultation with your office, as required by section 7 of the ESA."

By letter to FERC dated December 8, 2021, NMFS informed FERC that it had received "[a]ll the information required to initiate formal consultation", and that the date that all of the information necessary to carry out the consultation was received (i.e., December 2, 2021) would serve as the commencement of the formal consultation process. NMFS further acknowledged that the ESA Section 7 regulations (50 CFR 402.14) require that "formal consultation be concluded within 90 calendar days of initiation, and the biological opinion be delivered to the action agency within 45 days after the conclusion of formal consultation (i.e., April 15, 2022), unless we mutually agree on an extension" and noted that "given the complexity of the pending consultation, we anticipate that an extension may be necessary."

NMFS requested an extension of the 90-day consultation process on March 2, 2022 for 60 days, to June 15, 2022, "(g)iven the extent of the analysis required to support development of our biological opinion for the five federal actions under consideration." NMFS noted that, because FERC's draft Environmental Impact Statement (EIS) was not expected until August 2022, NMFS did not anticipate that the extension for issuance of the BiOP would delay the FERC proceedings. FERC granted the extension on March 8, 2022.

On June 9, 2022, NMFS filed an additional request for an extension of time to complete Section 7 consultation to July 15, 2022. FERC's response letter dated June 22, 2022 granted the 30-day extension, acknowledging the Licensees' consent to the extension and that the extension would not substantially add to the application processing schedule.

On July 15, 2022, NMFS requested another 90-day extension to October 13, 2022 to complete the BiOP "to consider information and analysis related to downstream passage studies that was not included in the Biological Assessment, the Species Protection Plan, or the Environmental Assessment" that "emerged as a result of discussions between [NMFS] and the licensee related to addressing effects of the action on Atlantic salmon." FERC approved this extension by letter dated August 8, 2022.

2.0 NEW ISSUES AND INFORMATION

2.1 Latent Survival

On May 20, 2022, NMFS issued a draft/deliberative summary identifying a concern with the lack of analysis and measures to address delayed mortality in the SPP, ISPP and BAs. According to NMFS, there is additional downstream mortality for smolts passing the Weston, Shawmut, Hydro-Kennebec and Lockwood Projects that was not accounted for in the BAs. This mortality cited by NMFS occurred downstream of the first receiver at each Project, which is the receiver used by Normandeau Associates and the Licensees to estimate whole station survival in the 2012-2015 studies. NMFS indicated that the first receiver below each dam was not located far enough downstream to capture all of the direct mortality attributable to passage at the dams and, while survival through lower reaches below the first receiver to the next downstream dam was reported in the study reports, these estimates were not incorporated into the whole station survival estimates reported in the BAs.

While the Licensees acknowledge that mortality estimates from the first receiver below each dam to the next downstream dam were not reported or analyzed in the BAs, that analysis reported in the BAs regarding whole station survival merely summarized the 2012 – 2015 downstream smolt studies on the lower Kennebec River Projects that were conducted in full consultation with the agencies, including NMFS, and for which analysis of survival to the first receiver was consistently reported as whole station survival. Further, the locations of these first receivers were consistent with other smolt studies conducted in Maine[5].

Nevertheless, NMFS' May 2022 memo indicates concern with direct delayed mortality, that might occur later in temporal scope and further in geographic scope than that detected at the first receiver but which can still be attributable to project effects, including delayed effects of sub-lethal injury, disorientation, etc. A discussion of baseline whole station survival, including immediate and latent survival, is presented below.

2.2 Baseline Direct and Indirect/Delayed Survival Estimates

For each Project, the Licensees provided below a more detailed analysis of the following immediate and downstream effects based on the multiple years of smolt study[6]:

- "Initial" or "Immediate" - direct survival; as measured from 200 m upstream of the dam to the first receiver; by year and passage route and for the three-year weighted average and cumulative whole station
- "Latent" - delayed survival; as measured from the first receiver to the downstream receiver located 200 m upstream of the next downstream dam; by year and passage route and for the three-year weighted average and cumulative whole station
- Combined initial and latent survival; as estimated from 200 m upstream of the Project to 200 m upstream of the next downstream dam; by year and passage route and for the three-year weighted average and cumulative whole station

[5] NMFS has approved smolt studies throughout the state of Maine having the first receiver generally located approximately 1.5 mile downstream of the dam (see table below) to the extent practicable given access, coverage, and other considerations. This is consistent with studies conducted specifically to investigate concerns with "drift" (i.e. continued movement of fish on currents in spite of mortality), such as Havn, et. al., 2017, which concluded that "(o)verall, dead smolts drifted up to 2.4 km downstream" (i.e. 1.5 miles at most).

[6] In its May 19, 2022 memo, NMFS used the data tables provided only in the 2015 smolt report to estimate the baseline sublethal injury/indirect/direct delayed mortality.

- Route utilization; total three year pooled and by study year for each passage route (spill, fishway/bypass, and turbine/powerhouse).

2.2.1 Weston Project

For the Weston Project, the passage route that exhibits the lowest (immediate, latent and total) reach survival is spill; though only 23.6% of smolt used this route (3 year pooled). The combined immediate and latent survival for smolts passing downstream of Weston on spill is 84.5%. The existing fish bypass also experiences lower overall (i.e., direct and latent) survival among the three main Weston passage routes; exhibiting 88.9% survival for the full reach. The downstream bypass is used at the highest rate among all passage routes at 42.8% (3 year pooled). Powerhouse survival is quite high; with both immediate and latent in excess of 98% and a total reach survival of 97% for this route. This route receives moderate utilization at 30.6% of approaching smolts passing via the powerhouse (3 year pooled).

There are some operational considerations that lend context to these percentages. BWPH acquired the Weston Project in March 2013 and has refined operations at the Weston Project, and the Kennebec River in general, over the course of the subsequent study years. For example, in 2013, higher spring flows in the lower river resulted from less available storage at the Harris and Wyman Projects (owned and operated by [affiliates of] BWPH) over the course of the winter and spring of 2013. As a result, spill occurred through conveyances (top gates and stanchions) that are not regularly utilized under contemporary operations. In addition, in order to test the minimum survival achieved through the fish passage at Weston (i.e. the log sluice), flow set points of 6%, 8%, and 10% intervals were tested throughout the 2013 and 2014 study years. In practice, however, the log sluice is seasonally set to a minimum flow of 6% to 8% but is also prioritized as the primary conveyance for flows in excess of station capacity and so is routinely operated at flows much higher than the minimum set points for the downstream fish passage season.

Table 1. Weston Pooled Atlantic Salmon Smolt Passage Route Utilization

WESTON					
			Route		
Project	**Study Year**	**Parameter**	**Spill**	**Bypass**	**Turbine**
Weston	2013	Route Utilization (%)	28.3%	35.4%	31.3%
		Route Utilization (n)	28	35	31
	2014	Route Utilization (%)	42.0%	34.0%	20.0%
		Route Utilization (n)	42	34	20
	2015	Route Utilization (%)	0.0%	59.2%	40.8%
		Route Utilization (n)	0	58	40
	3-Year Pooled	**Route Utilization (%)**	**23.6%**	**42.8%**	**30.6%**
		Route Utilization (n)	**70**	**127**	**91**

Table 2. Weston Immediate and Latent Atlantic Salmon Smolt Passage Survival Analysis

WESTON					
Route	**Year**	**n**	**200 m Approach to DS #1 (Initial)**	**DS#1 to Shawmut (Latent)**	**Total Reach by Route**
	2013	28	100.0%	86.9%	86.9%
	2014	42	87.5%	94.4%	82.6%
	2015	0	-	-	-
Spill	**3-Yr. Weighted Average Survival**	**70**	**92.5%**	**91.4%**	**84.5%**
	2013	35	96.2%	92.5%	89.0%
	2014	34	86.7%	96.6%	83.8%
	2015	58	97.7%	94.1%	91.9%
Bypass	**3-Yr. Weighted Average Survival**	**127**	**94.3%**	**94.3%**	**88.9%**
	2013	31	98.5%	95.0%	93.6%
	2014	20	96.6%	100.0%	96.6%
	2015	40	100.0%	100.0%	100.0%
Turbine	**3-Yr. Weighted Average Survival**	**91**	**98.7%**	**98.3%**	**97.0%**

2.2.2 Shawmut Project

Based on the analysis below, turbine passage presents the lowest survival (both immediate and delayed) for smolt – approximately 84.5% total for smolt passing the Francis units (Units 1 – 6) and 88.4% for smolts passing the propeller units (Units 7 and 8) – and moderate utilization of this route (32.7% combined). It is important to note, however, that the units with the lowest survival have only 11.6% utilization. While the fish bypass has good immediate survival, it appears to have reduced latent survival, which would suggest that smolt may be sustaining sub-lethal injury when passing via the existing downstream bypass (i.e. forebay Tainter gate). Total spill survival is approximately 87.7% (i.e., immediate and latent survival combined) but is the lowest utilized route overall at 26.6% (3 year pooled).

As with the Weston Project, the Shawmut Project operations experienced a transition during the three years of smolt study. In addition to generally lower spring runoff flows as a result of leveraging the storage capabilities of the Wyman and Harris Projects over the winter and spring months, BWPH utilizes the rubber dams at the Shawmut Project spillway for pond control far less often than occurred immediately following their installation in 2010.

Table 3. Shawmut Pooled Atlantic Salmon Smolt Passage Route Utilization

SHAWMUT						
			Route			
Project	Study Year	Parameter	Spill	Bypass	Francis	Propeller
Shawmut	2013	Route Utilization (%)	14.4%	37.9%	20.6%	22.2%
		Route Utilization (n)	35	92	50	54
	2014	Route Utilization (%)	48.4%	19.3%	10.2%	19.7%
		Route Utilization (n)	118	47	25	48
	2015	Route Utilization (%)	15.3%	58.5%	3.1%	20.5%
		Route Utilization (n)	35	134	7	47
	3-Year Pooled	**Route Utilization (%)**	**26.6%**	**38.7%**	**11.6%**	**21.1%**
		Route Utilization (n)	**188**	**273**	**82**	**149**

Table 4. Shawmut Immediate and Latent Atlantic Salmon Smolt Passage Survival Analysis

SHAWMUT					
Route	Year	n	200 m Approach to DS #1 (Initial)	DS#1 to Hydro Kennebec (Latent)	Total Reach by Route
Spill	2013	13	100.0%	100.0%	100.0%
	2014	80	97.9%	87.0%	85.2%
	2015	29	87.2%	100.0%	87.2%
	3-Yr. Weighted Average Survival	**122**	**95.9%**	**91.4%**	**87.7%**
Bypass	2013	65	98.7%	90.3%	89.1%
	2014	25	100.0%	68.0%	68.0%
	2015	74	95.4%	94.2%	89.9%
	3-Yr. Weighted Average Survival	**164**	**97.5%**	**89.0%**	**86.8%**
Francis	2013	29	99.9%	89.3%	89.2%
	2014	17	83.7%	92.9%	77.8%
	2015	5	84.3%	87.7%	73.9%
	3-Yr. Weighted Average Survival	**51**	**93.6%**	**90.3%**	**84.5%**
Propeller	2013	41	100.0%	95.0%	95.0%
	2014	32	95.3%	96.7%	92.2%
	2015	33	83.0%	85.4%	70.9%
	3-Yr. Weighted Average Survival	**106**	**94.7%**	**93.4%**	**88.4%**

2.2.3 Hydro-Kennebec Project

At the Hydro-Kennebec Project, a relatively high percentage of smolt pass on spill (about 30.6% of smolt passed on spill [3 year pooled]) and the spillway has very high spill survival (both immediate and delayed) of almost 99% each, resulting in a total reach survival of 97.5% for smolts passed on spill. Unit 2, the passage route exhibiting the lowest rate of immediate and latent survival is also the most infrequently utilized. Although Unit 2 has a combined immediate and delayed survival of 69.4%, only 5.3% of smolt actually utilized this route. Unit 1 (89.7%) has relatively high combined immediate and latent survival, comparatively speaking. The much higher utilization of Unit 1 (22.0%) compared with Unit 2 suggests possible entrainment as a result of the boom gap and lack of screening of the intake immediately adjacent to the downstream bypass opening. Unit 2 entrainment would seem to be much more indicative of sounding behavior (i.e. swimming under the boom). Passage via the downstream bypass resulted in an overall survival of 94.5% and the downstream bypass is the most frequently utilized route at almost 40% of the 3-year pooled smolts passing the Project.

While a change in water management would affect how often the Hydro-Kennebec Project experiences spill conditions in the spring, during the downstream smolt passage season, operations at the Hydro-Kennebec Project have generally been consistent over the three study years (2012 – 2014) and as are currently conducted.

Table 5. Hydro Kennebec Pooled Atlantic Salmon Smolt Passage Route Utilization

HYDRO KENNEBEC						
			Route			
Project	**Study Year**	**Parameter**	**Spill**	**Bypass**	**Unit 1**	**Unit 2**
Hydro Kennebec	2012	Route Utilization (%)	0.0%	68.5%	21.3%	10.1%
		Route Utilization (n)	0	61	19	9
	2013	Route Utilization (%)	18.5%	54.7%	18.8%	5.5%
		Route Utilization (n)	67	198	68	20
	2014	Route Utilization (%)	49.6%	17.6%	25.3%	4.0%
		Route Utilization (n)	186	66	95	15
	3-Year Pooled	**Route Utilization (%)**	30.6%	39.3%	22.0%	5.3%
		Route Utilization (n)	**253**	**325**	**182**	**44**

Table 6. Hydro Kennebec Immediate and Latent Atlantic Salmon Smolt Passage Survival Analysis

HYDRO KENNEBEC					
Route	**Year**	**n**	**200 m Approach to DS #1 (Initial)**	**DS#1 to Lockwood (Latent)**	**Total Reach by Route**
	2012	0	-	-	-
	2013	10	90.9%	100.0%	90.9%
	2014	67	100.0%	98.5%	98.5%
Spill	**3-Yr. Weighted Average Survival**	**77**	**98.8%**	**98.7%**	**97.5%**
	2012	61	96.7%	91.2%	88.2%
	2013	87	100.0%	98.6%	98.6%
	2014	22	100.0%	95.7%	95.7%
Bypass	**3-Yr. Weighted Average Survival**	**170**	**98.8%**	**95.6%**	**94.5%**
	2012	19	84.2%	93.8%	79.0%
	2013	31	89.2%	95.9%	85.5%
	2014	48	99.0%	98.0%	97.0%
Unit 1	**3-Yr. Weighted Average Survival**	**98**	**93.0%**	**96.5%**	**89.7%**
	2012	9	77.8%	71.4%	55.5%
	2013	5	55.6%	100.0%	55.6%
	2014	9	90.9%	100.0%	90.9%
Unit 2	**3-Yr. Weighted Average Survival**	**23**	**78.1%**	**88.8%**	**69.4%**

2.2.4 Lockwood Project

The Lockwood Project exhibits very high immediate and latent survival for Atlantic salmon smolts among all available passage routes; a combined 95.7% survival. Although the Francis units exhibit lower total survival (85.5%) and the Kaplan units are the next lowest (88.1%), there is very little overall use of these routes (less than 15%). Lower entrainment rates would seem to indicate that the fish boom is effective in diverting smolts away from the units and to the existing downstream bypass, which is also highly effective.

Contemporary operations likely result in more available storage in the upper watershed and less frequent spill events. In addition, the Licensee periodically opened the sluice gate within the forebay during smolt testing to provide an additional route of passage. During the latter part of the 2015 smolt study, Brookfield operated the forebay sluice gate during the final two release events of the study. A total of four radio-tagged smolts that had sounded under the guidance boom located the sluice and successfully passed downstream with 100% of those individuals determined to have passed the downstream detection locations.

Table 7. Lockwood Pooled Atlantic Salmon Smolt Passage Route Utilization

LOCKWOOD						
Project	Study Year	Parameter	Route			
			Spill	Bypass	Francis	Kaplan
Lockwood	2013	Route Utilization (%)	45.3%	36.2%	9.4%	7.8%
		Route Utilization (n)	198	158	41	34
	2014	Route Utilization (%)	77.5%	11.4%	1.7%	6.2%
		Route Utilization (n)	361	53	8	29
	2015	Route Utilization (%)	42.4%	29.8%	10.3%	9.9%
		Route Utilization (n)	128	90	31	30
	3-Year Pooled	**Route Utilization (%)**	57.0%	25.0%	6.6%	7.7%
		Route Utilization (n)	**687**	**301**	**80**	**93**

Table 8. Lockwood Immediate and Latent Atlantic Salmon Smolt Passage Survival Analysis

LOCKWOOD					
Route	Year	n	200 m Approach to DS #1 (Initial)	DS#1 to DS#2 (Latent)	Total Reach by Route
Spill	2013	36	100.0%	98.9%	98.9%
	2014	81	100.0%	100.0%	100.0%
	2015	46	100.0%	91.4%	91.4%
	3-Yr. Weighted Average Survival	**163**	**100.0%**	**97.3%**	**97.3%**
Bypass	2013	33	100.0%	98.6%	98.6%
	2014	10	100.0%	100.0%	100.0%
	2015	29	94.4%	100.0%	94.4%
	3-Yr. Weighted Average Survival	**72**	**97.7%**	**99.4%**	**97.1%**
Francis	2013	16	98.7%	88.2%	87.1%
	2014	2	50.8%	100.0%	50.8%
	2015	7	90.2%	100.0%	90.2%
	3-Yr. Weighted Average Survival	**25**	**92.5%**	**92.4%**	**85.5%**
Kaplan	2013	15	91.2%	86.1%	78.5%
	2014	7	87.2%	100.0%	87.2%
	2015	13	100.0%	100.0%	100.0%
	3-Yr. Weighted Average Survival	**35**	**93.7%**	**94.0%**	**88.1%**

3.0 SUPPLEMENT TO THE SPP/ISPP AND FLA PROPOSED ACTIONS

3.1 SPP and ISPP Current and Additional/Revised Measures Summary

To better address latent survival, the Licensees are proposing to implement the proposed measures outlined in the May 31, 2021 SPP and ISPP as well as the following adaptive management measures on an accelerated schedule:

Table 9. Summary of Current and Additional SPP Measures

Project	Current SPP Measures	Additional/Revised Measures
Weston	• Maintain the existing fish boom • Make fishway improvements including resurfacing the flume, sealing gaps, and adding a velocity dissipation slope • Automate the left Tainter gate on the North Channel and reprioritize spill flows to direct spill to deeper locations and avoiding ledge outcroppings to the extent possible • Construct and operate a new upstream fish passage facility with an AWS having a 304 cfs capacity and a uniform acceleration weir • Operate the upstream and downstream fish passage facilities in accordance with the Fish Passage Operations and Maintenance Plan	• Install a 2-inch trashrack overlay for the protection of kelt • Modify the center stanchion top gates to allow flow conveyance with minimum headpond effects • Conduct a balloon tag study to confirm the appropriate gate prioritization to maximize survival on spill
Hydro-Kennebec	• Install a new, relocated downstream entrance with a uniform acceleration weir • Remove internal weirs and smooth downstream flume • Relocate the fish boom, connect directly to relocated entrance and eliminate gap • Operate the new upstream fish passage facility with an AWS/flume having a 200 - 400 cfs capacity • Operate the upstream and downstream fish passage facilities in accordance with the Fish Passage Operations and Maintenance Plan	• Install a 2-inch trashrack overlay for the protection of kelt • Implement nighttime shutdowns from 8 pm to 8 am for 4 weeks (but with the possibility of extending the shutdowns to 5 weeks) during the smolt migration period, generally targeted for the last week of April to the last week of May, with the start date to be determined in consultation with NMFS and the Maine Department of Marine Resources (MDMR) based on smolt trapping information or migration model • Conduct a survey of the bypass reach ledges for perched pools

Project	Current SPP Measures	Additional/Revised Measures
		and modify the ledges as necessary to provide opportunities for egress
Lockwood	• Maintain the existing fish boom • Construct and operate a new upstream fish passage facility with an AWS having a 220 cfs capacity • Operate the upstream and downstream fish passage facilities in accordance with the Fish Passage Operations and Maintenance Plan	• Install a 2-inch trashrack overlay at Unit 7 for the protection of kelt • Implement nighttime shutdowns from 8 pm to 8 am for 4 weeks (but with the possibility of extending the shutdowns to 5 weeks) during the smolt migration period, generally targeted for the last week of April to the last week of May, with the start date to be determined in consultation with NMFS and MDMR based on smolt trapping information or migration model • Install a uniform acceleration weir at both the downstream fishway and the forebay surface sluice
General	—	• Stock smolts upstream of the Weston Project sufficient to produce returns of 200 adults for the purpose of conducting upstream adult passage and downstream kelt passage studies. • Develop a mitigation plan, in consultation with NMFS, to fund the implementation of habitat improvement projects at $300,000 annually (as adjusted with attainment of the performance standards) in the Kennebec River basin or greater Merrymeeting Bay Salmon Habitat Recovery Unit (SHRU) as necessary. • Modify the language of the adaptive management plan to better clarify commitments for achievement of the upstream performance standard.

As noted, these adaptive management measures are already contemplated in Section 9.5 and Section 7.5 of the SPP. Specifically, Section 9.5 discusses Adaptive Management Plan (AMP) which outlines potential adaptive management measures including "relocated entrance," "Alden-style weir," "gate modifications," "unit shut-down," "dedicated spill" and "tighter rack spacing" Section 7.5 of the SPP indicates the Licensees commitment to continue "collective efforts to protect Atlantic salmon habitat and advance the restoration effort on the Kennebec River" in consultation and collaboration with the agencies.

3.2 Shawmut Relicensing Current and Additional/Revised Measures Summary

The Shawmut Project Licensee proposed a suite of protection, mitigation, and enhancement measures to be implemented at the Shawmut Project for upstream and downstream fish passage in the January 31, 2020 FLA submitted to FERC. These measures were accepted or modified by the FERC in its July 1, 2021 Draft DEA which also includes draft license conditions recommended by FERC Staff (Appendix E of the DEA) as well as the Section 18 mandatory fish passage prescriptions issued by the Department of Commerce (NMFS) on August 28, 2020 and the Department of the Interior (US Fish and Wildlife Service or USFWS) on August 27, 2020. The Shawmut Project Licensee is also proposing supplemental measures to be considered as part of the relicensing proposed action for the Shawmut Project.

Table 10. Summary of Current and Revised Shawmut Relicensing Measures

Project	Current Relicensing Measures	Additional/Revised Measures
Shawmut	• Install 1-inch overlays at the current intakes of the Unit 1 – 6 powerhouse • Install a fish boom at the current intakes of the Unit 7 & 8 powerhouse • Construct and operate a new upstream fish passage facility with an AWS having a 340 cfs capacity and a uniform acceleration weir • Construct a new downstream fish passage flume downstream of the forebay Tainter gate • Operate the upstream and downstream fish passage facilities in accordance with the Fish Passage Operations and Maintenance Plan	• Install a fish boom outside of the gate structure • Install a 2-inch trashrack overlay at Unit 7 & 8 for the protection of kelt • Resurface and smooth the spillway concrete below the hingeboards and the log sluice • Install a uniform acceleration weir at the Tainter gate • Reprioritize spill flows to direct spill to avoid ledge outcroppings to the extent possible • Implement nighttime shutdowns of Units 7 & 8 from 8 pm to 8 am for 4 weeks (but with the possibility of extending the shutdowns to 5 weeks) during the smolt migration period, generally targeted for the last week of April to the last week of May, with the start date to be determined in consultation with NMFS and MDMR based on smolt trapping information or migration model

3.3 Proposed SPP/ISPP and Additional/Revised Measures Discussion

3.3.1 Weston Project

Downstream passage at the Weston Project is provided though a sluice gate and associated concrete flume located on the South Channel dam near the Unit 4 intake. The sluice is 20.8-ft high and 70-ft long and discharges into a deep plunge pool. The gate is capable of discharging up to 2,500 cfs at full pond (approximately 45% of station unit flow) and is operated for fish passage to provide a minimum of 8% of station unit flow from April 1st to June 15th (24 hours / 7 days a week) for smolts and a minimum of 6% from November 1 to December 31st (24 hours/7 days week) for kelt. The gate is also operated at a minimum of 6% of station flow from September 15 to October 31 (8 hours per night/7 days week) for American eel.

In 2011, the Weston Project Licensee enhanced the downstream passage facility by installing a 300-ft long floating guidance boom in front of the intakes with suspended 10-ft deep sections of 5/16-inch metal punch plate screens leading to the sluice gate. On the North Channel side of the Weston Project, there are two Tainter gates, an inflatable rubber dam section with two Obermeyers, and stanchion gate sections with top gates and stanchion. Additional passage opportunities are provided at the South Channel side of the dam via spillage through top gates and stanchions in times of high flows.

Downstream passage operations proposed under the supplemented SPP are as follows:

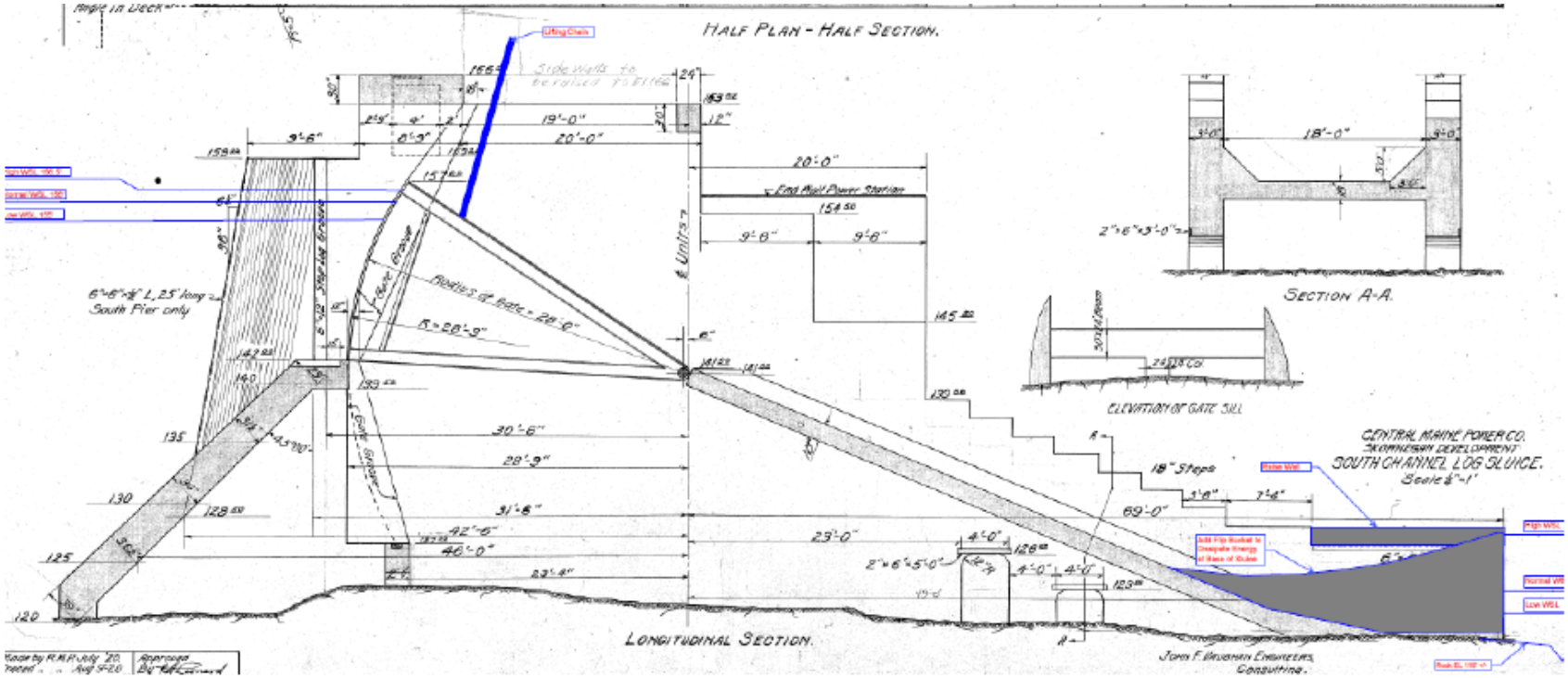
> From April 1 to June 15, the Weston Project bypass log sluice is operated at a minimum of 8% of station flow (approximately 3.5 ft at normal full pond elevation of 156 ft) (up to a maximum capacity of 2,500 cfs or 45% of station flow) 24 hours/day, 7 days/week, as river and icing conditions allow, targeting the downstream passage of Atlantic salmon smolts (with the minimum target flow based on three years of downstream effectiveness testing). The log sluice is priority operated to pass flows in excess of station capacity up to its maximum capacity of 2,500 cfs.
>
> From June 16 to September 14, following construction and commissioning of the upstream fish passage facility or in the event that MDMR trucking operations result in stocking alosine above the Weston Project, the bypass log sluice will be operated at a minimum of 6% of station flow (approximately 3.0 ft at normal full pond elevation of 156 ft) (up to a maximum capacity of 2,500 cfs or 45% of station flow) 24 hours/day, 7 days/week, as river conditions allow. In the interim, the log sluice bypass does not have a minimum setting specifically for downstream fish passage but passes water in excess of station capacity to its maximum capacity of 2,500 cfs.
>
> From September 15 to October 31, the bypass log sluice is operated at a minimum of 6% of station flow (approximately 3.0 ft at normal full pond elevation of 156 ft) for 8 hours per night, 7 days/week, for downstream passage targeting American eel. The log sluice is operated to pass flows in excess of station capacity up to its maximum capacity of 2,500 cfs (a maximum capacity of 45% of station flow).
>
> From November 1 to December 31, the bypass log sluice is operated at a minimum of 6% of station flow (approximately 3.0 ft at normal full pond elevation of 156 ft) (up to a maximum capacity of 2,500 cfs or 45% of station flow) 24 hours/day, 7 days/week, targeting the downstream passage of Atlantic salmon kelt, as river and icing conditions

allow. The log sluice is operated to pass flows in excess of station capacity up to its maximum capacity of 2,500 cfs.

The May 2021 lower Kennebec SPP includes a proposal to modify the downstream log sluice bypass to improve safe passage conditions and reduce potential injury by smoothing the flume concrete and modifying the bottom to dissipate discharge (see figure below), which proposal is retained.

As an additional measure under the AMP, Section 9.5 of the May 31, 2021 SPP, BWPH proposes to investigate the need for and nature of “gate modifications” at the log sluice to ensure there are no gaps that could lead to injury or mortality.

Figure 1. Preliminary conceptual design of downstream Weston Project improvements



The SPP proposed measures to improve passage survival via spill include modifications to the left Tainter gate, such that it is able to be remotely operated by the National System Control Center (NSCC) and prioritized to be first opened and last closed (see figure below). Under the SPP proposed conditions, the left Tainter gate would be operated first (up to max capacity of 5,000 cfs) and discharge to the deep pool in the tailrace immediately below followed by the right Obermeyer (up to a max capacity of 4,450 cfs).

However, subsequent analysis of gate operations during the 2013 and 2015 smolt studies were inconclusive regarding the benefit of prioritized Tainter gate operation. As such, the Weston Project Licensee is proposing a preliminary North Channel gate prioritization, coupled with a balloon tag study to identify routes of spill passage that are most favorable to immediate and latent survival. Current operations have the log sluice as prioritized up to a maximum capacity of 2,500 cfs for inflows in excess of station capacity.

As a preliminary measure, the Weston Project Licensee will prioritize the right Obermeyer (up to a max capacity of 4,450 cfs), which would be operated as first on and last off followed by the left Obermeyer (up to a max capacity of 4,450 cfs). Flows from these gates would discharge to the same deep pool as the Tainter gates. At flows above the capacity of the powerhouse, the top half of the center stanchions would be tripped followed by the left Tainter gate (up to a max capacity of 5,000 cfs) and the right Tainter gate (up to a maximum capacity of 5,000 cfs). The North Channel bypass reach ledges would be expected to be partially if not fully inundated at the cumulative flows in excess of 23,000 cfs such that effects from opening the right Tainter gate would be significantly reduced compared with existing operations. The remaining top gates of the north channel and south channel will be operated last and, based on flow duration curves developed for April 15 to June 15 (2016-2021), would be operated less than 10% of the time during the fish passage season.

Table 11. Weston Project Spill Flow Preliminary Prioritization Sequence and Flow Conditions (April 15 to June 15)

Conveyance	Incremental Flow (cfs)	Cumulative Flow (cfs)	Exceedance (%)
Log Sluice (Min Setting)	440	440	100%
Upstream Passage AWS	304	744	100%
Turbines (Operating Capacity)	5,500	6,244	53%
Log Sluice (Max Setting)	2,060	8,304	44%
Right Obermeyer	4,450	12,754	31%
Left Obermeyer	4,450	17,204	23%
Center Stanchion Top Gates (top half of Top Gates)	715	17,919	21%
Left Tainter	5,000	22,919	14%
Right Tainter	5,000	27,919	8%
North Channel Stanchion Top Gates	5,005	32,924	5%
South Channel Stanchion Top Gates	4,620	37,544	2%

Figure 2. Weston Project North Channel Bypass Reach Flow Conveyance Structures

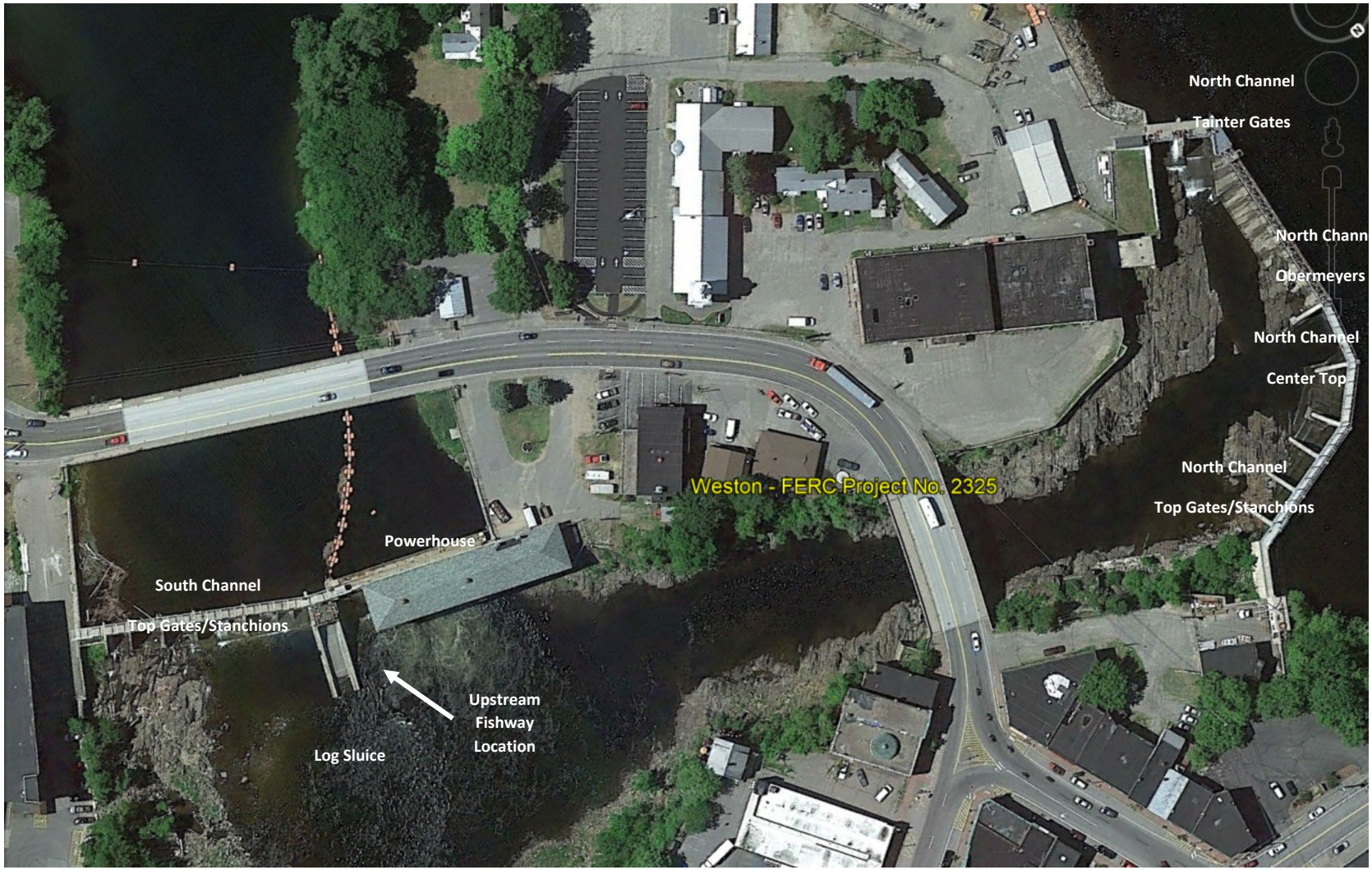
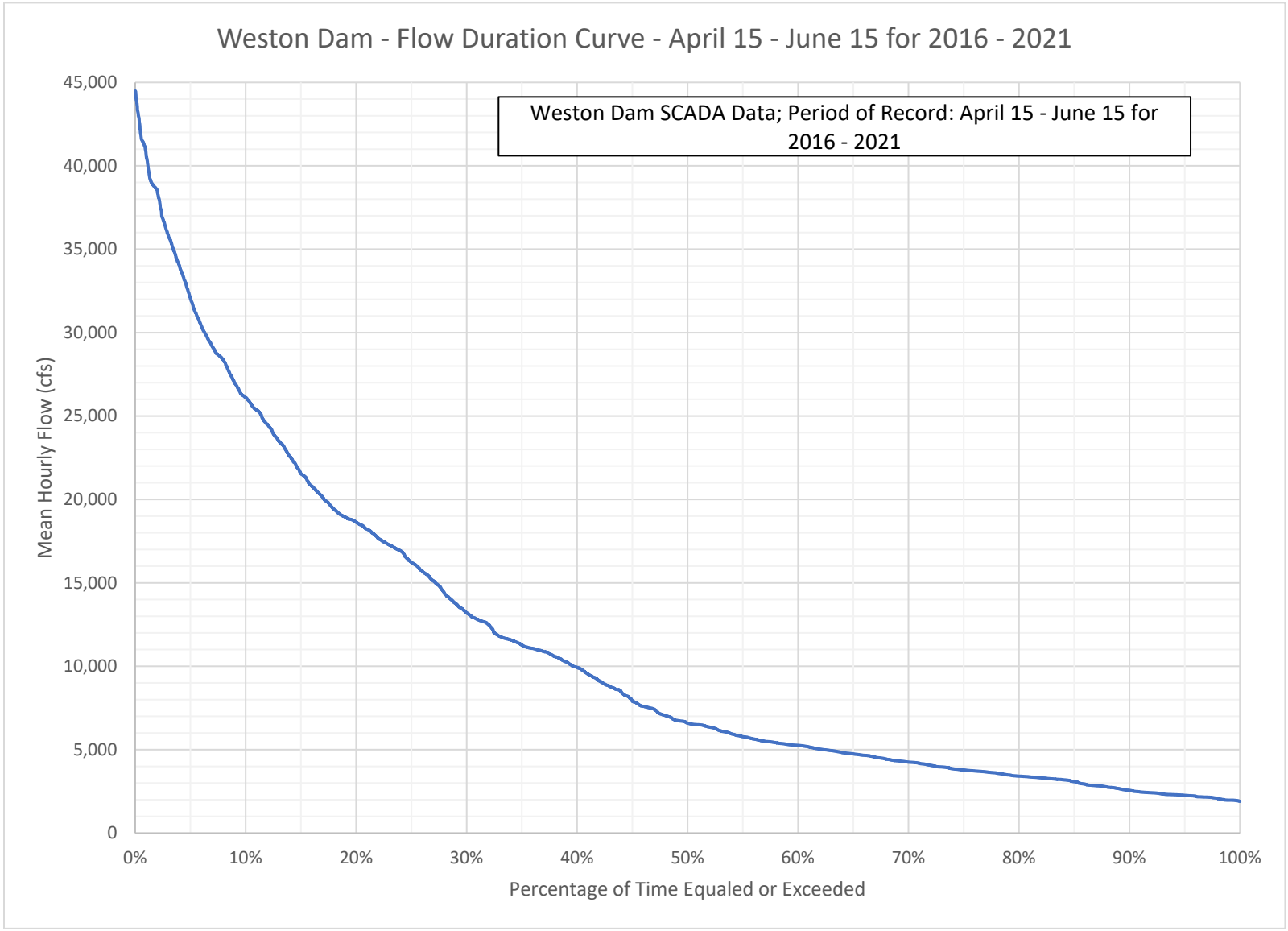


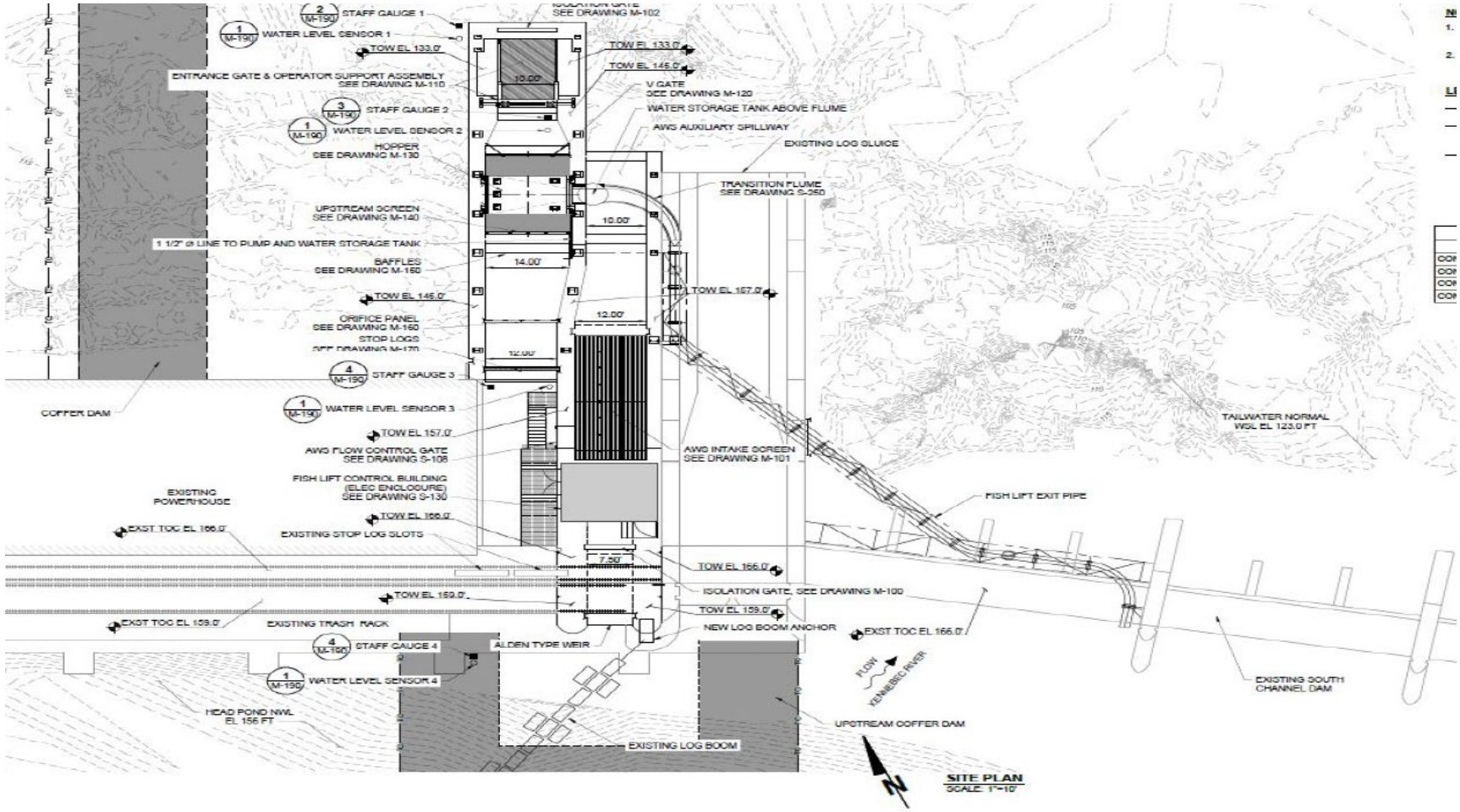
Figure 3. Weston Project Flow Duration Curve (April 15 – June 15 for 2016 – 2021)



In addition, the upstream fish passage facility at Weston, discussed in the lower Kennebec SPP, would provide an additional route for downstream passage, having an auxiliary water system (AWS) with a capacity of up to 304 cfs, approximately 5.5% of station capacity, and a uniform acceleration weir. This would be located at the inboard of the existing fish boom and immediately adjacent to the existing log sluice, operated as the dedicated downstream fish passage conveyance as well as prioritized to pass inflows in excess of station capacity. The location of the AWS between the boom and log sluice would be expected to result in additional downstream passage opportunity, particularly for any fish that sound under the existing fish boom.

Among the AMP measures outlined in Section 9.5 of the SPP to enhance downstream passage survival are “tighter spaced racks.” While the operational measures above are focused primarily on smolt passage, the Weston Project Licensee will install 2-inch clear spaced overlays at the Weston Project, as an accelerated step of the AMP, for the protection of kelt.

Figure 4. Weston Project Upstream Fish Passage Facility Design



3.3.2 Shawmut Project

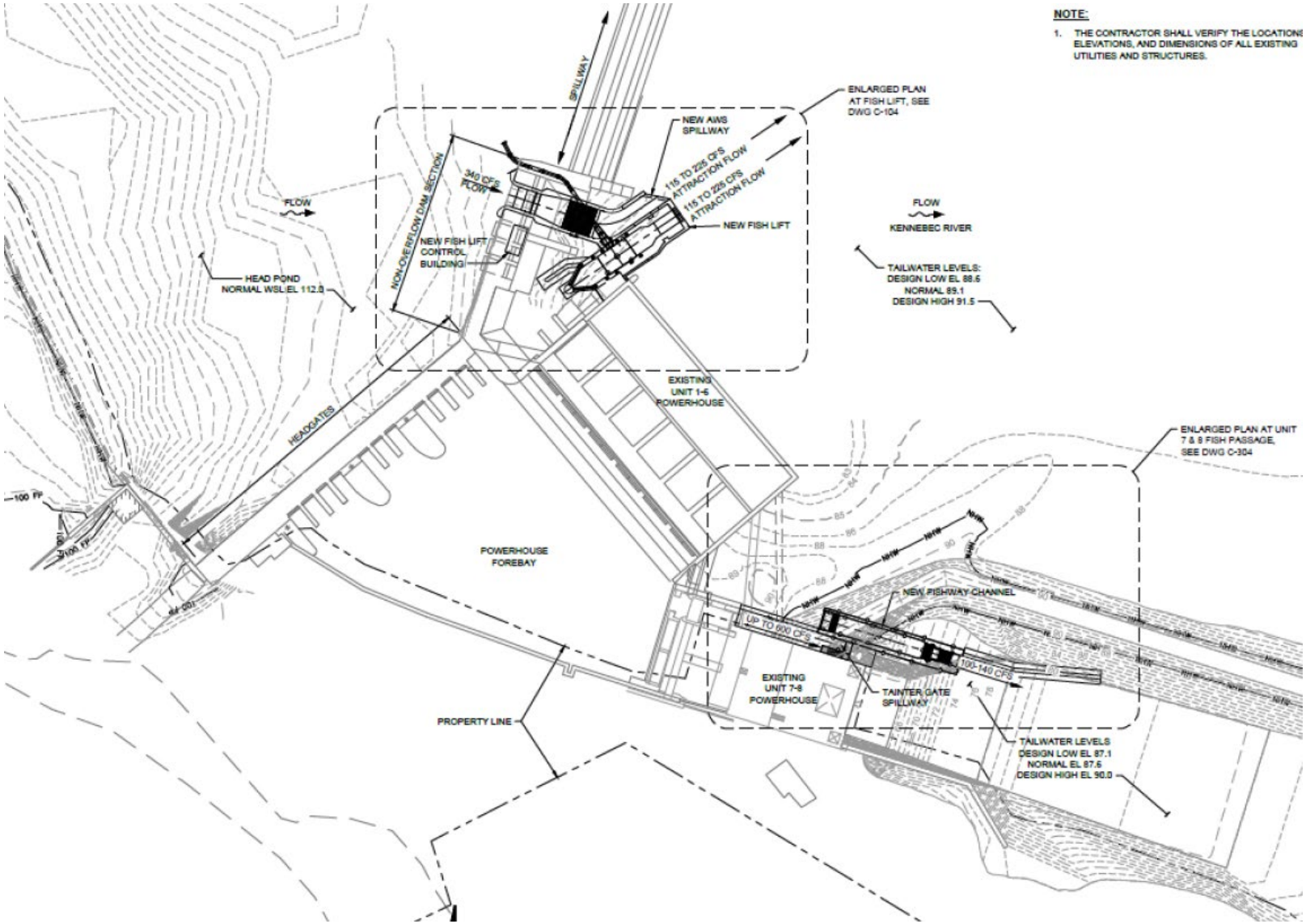
Downstream passage operations proposed under the FLA are as follows:

> From April 1 to June 15, the Tainter gate is open to 6% of station flow (the total capacity of the gate is 600 cfs) 24 hours/day, 7 days/week, as river and ice conditions allow, targeting the downstream passage of Atlantic salmon smolt.
>
> For downstream eel passage, the deep drain gate next to Unit 7 is open to 425 cfs (approximately 6% of total station capacity), as river conditions allow, for 8 hours per night beginning 1 hour after sunset, 7 days/week. Units 7 and 8 are simultaneously shut down during this period. The opening of the deep gate and simultaneous unit shutdowns are implemented over a 6-week period between September 15 and November 15 but are typically implemented September 15 to October 31.
>
> From November 1 to December 31, the Tainter gate is open to 6% of station flow (the total capacity of the gate is 600 cfs) 24 hours/day, 7 days/week, as river and ice conditions allow, targeting the downstream passage of Atlantic salmon kelt.
>
> From April 1 to December 31, the surface sluice is open, as river and ice conditions allow, providing 30 to 35 cfs for downstream passage continually throughout the downstream passage season.

Measures for downstream fish passage will be implemented as part of the FERC Staff Recommended Measures with Mandatory Section 18 Fish Passage Prescriptions at the Shawmut Project. NMFS's and USFWS's Preliminary Section 18 prescription requires the installation of a fish guidance boom at the Unit 7 and 8 powerhouse providing guidance to the existing downstream fishway, coupled with 1-inch seasonal trashrack overlays at the Unit 1 – 6 and Unit 7 and 8 powerhouses depending on whether such overlays could be installed and still maintain low approach velocities. The FERC Staff Recommended Measures with Mandatory Section 18 Fish Passage Prescriptions also includes the construction of the upstream fishway, having an AWS with a capacity of 340 cfs and a uniform acceleration weir, as well as the Unit 7 & 8 upstream fishway and forebay Tainter gate downstream fish passage flume.

While the current prescription calls for a fish guidance boom to be installed within the forebay, BWPH will accelerate the implementation of the AMP, Section 9.5 of the SPP, and install a second boom outside of the forebay in front of the existing gate structure to reduce the number of fish entering the forebay and to provide guidance to the uniform acceleration weir entrance of the upstream fishway AWS. This would reduce the entrance of downstream migrants into the forebay and provide a dedicated downstream fish passage route. The Shawmut fish lift AWS, shown in Figure 5 below, is designed for a capacity of 340 cfs, or 5% of station flow and has a uniform acceleration weir.

Figure 5. Shawmut Project Upstream Fish Passage Facility Design



The percentage of fish that sound under the boom located outside of the gate structure will be further protected from entrainment by the second forebay boom and the overlays at the Unit 1 – 6 powerhouse, and improvements to the downstream forebay fishway, all of which are within the current Section 18 prescription, as well as station shutdowns proposed to be implemented as an additional adaptive management measure.

Regarding overlays, the NMFS Preliminary Section 18 prescription requires:

> Installation of 1-inch clear space trashracks or overlays at existing trashracks for the Francis units and the propeller units. Velocities in front of the trashracks must be sufficiently low to reduce the risk of impingement during periods critical for downstream fish passage.
>
> - If: 1) it is demonstrated that the approach velocities in front of the racks at the propeller units are excessive; and 2) after consultation with NMFS, it is therefore determined that the installation of the required 1-inch trashracks are infeasible, the Licensee will instead install 1.5-inch trashracks and extend the depth of the required guidance boom to 20 feet.
> - If: 1) it is demonstrated that the approach velocities in front of the racks at the Francis units are excessive; and 2) after consultation with NMFS, it is therefore determined that the installation of the required trashracks are infeasible, the Licensee will instead implement one or more of the adaptive measures listed below, in consultation with NMFS.

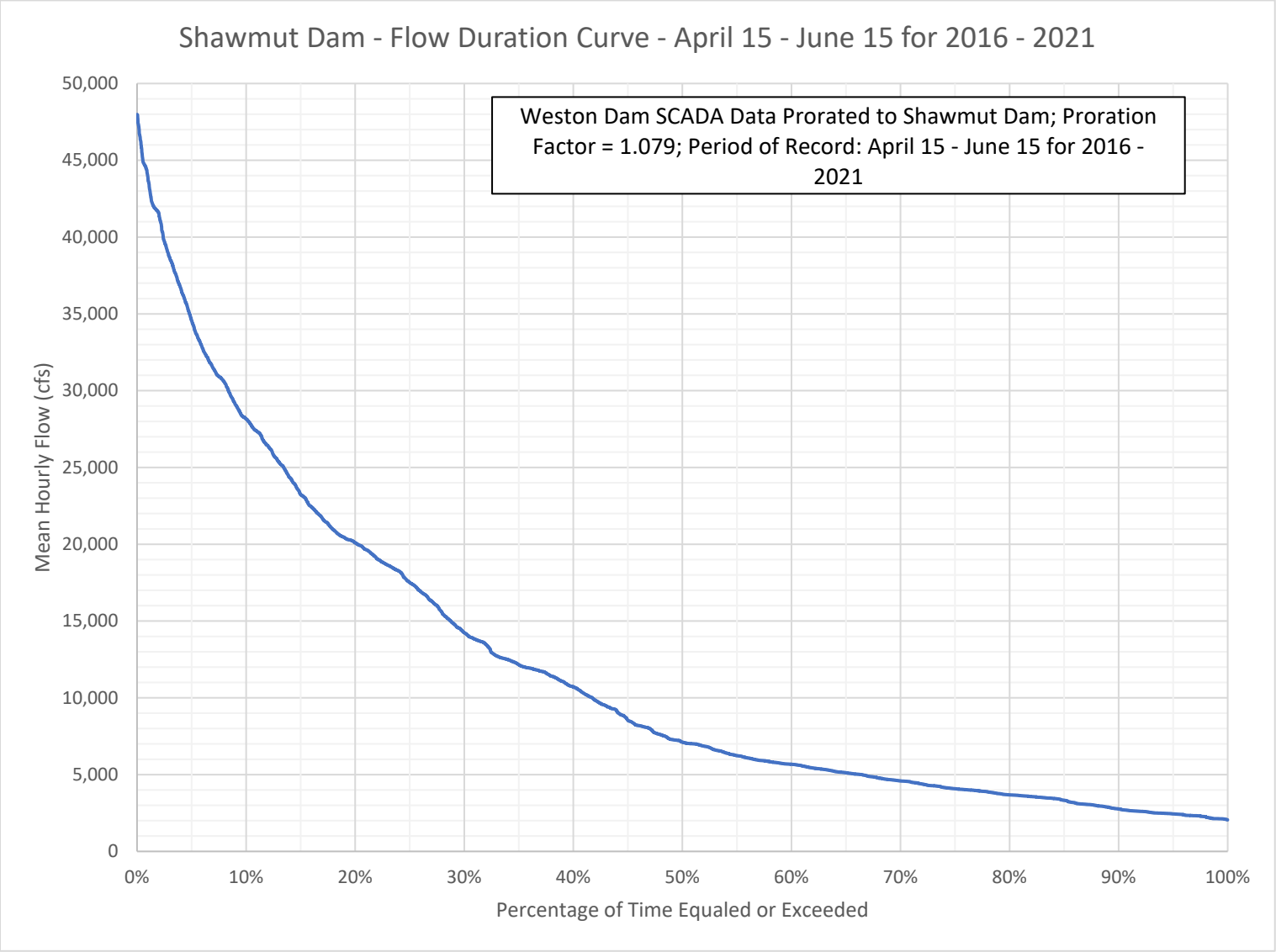
In response to concerns with high approach velocities at the Unit 7 & 8 powerhouse and because the Unit 7 & 8 powerhouse will be screened by two fish booms (one inside and one outside of the gates structure), the Shawmut Project Licensee is proposing to implement nighttime shutdowns at the Unit 7 & 8 powerhouse for the protection of smolt under the AMP. Specifically, the Shawmut Project Licensee will implement nighttime shutdowns of the Unit 7 & 8 Powerhouse from 8 pm to 8 am for 4 weeks on a start date to be determined in consultation with NMFS and based either on MDMR Sandy River smolt trapping or on a Kennebec River specific smolt migration model (generally targeted for the last week of April based on 97% of the historical smolt migration) within 1 year of SPP approval. Should smolt trapping indicate that in excess of 50 smolts/day are continuing outmigration beyond the end of the 4-week shutdown period, the Shawmut Project Licensee will continue nighttime shutdowns from 8 pm to 8 am for an extended period not to exceed 7 additional nights of shutdowns. For the protection of kelt, the Shawmut Project Licensee will install 2-inch overlays at the Unit 7 & 8 Powerhouse, consistent with, but in slight variation to, the existing Section 18 Prescription.

Regarding spill flow at the Shawmut Project, the Shawmut Project Licensee implement the current prioritization procedure.

Table 12. Shawmut Project Spill Flow Prioritization Sequence and Flow Conditions (April 15 to June 15)

Conveyance	Incremental Flow (cfs)	Cumulative Flow (cfs)	Exceedance (%)
Tainter Gate	600	600	100%
Sluice Gate	35	635	100%
Upstream Passage AWS	340	975	100%
Turbines (Operating Capacity)	6,755	7,730	48%
Log Sluice	1,840	9,570	43%
Hinge Boards (Min Setting)	7,000	16,570	26%
Rubber Dam #1	7,000	23,570	15%
Rubber Dam #2	7,000	30,570	8%
Rubber Dam #3	7,000	37,570	4%
Hinge Boards (Max Setting)	3,050	40,620	2%

Figure 6. Shawmut Project Flow Duration Curves (April 15 – June 15 for 2016 – 2021)

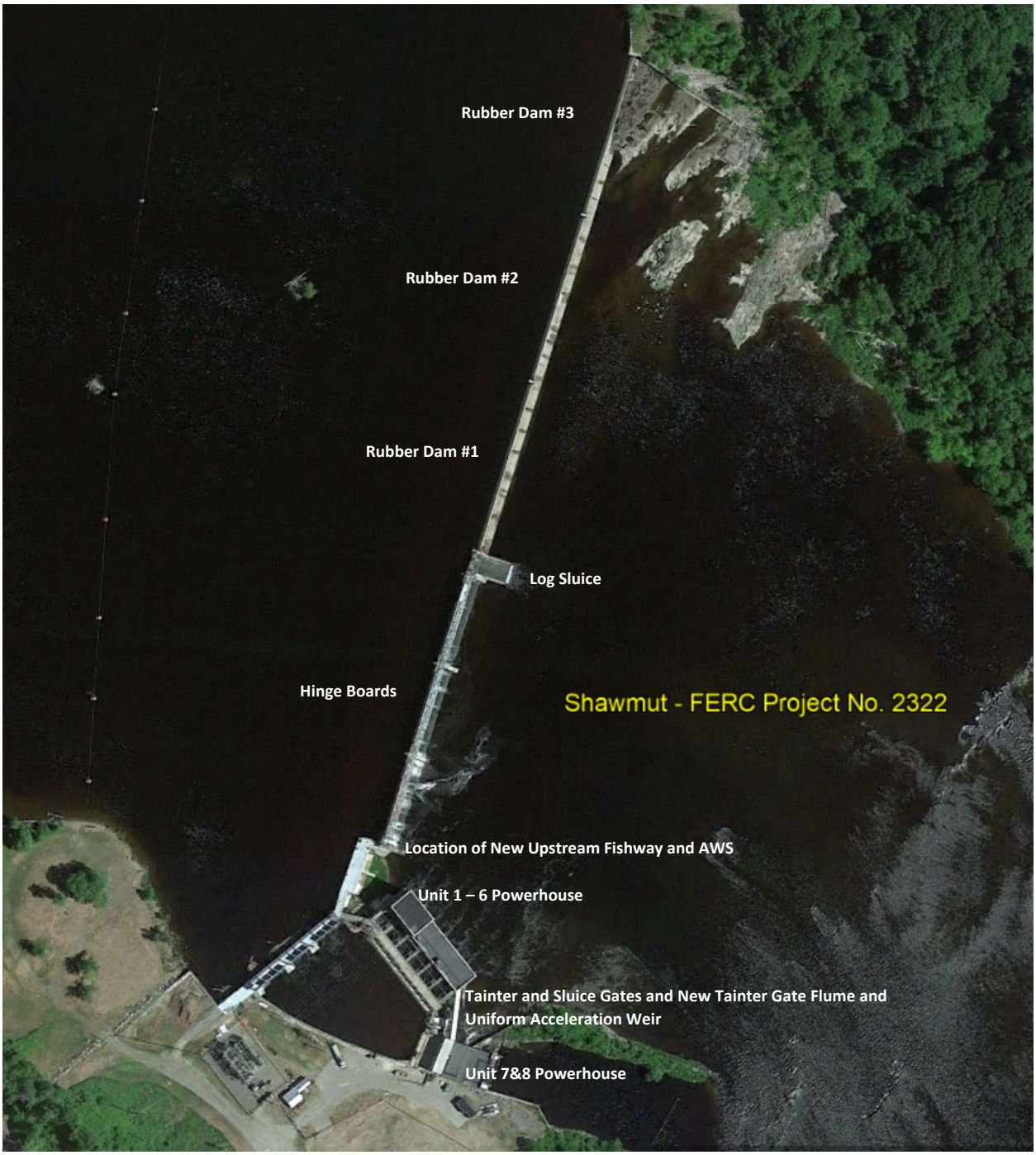


As the relocated boom and nighttime shutdowns will direct more fish to pass via the spillway and as passage on spill has resulted in lower than desired survival, BWPH will resurface and smooth the majority of the approximately 375-foot-long hingeboard spillway section of the dam, as an accelerated AMP measure for project modifications to improve downstream passage. Likewise, as passage via the log sluice has also resulted in lower survival, BWPH will smooth the log sluice as an accelerated AMP measure.

Under the FERC Staff Recommended Measures with Mandatory Conditions, a new downstream fish passage flume will be constructed as part of the Unit 7 & 8 upstream fishway. As shown in Figure 5, an excavated channel will be constructed immediately downstream of the forebay Tainter gate. The existing angled wall along the north end of the island separating the Project powerhouses onto which the Tainter gate discharge is directed will be demolished. A new concrete flume wall will be constructed and the flume excavated to bedrock to provide a linear, uniform channel for downstream fish passage via the Tainter gate. To further enhance downstream passage via the Tainter gate, BWPH, as an adaptive management measure, will install a uniform acceleration weir at the entrance to the downstream passage flume in front of the Tainter gate.

Finally, the performance standard for the Shawmut Project is an individual standard of 97%. In other words, there is some inherent flexibility at the other lower Kennebec Projects with respect to the per Project target of 97%, allowing for variation at the individual Projects so long as the cumulative standard of 88.5% is attained. This is not the case for the Shawmut Project, where the Section 18 prescription calls for a site-specific performance standard, rather than a target.

Figure 7. Shawmut Project Flow Conveyance Routes



3.3.3 Hydro-Kennebec Project

The downstream passage facility at the Hydro-Kennebec Project consists of a floating angled guidance boom that guides fish to a deep-gated surface bypass slot that directs fish into a plunge pool and then to the tailwater area. In 2006, the floating guidance boom was installed in the Hydro-Kennebec forebay to guide downstream migrating fish to a 4-ft wide by 8-ft deep

gated surface weir capable of passing 320 cfs (4% of station flow). The surface weir discharges into a plunge pool which flows out to the tailrace. The boom has steel perforated plates (5/16-inch diameter holes) configured as a series of interlocking panels 10 ft deep designed to be left in place year-round.

Downstream passage operations proposed under the SPP are as follows:

> From April 1 to December 31, the downstream bypass gate is open to 4% of station flow 24 hours/day, 7 days/week, as river and ice conditions allow, targeting the downstream passage of Atlantic salmon smolt and kelt, as well as alosine and eel.

As outlined in the lower Kennebec SPP, the proposals for improving fish passage conditions at the Hydro-Kennebec Project include major modifications to the existing downstream fish passage facilities, including relocating the entrance further upstream and away from the Project intakes, increasing the fishway entrance to accommodate 5% of station flow, installing a uniform acceleration weir, and relocating the fish boom to connect directly with the dam adjacent to the entrance of the downstream fishway (there is currently an approximately 5 ft wide gap between the end of the fish boom and the existing entrance to the downstream fishway) (see figure below).

As an additional measure under the AMP, the Hydro-Kennebec Project Licensee proposes to implement unit shutdowns on an accelerated schedule. Specifically, the Hydro-Kennebec Licensee will implement nighttime station shutdowns from 8 pm to 8 am for 4 weeks on a start date to be determined in consultation with NMFS and based either on MDMR Sandy River smolt trapping or on a Kennebec River specific smolt migration model (generally targeted for the last week of April based on 97% of the historical smolt migration) within 1 year of SPP approval. Should smolt trapping indicate that in excess of 50 smolts/day are continuing outmigration beyond the end of the 4-week shutdown period, the Hydro-Kennebec Licensee will continue nighttime shutdowns from 8 pm to 8 am for an extended period not to exceed 7 additional days of shutdowns.

Among the AMP measures outlined in Section 9.5 of the SPP to enhance downstream passage survival are “tighter spaced racks.” While the operational measures above are focused primarily on smolt passage, the Hydro-Kennebec Project Licensee will install 2-inch clear spaced overlays at the Hydro-Kennebec Project, as an accelerated step of the AMP, for the protection of kelt.

The existing upstream fishway also provides an opportunity for downstream passage supplemental to the proposed improvements. The AWS and hopper conveyance can be set between 250 cfs and 400 cfs, representing between 3% to 5% of station capacity.

Figure 8. Hydro-Kennebec Project Downstream Fish Passage Facility Improvements

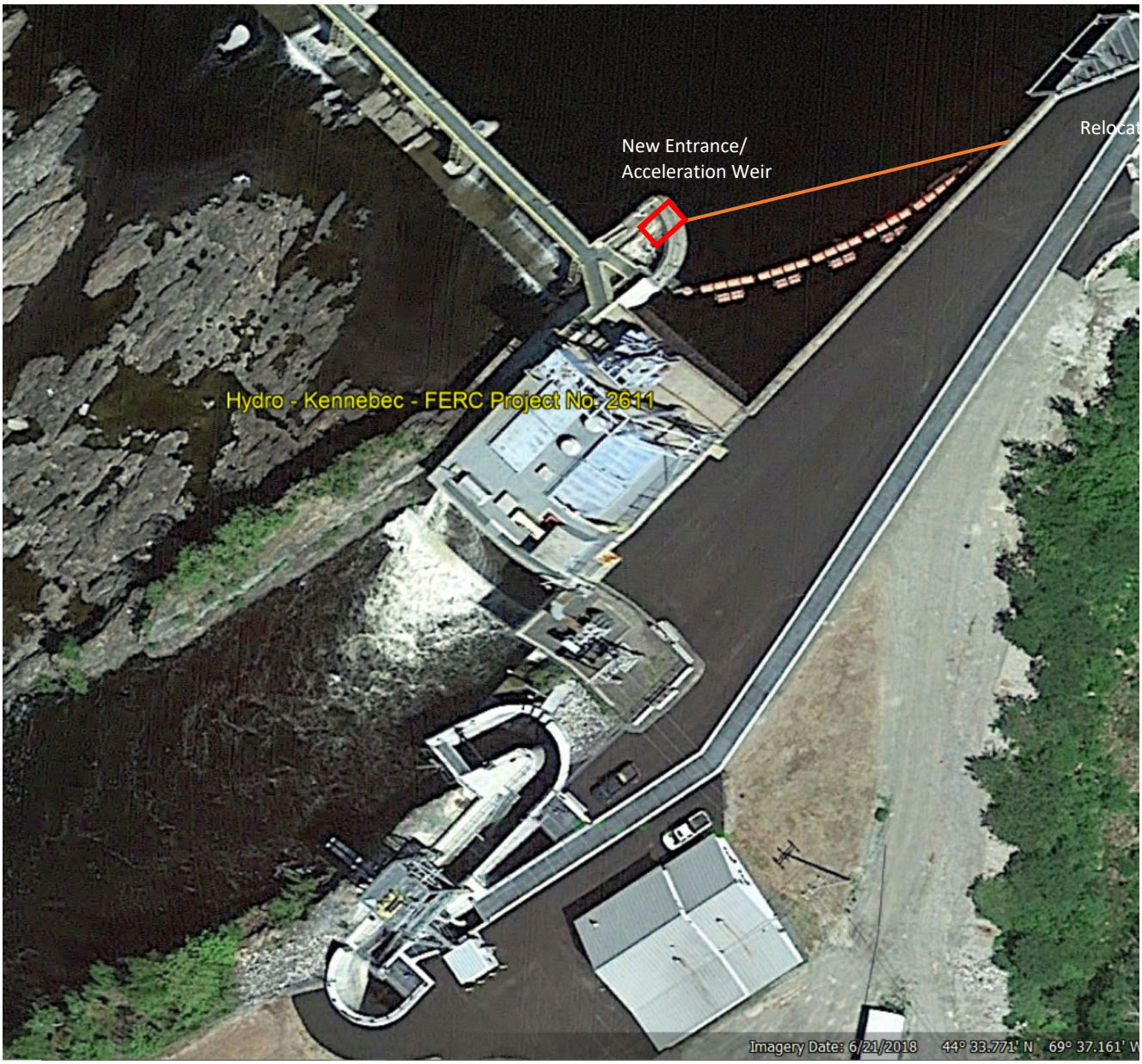
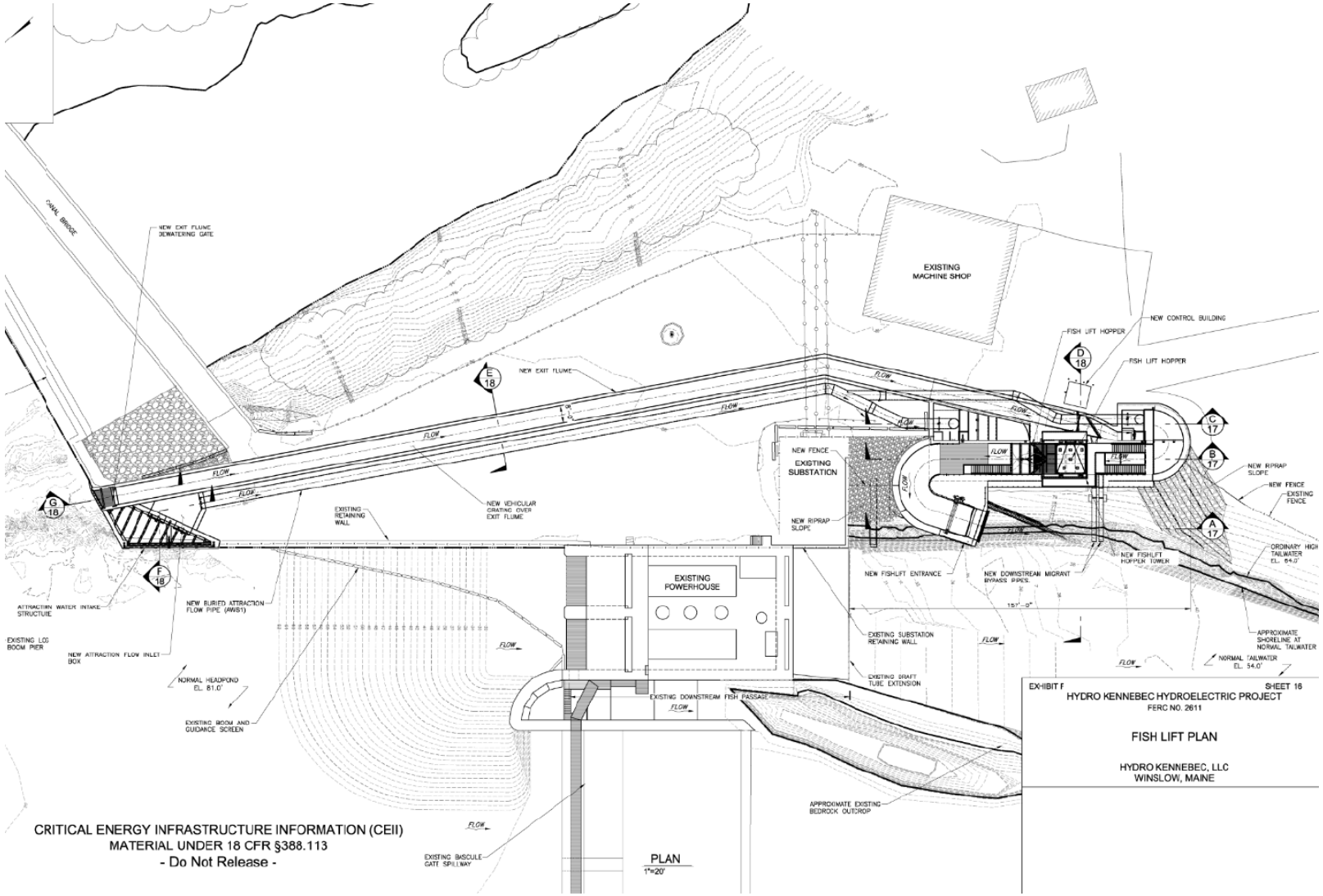


Figure 9. Hydro-Kennebec Project Upstream Fish Passage Facility Design



3.3.4 Lockwood Project

Downstream fish passage is provided at the Lockwood Project via a 7-ft wide by 9-ft deep mechanical over-flow gate (fish sluice) located on the outboard side of the power canal just upstream of the Unit 1 trash rack and discharges directly into the river. Maximum flow through the gate is 6% of station capacity or 340 cfs. In 2009, a floating guidance boom was installed in the forebay, angled across the forebay from the west wall of the canal downstream to the fish sluice to enhance use of the downstream passage. The current design consists of a 300-ft long boom with two 10-ft long plastic cylindrical "Tuff Boom" brand floats per section. From the upstream end, the first 250 ft of boom has 4-ft deep steel punch plate panels (5/16" diameter holes). An additional six ft of Dynema curtain is attached to the bottom of each panel. The lower 50 ft section of boom has 10 ft deep steel punch plate panels with no Dynema curtain attached at the bottom. All gaps between the panels are covered by rubber flanges. A surface sluice having a capacity of 60 cfs and located between the Unit 7 and the Unit 1 – 6 powerhouses is operated to provide an additional opportunity for egress for fish that sound under the boom.

Downstream passage operations proposed under the SPP are as follows:

> From April 1 to December 31, the downstream bypass gate is open to 6% of station flow 24 hours/day, 7 days/week, as river and ice conditions allow, which includes the downstream passage seasons for Atlantic salmon smolt and kelt.
>
> From April 1 to December 31, as river and ice conditions allow, the forebay surface sluice is open to approximately 60 cfs to provide additional opportunities for passage for fish, including Atlantic salmon smolt and kelt, that may sound under the boom and as supplemental flow for attraction water to the upstream fishway.
>
> For downstream eel passage, the forebay deep gate is open to 300 cfs (approximately 5% of total station capacity), as river conditions allow, for 8 hours per night, 7 days/week. The opening of the deep gate is implemented over a 6-week period between September 15 and November 15 but is typically implemented September 15 to October 31.

In addition to the fish sluice gate and associated guidance boom, downstream migrating fish may also use the three submerged orifices (3-ft long by 8-in high), cut into the flashboards along the spillway. The orifices are designed to provide flow through the ledges and pools in the bypass reach and pass approximately 25 cfs of the required 50 cfs minimum flow at normal full pond, the remainder of which is provided by flashboard leakage. The orifices provide additional downstream passage routes along the spillway even when the project is not spilling over the top of the flashboards.

The Lockwood Project exhibits very high immediate and latent survival for Atlantic salmon smolts among all available passage routes. Lower entrainment rates indicate that the fish boom is effective in diverting smolt away from the units and to the existing downstream bypass, which is also highly effective. While the lower Kennebec SPP proposes that, in times of low flow, less than 70% of the long-term average (LTA) flow in the month of May, spill will be enhanced, as an adaptive management measure under the AMP, the Lockwood Project Licensee instead proposes to implement unit shutdowns on an accelerated schedule. Specifically, the Lockwood Project Licensee will implement nighttime station shutdowns from 8 pm to 8 am for 4 weeks on a start date to be determined in consultation with NMFS and based either on MDMR Sandy

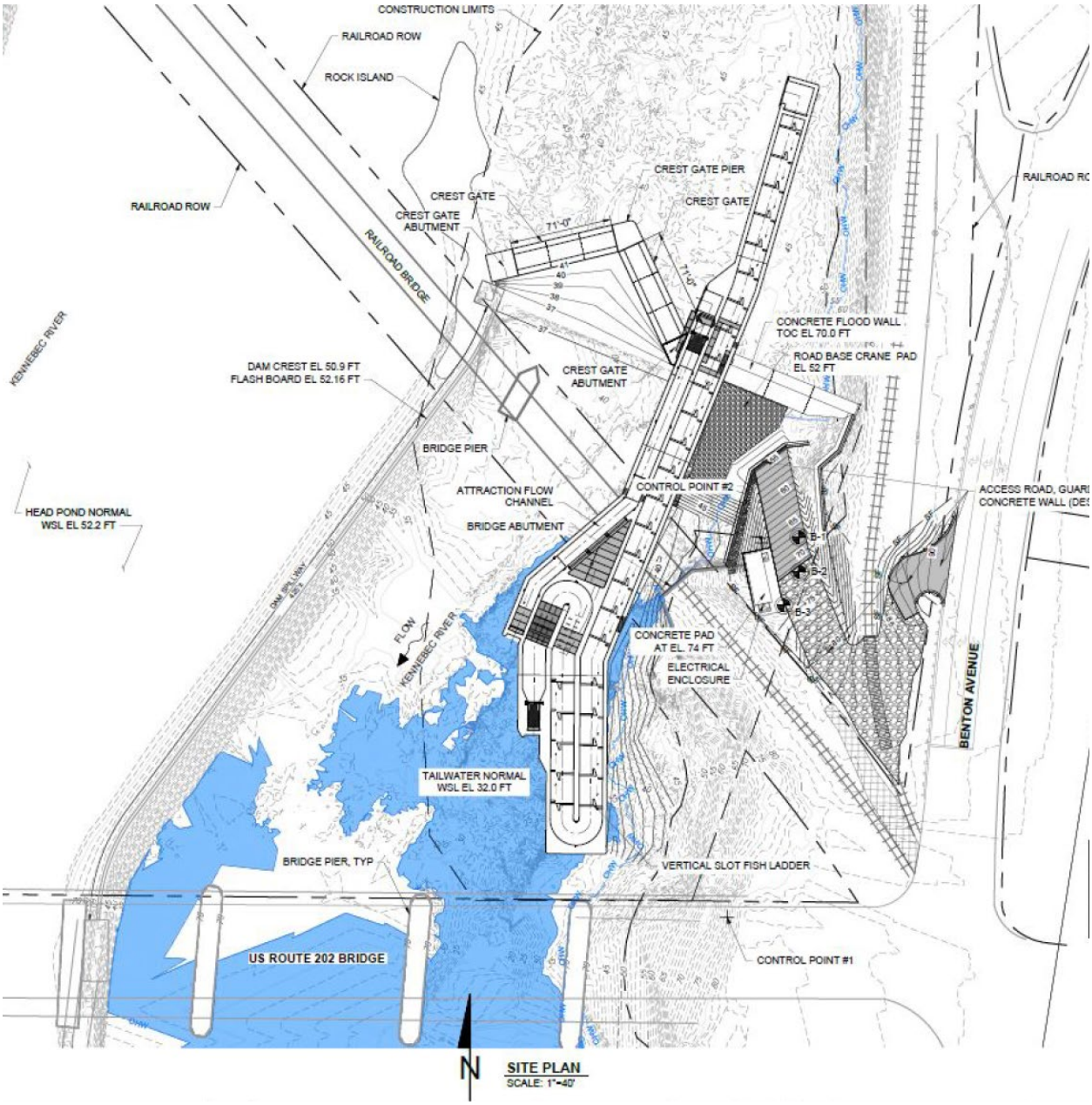
River smolt trapping or on a Kennebec River specific smolt migration model (generally targeted for the last week of April based on 97% of the historical smolt migration) within 1 year of SPP approval. Should smolt trapping indicate that in excess of 50 smolts/day are continuing outmigration beyond the end of the 4-week shutdown period, the Lockwood Project Licensee will continue nighttime shutdowns from 8 pm to 8 am for an extended period not to exceed 7 additional days of shutdowns.

In addition, the AMP includes the installation of “Alden style weir(s)” as a potential modification to increase bypass utilization. The Lockwood Project Licensee will accelerate this measure of the AMP by installing a uniform acceleration weir at the existing downstream fishway as well as at the surface sluice within the forebay, which is operated as a supplemental downstream fish passage route.

Among the AMP measures outlined in Section 9.5 of the SPP to enhance downstream passage survival are “tighter spaced racks.” While the operational measures above are focused primarily on smolt passage, the Lockwood Project Licensee will install 2-inch clear spaced overlays at the Lockwood Project, as an accelerated step of the AMP, for the protection of kelt.

Further, a new fishway will be constructed in the bypass reach of the Lockwood Project, with an attraction water system and conveyance flow of up to approximately 220 cfs; approximately 4% of station capacity. The AWS will provide an additional route of downstream passage for fish that are attracted to the spillway section of the dam, particularly in times of no spill.

Figure 10. Lockwood Project Upstream Fish Passage Facility Design



3.4 Analysis of SPP/ISPP/FLA and Additional/Revised Measures on Immediate and Latent Survival

3.4.1 Weston Project

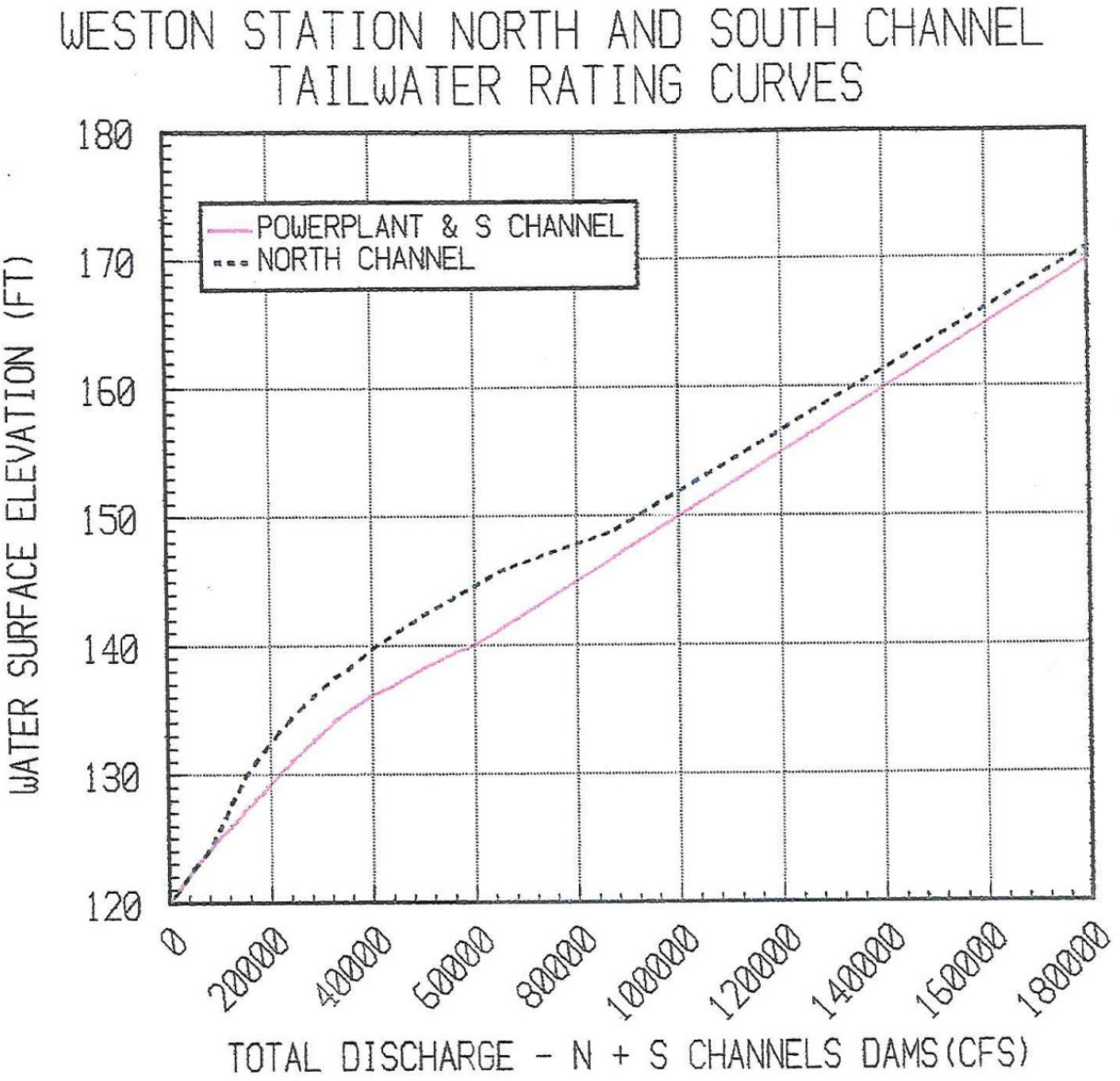
For the Weston Project, the passage route that exhibits the lowest (immediate, latent and total) reach survival is spill; though only 23.6% of smolt used this route (3 year pooled). The combined immediate and latent survival for smolt passing on spill is 84.5%. Under current operations, the right Tainter is generally operated first as the left Tainter cannot be operated remotely by the NSCC. Should operations staff be onsite for manual operation of the left Tainter, the flows are

distributed evenly among the two gates. Otherwise, the left Obermeyer may be operated remotely to pass inflows in excess of the right Tainter. These operations are followed by the left Tainter, if not already operational, and the right Obermeyer. As shown in the photo below, under current operations, the flow from the left Tainter is discharged fully onto exposed ledges, as is the majority of flow from the right Obermeyer. With this in mind, it makes sense that immediate survival may be impacted by blunt force trauma and latent survival may be impacted by scrapes, descaling, and disorientation for smolt passing via routes that discharge onto the exposed ledges.

Figure 11. Weston North Channel Spillway Bypass Reach

The proposed measures outlined in the lower Kennebec SPP include modifications to the left Tainter gate, such that it is able to be remotely operated by the NSCC and gate prioritization to convey flow to the areas below the spillway having deep pools as opposed to exposed ledges. At inflows resulting in spill above the capacity of the Obermeyers (17,900 cfs combined), the North Channel bypass reach ledges would be expected to be partially if not fully inundated such that effects from opening the Tainter gates would be significantly reduced compared with existing operations. To that end, the normal tailwater elevation of the Weston North Channel spillway bypass reach is 122.5 ft. At Project flows of approximately 18,000 cfs, the tailwater in the North Channel increases to approximately 131 ft.

Figure 12. Weston Project Tailwater Rating Curves



Weston has a similar bypass reach to the Lockwood Project, comprised primarily of bedrock in various stages of inundation under the range annual flow conditions. Given that a balloon tag study will be conducted to specifically identify the passage routes on spill that are most favorable to both immediate and latent survival and a gate prioritization protocol developed based on the results of the study, we would anticipate that immediate survival at the Weston Project could be improved to levels experienced by smolt passing on spill at the Lockwood, as high as 100% immediate survival, with the implementation of a proposed gate prioritization to target high survival routes for passage on spill. Likewise, we would expect spill enhancements to improve latent survival to at least 97.3%, the current weighted average latent survival for smolts passing on spill at Lockwood during the 2013-2015 studies. Latent spill survival at

Weston could be improved to as high as 100%, the highest single-year latent survival rate estimated at the Lockwood Project in 2014.

The existing fish bypass experiences lower overall (direct and latent) survival than the three main routes (fish bypass, powerhouse, spill), a total of 88.9% survival for the full reach for fish passing via the fish bypass. The downstream bypass is used at the highest rate among all passage routes at 42.8% (3 year pooled). The lower Kennebec SPP coupled with the AMP measures include a proposal to modify the downstream bypass to improve passage conditions (smooth flume, close gaps) and dissipate discharge. Once these improvements are in place, we believe that this fishway will perform as well as the similarly configured Hydro-Kennebec downstream bypass (which also consists of a gate adjacent to the existing intakes leading to a concrete flume). Once the modifications are in place; the resulting immediate survival for the downstream bypass at Weston would be expected to be at least 98.8% and the latent survival would be expected to be at least 95.6%, based on the three-year weighted average results at the Hydro Kennebec Project (2012-2014). However, these rates could be as high as 100% for immediate survival, consistent with that experienced at the Hydro-Kennebec Project in 2013 and 2014 and as high as 98.6% for latent survival, consistent with that experienced at Hydro-Kennebec in 2013.

In addition, log sluice flows were tested under the minimum operational conditions during the 2013 – 2014 study years. In all years, the log sluice was set to 6%, 8% and/or 10% of station flows to determine the utilization and survival of this route under the minimum flow set point conditions. However, in practice, the log sluice is prioritized as the first conveyance of inflows in excess of station capacity. As such, there was a) less spill directed to the log sluice passage route in 2013 and 2014 than under normal operating conditions and b) more spill directed to the North Channel spillway in 2013 and 2014 than under normal operating conditions. In 2015, when the log sluice was operated at least at its minimum capacity and also prioritized for flows in excess of station capacity, the immediate and latent survival for this route was the highest among all study years at 97.7% immediate, 94.1% latent and 91.9% total survival for fish passing via the log sluice. On average, the capacity of the powerhouse is exceeded approximately 55% of the time from April 15 to June 15, resulting in supplemental log sluice flows. The log sluice is operated at its full capacity approximately 45% of the time, on average, during the downstream fish passage season.

Powerhouse survival is quite high; with both immediate and latent three-year weighted average survival in excess of 98% and the single year immediate and latent survival in 2015 at 100%. This route receives moderate utilization at 30.6% of approaching smolts passing via the powerhouse (3 year pooled). Smolts experiencing turbine passage are not exhibiting high immediate mortality nor significant latent mortality due to injury. Turbine entrainment, as such, does not appear to be a significant issue at this site and as such any alternative that reduces entrainment would not measurably improve passage conditions at the Project and has not been proposed as part of the Licensees AMP measures at this time.

Finally, while no specific quantification for route selection and survival can be made at this time, the upstream fish passage facility would provide an additional route for downstream passage, having an auxiliary water system with a capacity of up to 304 cfs (5.5% of station capacity). With downstream passage use documented at lower Penobscot River upstream passage facilities including Milford (fish lift), it is anticipated that this additional route for downstream passage will be available and augment proposed improvements. Given its location between the

existing downstream fish bypass (log sluice) and the powerhouse and given the installation of a uniform acceleration weir at the entrance, the AWS will provide an opportunity for egress for fish that happen to sound under the boom.

In summary, the improvements to bypass and spill passage, as proposed in the supplemented SPP, should result in the enhancement of immediate survival to 98.8% and 100.0%, respectively, and latent survival to 95.6% and 97.3%, respectively, for the two passage routes under a conservative set of assumptions that consider the three-year weighted average survival outcomes for similar routes at other Kennebec River Projects. This will improve the anticipated immediate whole station survival to 99.1% and latent survival to 96.9%, resulting in a total reach survival for the approximately 22 km reach between the Weston and Shawmut Projects of 96.0%. Taking a more optimistic set of assumptions that consider the best single year outcomes for similar routes at other Kennebec River Projects, immediate survival could be as high as 99.7% and latent survival could be as high as 98.9% with a potential total reach survival of 98.6%.

In its Draft EA for the Shawmut Project, FERC analyzed the minimum sizes of anadromous fish, including adult Atlantic salmon kelt that would be physically excluded by trash racks of variable spacing. FERC indicates that the length range for adult downstream migrating Atlantic salmon would be 28 to 37 inches. While 2-inch racks were not specifically analyzed, FERC determines that Atlantic salmon longer than 14.4 inches would be fully excluded by 1.5 inch clear spaced racks, while Atlantic salmon longer than 33.5 inches would be fully excluded by 3.5 inch clear spaced racks. As such, 2-inch clear spaced overlays, as proposed as an adaptive management measure for the Weston Project, are anticipated to be fully exclusive of Atlantic salmon downstream migrating kelts[7].

3.4.2 Shawmut Project

While we are providing an analysis of proposed adaptive management measures for the Shawmut Project herein, measures for downstream fish passage will be implemented as part of the FERC Staff Recommended Measures with Mandatory Section 18 Fish Passage Prescriptions. The analysis herein is based on the existing FERC Staff Recommended Measures with Mandatory Section 18 Fish Passage Prescriptions from the Draft EA.

Turbine passage presents the lowest survival (both immediate and delayed) for smolt – approximately 84.5% total for smolt passing the Francis units (Units 1 – 6) and 88.4% for smolts passing the propeller units (Units 7 and 8) – and moderate utilization of this route (32.7% combined). It is important to note, however, that the units with the lowest survival have only 11.6% utilization. A focus of improved passage conditions at the Shawmut Project through implementation of accelerated adaptive management measures is reducing entrainment.

NMFS and USFWS Section 18 prescription requires the installation of both a fish guidance boom (in front of the Unit 7 & 8 intakes), coupled with 1-inch seasonal trashrack overlays, in the power canal. As currently prescribed, the fish boom will provide physical guidance to the existing downstream fishway, as well as sweeping flows, and will provide some exclusion from Units 7 & 8. The Shawmut Project Licensee is proposing an additional boom outside of the gate

[7] As a constituent element of critical habitat, adult American shad with a length range of 14 to 30 inches would likewise be anticipated to be fully excluded by 2 inch clear spaced overlays. While juvenile alosines would not be excluded by 2 inch overlays, desktop entrainment studies utilizing USFWS' Turbine Blade Strike Analysis (TBSA) model have generally shown good survival for vertical Francis units.

structure and directed to the proposed upstream fishway AWS (which is sized to provide 340 cfs of 5% of station flow and is designed to enhance downstream passage with a uniform acceleration weir).

Fish that sound under the outside boom and enter the forebay will either encounter the second boom in front of the Unit 7 & 8 powerhouse or the 1-inch overlays at the Unit 1 – 6 powerhouse. Currently, there is very little entrainment at the Unit 1 – 6 powerhouse which have 1.5-inch clear spaced trashracks. With 1-inch overlays, this would be reduced even further. Even without an angle, 1-inch overlays/trashracks have been shown to be highly effective in reducing entrainment on the Penobscot River.

The approach velocity in front of the Units 1 through 6 is estimated to be 1.6 fps, while the approach velocity in front of Units 7 and 8 is estimated to be 3.5 fps. As such, the Shawmut Project Licensee is proposing to install a 2-inch overlay at the Unit 7 & 8 intake, consistent with the concerns outlined in NMFS Preliminary Section 18 prescription, and implement, as an adaptive management measure, nighttime shutdowns for 4 weeks (up to 5 weeks) during the smolt migration period. With the installation of both the booms and 1-inch overlays at the Unit 1 – 6 powerhouse and 2-inch overlays coupled with nighttime shutdowns at the Unit 7 & 8 powerhouse, turbine entrainment is anticipated to be significantly reduced under the post-license condition.

Regarding the anticipated reductions in entrainment and improvements to survival of these proposed measures, the boom outside of the gate structure would be expected to perform, on average, consistent with the Weston and Hydro-Kennebec Project booms, neither of which are contained within a forebay. As such, 29% of fish may sound under the boom at the Shawmut Project and enter the forebay, an improvement of 71% over baseline conditions.

It is expected that fish excluded from the forebay by the boom would pass downstream via the AWS or via the hingeboard section of the spillway. The upstream fish passage facility would provide an additional route for downstream passage with the current configuration of the AWS, specifically designed to serve as a downstream passage route with a capacity of 340 cfs, or 5% of station flow, and a uniform acceleration weir. It is assumed that the 71% of smolts deterred by the boom would generally pass via these routes and that survival outcomes would be similar.

The Shawmut Project Licensee is also proposing, as an adaptive management measure, to enhance downstream passage survival by resurfacing the hingeboard spillway. The log boom would also be resurfaced and continue to be prioritized as the primary spill conveyance. Under this prioritization, the log sluice would continue to be prioritized as the first on, last off spillway conveyance when flows exceed the capacity of the powerhouse (plus fishway flows), which occurs approximately 43% of the time, on average, from April 15 to June 15. As a result of these combined measures, fish approaching or otherwise directed to the spillway by the outside boom, are anticipated to result in a conservative estimated improvement in total survival to 97.5% [i.e., the assumed achievable total spill survival rate based on the (2013-2015) three-year weighted averages for immediate (98.8%) and latent (98.7%) survival for smolts passing Hydro Kennebec]. Optimistically, immediate and latent survival following construction of the AWS and improvements to the Shawmut spillway could be as high as 100%, the single year best survival estimates for passage on spill at Hydro-Kennebec observed during 2014 and 2013, respectively.

Whereas the second boom at the Unit 7 & 8 powerhouse and the 1-inch racks at the Unit 1 – 6 powerhouse will result in a reduction of entrainment for fish sounding under the outside boom and entering the forebay, we can assume that some level of entrainment will still occur despite the narrower rack spacing and the second forebay boom. Based on entrainment levels observed at Projects on the Penobscot River, wherein the average of five years of turbine entrainment data from the Stillwater A and Orono A projects (which have 1-inch rack spacing but not angled racks) is an estimated 6.6% entrainment, we would expect a requisite and proportional reduction of entrainment through the Unit 1-6. Further, based on entrainment levels observed at the Lockwood Project, which has a similar forebay boom configuration as that proposed for the Shawmut Project, wherein the average of three years of turbine entrainment data for smolts which entered into the project power canal is an estimated 36% entrainment, we would expect a requisite and proportional reduction of entrainment through Units 7 & 8 for those fish that pass during the day. For those smolt that sound under the Unit 7 & 8 boom, we would expect them to be entrained as generally 2-inch clear spaced overlays would not be expected to prevent entrainment of smolt. As such, once the fish booms and 1-inch trashrack are in place at the Project, we anticipate a reduction of fish entering the forebay by 71% and a further reduction in entrainment from the 1-inch racks by 93.4% (Units 1 – 6 powerhouse) and from the second boom by 64% (Unit 7 & 8 powerhouse).

Further, this is the outcome anticipated for fish that encounter the Shawmut Project during the day, generally defined as 8 am to 8 pm. As an additional adaptive management measure, the Shawmut Project Licensee is proposing to implement nighttime shutdowns at the Shawmut Project from 8 pm to 8 am. Shutdowns would be implemented for 4 weeks during the smolt passage season but could continue for up to 5 weeks based on the timing of the run. While the actual dates of initiation of shutdowns would be developed in consultation with NMFS and based on MDMR smolt trap data or a Kennebec River specific smolt migration model, based on 2020 and 2021 smolt trap data, the range of time between April 24 and May 24 would capture 97% of the smolt migration period. If it is assumed that 97% of the run would encounter nighttime shutdowns at the Project, the resultant increase in passage on spill overall will, when combined with the anticipated high survival of passage on spill following improvements to the spillway and log sluice, significantly improve passage conditions at the Project.

It is expected that fish entering the forebay (i.e., sounded at the boom) but which are deterred by the 1-inch trashrack or by the boom would pass downstream via the fish bypass. While the fish bypass has good immediate survival, it appears to have reduced latent survival, which would indicate that smolt may be sustaining sub-lethal injury when passing via the existing downstream bypass. While the existing surface sluice discharges to a plunge pool, the Tainter gate does not and instead discharges to a shallow reach terminating with the angled retaining wall that separates the Unit 7 & 8 powerhouse tailrace from the Unit 1 – 6 powerhouse tailrace. As part of the existing FLA proposed action, the Shawmut Project Licensee is proposing to modify the existing Tainter gate to discharge into a linear, excavated flume that would be constructed as part of the Unit 7 & 8 upstream fishway, to reduce risk of injury and improve latent survival via this route (an expected reduction on par with other lower Kennebec River fish bypasses). It is assumed the incorporation of a linear, excavated flume downstream of the Tainter gate can enhance immediate and delayed survival to a rate similar to that observed at Hydro Kennebec where bypass flows discharge to a downstream flume prior to entry into the downstream tailrace; conservatively 94.5% total reach survival for this route based on the three

year average but optimistically as high as 98.6% based on that observed at Hydro-Kennebec in 2013.

In addition, the performance standard for the Shawmut Project is an individual standard of 97%. In other words, while there is some flexibility at the other Projects inherent to this per Project target of 97% at other facilities, there can be some variation at the individual Projects so long as the cumulative standard of 88.5% is attained. This is not the case for the Shawmut Project where the Section 18 prescription calls for a site specific performance standard, rather than a target.

In summary, the installation of 1-inch trashracks and two fish guidance booms, should result in reduced turbine entrainment at both powerhouses [based on entrainment observed at the Weston and Hydro-Kennebec Projects for the outer boom and at the Lockwood Project for the inner boom] which would be further reduced with the implementation of night-time shutdowns at the Project. Downstream passage via the AWS, hingeboard and log sluice spill, and the forebay Tainter gate will be enhanced via structural modifications at those locations. This will improve the anticipated immediate and latent survival to 98.7% and 98.0%, respectively, and result in a total survival for the reach between the Shawmut and Hydro Kennebec Projects of 96.7 as a conservative estimate. An optimistic estimate would improve immediate survival to 99.9% and latent survival to 99.7% with a total reach survival of 99.6%.

As discussed above, FERC analyzed the minimum sizes of anadromous fish, including adult Atlantic salmon kelt that would be physically excluded by trash racks with 1.5 and 3.5-inch clear spacing and concluded that 2-inch clear spaced overlays, as proposed as an adaptive management measure for the Shawmut Project, are anticipated to be fully exclusive of Atlantic salmon downstream migrating kelts[8].

3.4.3 Hydro-Kennebec Project

At the Hydro-Kennebec Project, a relatively high percentage of smolt pass on spill (30.6% of smolt passed on spill (3 year pooled)) and the spillway has very high spill survival (both immediate and delayed) of almost 99% each. Unit 2, the passage route exhibiting the lowest rate of immediate and latent survival, is also the most infrequently utilized. Although Unit 2 has a combined immediate and delayed survival of 69.4%, only 5.3% of smolt actually utilized this route. Alternatively, passage via the downstream bypass and Unit 1 have relatively high combined immediate and latent survival, 94.5% and 89.7% respectively, with the downstream bypass being the most frequently utilized route.

As outlined in the lower Kennebec SPP, the proposals for improving fish passage conditions at the Hydro-Kennebec Project include major modifications to the existing downstream fish passage facilities, including relocating the entrance further upstream and away from the Project intakes, increasing the fishway entrance to accommodate 5% of station flow, installing a uniform acceleration weir, removing the internal weirs and improving the flume, and relocating the fish boom to connect directly with the dam adjacent to the entrance of the downstream fishway.

There is currently an approximately 5 ft wide gap between the end of the fish boom and the existing entrance to the downstream fishway, immediately upstream of the Unit 1 intake. This

[8] As a constituent element of critical habitat, adult American shad with a length range of 14 to 30 inches would likewise be anticipated to be fully excluded by 2 inch clear spaced overlays. Propeller units are assumed to be favorable to juvenile alosine survival based on TBSA models.

gap is evidenced by the disparity in route utilization between Units 1 and 2. Smolt entrainment at Unit 2, which is a distance away from the gap, likely comprise a majority of smolts sounding under the existing fish boom at approximately 5%. Alternatively, approximately 22% of the smolts were entrained through Unit 1, which likely comprise a majority of smolts passing through the gap at the end of the boom in front of the Unit 1 intake. As such, it is assumed that potentially 17% of the smolt entrained through Unit 1 are not sounding under the boom but are instead traversing the gap at the end of the boom.

Relocating the entrance to the fishway upstream and closing the gap in the boom would likely reduce turbine entrainment through Unit 1 to about 5%, on par with Unit 2. If the 17% of smolts that were traversing the gap between the end of the boom and the downstream fishway and getting entrained through Unit 1 are now able to successfully pass the fishway (i.e., a reduction in Unit 1 entrainment by 77.2%), we will see a significant improvement to immediate and latent survival. In addition, reconfiguring and improving the downstream fish passage facility would be expected to significantly improve latent survival for fish passing via this route as well. While immediate survival is quite high, latent survival is approximately 96%, indicating there may be an unknown source of injury in the existing fishway. The configuration of the fishway is such that the entrance is located 90 degrees from the discharge flume which may be the source of some injury even with the plunge pool. Relocating the entrance and eliminating the angle of conveyance and the internal structures, installing a uniform acceleration weir and reconstructing the downstream passage flume will all likely contribute to higher utilization and higher immediate and latent survival, likely on par with the highest survival achieved in a single year at the Hydro-Kennebec Project. While this is an optimistic approach, we have also conservatively estimated no improvement to immediate or latent survival at Hydro-Kennebec, following the implementation of the improvements.

The existing upstream fishway provides opportunity for downstream passage supplemental to the proposed improvements. The AWS/conveyance flume can be set between 250 cfs and 400 cfs, representing between 3% to 5% of station capacity. It is unknown the utilization this route may experience but provides an augmented route of passage, nonetheless.

Considering the high rate of survival of passage on spill, the Hydro-Kennebec Project Licensee will implement nighttime shutdowns for 4 (up to 5) weeks during the smolt passage season. The initial target start date would be developed in consultation with NMFS but is assumed to occur during the last week of April and capture 97% of the smolt migration period. An expected 28% increase in passage on spill overall would result which, when combined with the high survival of passage on spill, will significantly improve passage conditions at the Project.

In summary, the reduction in daytime turbine entrainment to 5% for each Unit, with a resultant increase in downstream bypass utilization, , as well as an increase in spill utilization as a result of nighttime shutdowns, is conservatively estimated to improve the anticipated immediate whole station survival to 98.4% and latent survival to 97.2% [based on the three-year weighted average bypass, spill and turbine survival rates for the Hydro-Kennebec Project coupled with changes in route utilization from the relocated boom, reconfigured fishway and night-time shutdowns]. Optimistically, immediate survival could be as high as 98.9% and latent survival could be as high as 98.5%, resulting in a total reach survival of 97.4% [based on the highest observed survival through the fishway and changes to route utilization from improvements and nighttime shut-downs].

In addition to passage improvements, the Hydro-Kennebec Project Licensee will conduct a survey of ledge conditions in the spillway at the Project to determine if there are any perched pools that present a risk of stranding. Ledge modifications to provide egress and flows may be implemented to address any areas without suitable zone of passage. It is not expected that stranding is a significant issue at the Project given periodic stranding checks have not resulted in the identification of stranding events and the three years of study have resulted in high overall survival and continued downstream migration at the Project.

Based on FERC's analysis of the physical exclusion benefits of variable trashrack spacing conducted as part of the Shawmut Draft EA, adult Atlantic salmon kelt would be physically excluded by the 2-inch overlays, proposed as an adaptive management measure for the Hydro-Kennebec Project[9].

3.4.4 Lockwood Project

The Lockwood Project exhibits very high immediate and latent survival for Atlantic salmon smolts among all available passage routes. While the Francis units exhibit relatively low immediate survival and the Kaplan units are the next lowest, there is very little overall use of these routes and latent survival is comparable to spill. Low entrainment rates indicate that the fish boom is effective in diverting smolt away from the units and to the existing downstream bypass, which is also highly effective. Further, a new fishway constructed in the bypass reach of the Lockwood Project, with an attraction water system of up to 250 cfs will offer an additional available route providing downstream passage at over 4% of station flow to augment the current high rate of total passage survival.

Considering the high rate of survival of passage on spill, the Licensees will implement nighttime shutdowns for 4 (up to 5) weeks during the smolt passage season as an accelerated AMP measure. The actual dates of initiation of shutdowns would be developed in consultation with NMFS and based on MDMR smolt trap data or a Kennebec River specific smolt migration model but are assumed to 97% of the run with a late April start date. Turbine entrainment will be reduced by 70% for each Unit which is conservatively estimated to improve the anticipated immediate whole station survival to 99.1% and latent survival to 97.7% for a total reach survival of 96.8% [based on the three-year weighted average bypass, spill and turbine survival rates for the Lockwood Project coupled with changes in route utilization from the night-time shutdowns]. Optimistically, the immediate survival is estimated to be 99.2% while the latent survival is estimated to be 97.7% for a total reach survival of 96.9% [based on the three-year weighted average bypass, spill and turbine survival rates for the Lockwood Project coupled with improvements to passage via the fishway as a result of the highest single year boom effectiveness and night-time shutdowns].

[9] As a constituent element of critical habitat, adult American shad with a length range of 14 to 30 inches would likewise be anticipated to be fully excluded by 2 inch clear spaced overlays. A 2016 study of downstream adult river herring passage was conducted at the Hydro Kennebec Project. Overall, radio-tagged adult herring readily used the existing downstream bypass and subsequent survival passed the project and downstream to Lockwood was excellent. The existing guidance boom and associated bypass successfully passed 116 of the 144 (81%) radio-tagged herring downstream. While the use of the paired release model was hindered by lower than expected survival of control fish, the CJS model produced reach specific survival estimates of 96.4% from approach to the upstream face of the dam and 99.3% from passage to the first downstream receiver, the product of which generated a project reach survival estimate of 95.7% (95% C.I. = 91.4-98.6%).

The Lockwood Project trash racks screening the intakes have 2.0-inch clear spacing in front of Units 1-6 and 3.5-inch clear spacing in front of Unit 7. As an accelerated AMP measure, the Licensees are proposing to install 2-inch overlays at Unit 7. Based on FERC's analysis of the physical exclusion benefits of variable trashrack spacing conducted as part of the Shawmut Draft EA, adult Atlantic salmon kelt would be physically excluded by the 2-inch overlays[10].

3.4.5 Cumulative Analysis

To determine the improvements to immediate and latent survival that would be anticipated to result from the implementation of the accelerated AMP measures, the Licensees conducted a series of initial calculations to first estimate "baseline" passage success at the Projects. These initial calculations were informed using the Project specific three-year pooled downstream route utilization and three-year weighted average downstream route passage survival. Calculation of baseline estimates assumed downstream passage of a theoretical cohort of smolts at each Project and distributed among potential downstream passage routes at the observed rates of utilization from the 2012-2015 studies. Route-specific immediate and latent survival rates were then applied to each group of passed smolts. The surviving route-specific fractions were then recombined to provide the baseline estimate of total reach survival for each Project (see Table below).

Table 13. Baseline Cumulative Immediate and Latent Survival Estimates

Project	Immediate (200m approach to DS #1)	Latent (DS#1 to next Project)	Total Reach
Weston	95.3%	94.9%	90.4%
Shawmut	96.0%	90.7%	87.1%
Hydro Kennebec	96.4%	96.5%	93.0%
Lockwood	98.4%	97.3%	95.7%
Cumulative	86.7%	80.8%	70.1%

Following development of the baseline estimates, the Licensees developed both "conservative" and "optimistic" estimates for immediate and latent survival at each Project to incorporate the benefits from the implementation of the accelerated AMP measures. The conservative estimates incorporated site-specific survival and route utilization rates and where appropriate, assumed route-specific three-year weighted average immediate and latent survival rates calculated from similar projects or structures to be representative of the proposed measures to be implemented. Rather than incorporating three-year weighted average survival rates, the optimistic estimates assumed route-specific single-year immediate and latent survival rates calculated from similar projects or structures (i.e., the highest single year observed during 2013-

[10] As a constituent element of critical habitat, adult American shad with a length range of 14 to 30 inches would likewise be anticipated to be fully excluded by 2-inch clear spaced overlays. A 2016 study of downstream adult river herring passage was conducted at the Lockwood Project. Of the 128 radio-tagged Alewives passing Lockwood, 37 of the 128 (29%) passed via spill. A total of 87 radio-tagged alewives were determined to have entered the project forebay canal. Of those individuals, 28 of the 87 (32%) used the downstream bypass, 13 of the 87 (15%) passed via the surface sluice located between units 6 and 7, 31 of the 87 (36%) passed via the Francis units, and 15 of the 87 (17%) passed via the Kaplan unit. Results of the paired release-recapture model estimated whole station survival for adult alewife at Lockwood to be 85% (75% CI = 69.0-100.0%).

2015 studies) to be representative of the proposed measures to be implemented. These assumptions are summarized above and discussed in greater detail in Appendix A.

In summary, the improvements to bypass and spill passage at the Weston Project; improvements to bypass passage and reduction in turbine entrainment at the Hydro-Kennebec Project; improvements to bypass passage and reduction in turbine entrainment at the Lockwood Project and improvements to bypass and spill passage and reduction in turbine entrainment at the Shawmut Project, as proposed in the SPP and FLA and supplemented herein by accelerated AMP measures, is expected to result in the “conservative” enhancement of immediate and latent cumulative survival for a total cumulative reach survival from above Weston to below Lockwood of 86.0%, an improvement in total reach survival of over 15% relative to the baseline (i.e., total reach) estimate of 70.1%. When the “optimistic” enhancement of immediate and latent cumulative survival is considered, total cumulative reach survival from above Weston to below Lockwood is calculated at 92.7%.

Table 14. Cumulative Conservative and Optimistic Immediate, Latent and Total Survival Estimates Following AMP Implementation

Project	SPP/AMP Measures	Conservative Estimate			Optimistic Estimate		
		Immediate	Latent	Total	Immediate	Latent	Total
Weston	SPP Measures: gate prioritization, bypass improvements, AWS bypass	99.1%	96.9%	96.0%	99.7%	98.9%	98.6%
Shawmut	Section 18/FLA Measures: 1-inch overlay (Unit 1-6), boom (Unit 7&8), AWS bypass, Tainter bypass flume AMP Measures: 2-inch overlay (Unit 7&8), guidance boom outside of gate structure, uniform acceleration weir (Tainter bypass), smooth spillway and log sluice, 4 week night-time shutdown (2000-0800)	98.7%	98.0%	96.7%	99.9%	99.7%	99.6%
Hydro Kennebec	SPP measures: reconfigure fishway and relocate entrance and boom, uniform acceleration weir, upstream flume bypass AMP Measures: 2-inch overlay, 4 week night-time shutdown (2000-0800)	98.4%	97.2%	96.6%	98.9%	98.5%	97.4%
Lockwood	SPP measures: upstream flume/AWS bypass AMP Measures: 2-inch overlay (Unit 7), uniform acceleration weirs (downstream bypass and surface sluice), 4 week night-time shutdown (2000-0800)	99.1%	97.7%	96.8%	99.2%	97.7%	96.9%
Cumulative		95.4%	90.2%	86.0%	97.7%	94.9%	92.7%

4.0 ADAPTIVE MANAGEMENT AND OTHER SPP AND ADDITIONAL MEASURES

In addition to proposed improvements to downstream passage facilities at the lower Kennebec River Projects, the SPP includes:

- A commitment to studying a whole station survival cumulative standard of 88.5% (an individual project target of 97% for Lockwood, Hydro-Kennebec and Weston with an anticipated site-specific, individual performance standard of 97% at the Shawmut Project) (Section 8.0 of the lower Kennebec SPP and as prescribed for the Shawmut Project by NMFS);
- Implementing an adaptive management plan to ensure attainment of the cumulative 88.5% and Shawmut Project site-specific 97% performance standards (Section 9.5 of the SPP and as discussed in FERC's EA);
- Implementing additional measures to "protect Atlantic salmon habitat and advance the restoration effort on the Kennebec River" including "supporting agency or university studies of Atlantic salmon, assisting with egg, fry, or smolt stocking in the Sandy River (or other areas in the Kennebec watershed), supporting agency studies of estuarian mortality, and assisting with interim salmon trap and truck efforts from Lockwood, as needed" (Section 7.5 of the SPP); and
- Conducting a study, the scope of which is to be developed with the agencies, investigating dam passage injuries that have the potential to contribute to hydrosystem delayed mortality.

Following discussions with NMFS regarding latent mortality and other effects of the action, and consistent with Section 7.5 of the SPP, the Licensees have agreed to provide funding or other agreed support to offset the costs of production of smolts to be stocked upstream of the Weston project with the purpose of producing approximately 200 motivated prespawn adults to evaluate the effectiveness of the proposed new fishways; provided, however, that such stocking efforts shall not (i) exceed 250,000 smolts per year, (ii) be required to continue beyond the earlier of 6 years from commencement of stocking or the expiration of the incidental take statement, nor (iii) begin prior to 2 years before expected completion of all upstream passage facilities. Depending on the final study design, or on the implementation and empirical validation of downstream protective measures, fewer smolts may be required to achieve the study objectives. Licensee will develop the study plan in coordination with, and approval from, NMFS, within a year of the issuance of the license amendments.

In addition, consistent with Section 7.5 of the SPP, the Licensees have agreed to develop a mitigation plan in consultation with NMFS to offset upstream and downstream effects of the projects until the performance standards have been achieved through funding of habitat restoration focusing on restoring access to, and suitability of, high value, climate resilient, spawning and rearing habitat for Atlantic salmon within the Kennebec River and Merrymeeting Bay SHUR. To that end, the Licensees commit to contribute $300,000 ($75,000 per Project) in the aggregate annually for the first 10 years (with a review in year 10 to determine attainment of the upstream and downstream performance standard) for the purpose of funding habitat enhancement projects to be determined in consultation with NMFS in the Kennebec River and Merrymeeting Bay SHRU. Should attainment of the performance standards for upstream and downstream passage be attained within the 10-year timeframe, funding would cease or be potentially reduced from the year of attainment to the expiration of the SPP.

If during the term of the license, it is determined that either the upstream or downstream performance standard for Atlantic salmon is not being achieved, the Licensees propose to implement the Adaptive Management Plan, described in Section 9.5 of the SPP with a commitment to the same for the Shawmut Project as part of relicense.

The Licensees will continue to meet annually[11] with the fishery agencies and consult with the agencies to consider adaptations that could be made to achieve the performance standards if either the upstream or downstream standard for Atlantic salmon is not being met. While it is not known today exactly which measures might be most effective in improving passage performance, there are certain activities or measures that the Licensees and agencies could consider as potential "tools" in improving passage performance, which are outlined in Section 9.5 of the SPP. If the Licensee cannot demonstrate achievement of the proposed cumulative performance/delay standard within three years, it will consult with NMFS regarding additional operational or infrastructure improvements. In consultation with NMFS, the licensee will develop and implement additional operational or infrastructure measures, as reasonable and practicable, that are likely to meet or exceed the upstream performance standard. Additional commitments to achieve the downstream performance standard are outlined above and in Section 9.5 of the SPP.

The annual agency meetings will also be used to discuss other issues related to the GOM DPS of Atlantic salmon restoration and cooperative management activities that may be relevant to the Kennebec River such as availability of hatchery stocks for studies and restoration efforts and coordination of fish passage study efforts with agency studies or the studies being conducted by other hydropower project owners in the watershed.

[11] Annual meetings between the Licensees and the fishery agencies have been occurring for many years in accordance with the provisions of the KHDG Agreement. These same meetings will be used to consider the need for any adaptive management measures included in the AMP for the Shawmut Project, as well as the AMP for the other three lower Kennebec projects that are covered under the Species Protection Plan (SPP) for those projects.

5.0 CONCLUSIONS

The proposed upstream and downstream passage improvements outlined in the Licensees' SPP and the Shawmut Project FERC Staff Recommended Measures with Mandatory Conditions, and as supplemented herein through acceleration of AMP measures, would contribute positively and significantly to returns (reproduction and numbers) and accessibility (distribution) over baseline conditions.

For downlisting, the Merrymeeting Bay SHRU must have a minimum of 500 returning adults, a mean growth rate greater than 1.0 in 10 years, and at least 7,500 units of accessible habitat. For delisting, the Merrymeeting Bay SHRU must have at least 2,000 returning adults, a mean positive growth rate of greater than 1.0 in 10 years and at least 30,000 units of accessible habitat.

Currently, returns to the Kennebec, Androscoggin and Sheepscot Rivers are low; however, the Kennebec River has a positive growth rate of 1.1 under baseline conditions and this would be expected to improve with the SPP proposed and supplemental measures for upstream and downstream fish passage; ultimately contributing positively to the minimum escapement goals.

The available accessible habitat used by salmon for spawning and rearing includes the 3,131 units below Lockwood plus the 46,833 units above Weston (including the Sandy River) into which adult Atlantic salmon currently access via trap and truck activities at the Lockwood Project. Once volitional fish passage is in place at the four lower Kennebec River Projects, the intervening 22,170 units of habitat will be accessible, bringing the total to 72,134 units, more than double the necessary units for delisting needed for the entire SHRU. Furthermore, the commitment to development of a mitigation plan for the purpose of funding and implementing habitat improvement projects within the Kennebec River watershed and Merrymeeting Bay SHRU will further increase available habitat, particularly that serving as cold water refugia for which the habitat improvement projects are anticipated to be prioritized.

Further, in accordance with the 2019 Atlantic Salmon Recovery Plan, recovery efforts are in Phase 2, which is focused on hatchery supplementation with no plans to transition to Phase 3 for the next 40 years. NMFS states in the 2021 Androscoggin BiOp, within the Merrymeeting Bay SHRU, that "(a)s long as the hatchery continues to produce Atlantic salmon, the species will not go extinct in the wild". While not specifically targeted toward recovery, the stocking of smolts above Weston as part of upstream study efforts, will contribute positively toward increasing adult returns and will complement the stocking efforts undertaken by the MDMR.

Considering the status of phased recovery, the commitment to improved upstream and downstream passage measures inclusive of adaptive management to achieve agency-supported performance standards and expanded accessible habitat in the SHRU; an existing baseline positive growth rate; and a commitment to other supportive measures such as studies and stocking efforts as well as the funding of habitat enhancements, the Licensees believe that these collective actions contribute to the survival and recovery of Atlantic salmon in the Kennebec River, Merrymeeting Bay SHRU, and GOM DPS as a whole.

APPENDIX A

DETAILED LIST OF CONSERVATIVE AND OPTIMISTIC ANALYSIS ASSUMPTIONS

The following methods and assumptions were used for the calculation of the conservative estimated immediate and latent survival following AMP implementation at each of the four Kennebec River Projects:

Weston:

- Assumes all smolts which approach the Project pass downstream through an available passage route.
- Assumes smolts passed downstream following the three-year pooled route utilization distribution among Project passage routes (i.e., spill, downstream bypass, or turbine) (Table 1).
- Assumes Weston (2013-2015) three-year weighted average immediate (98.7%) and latent (98.3%) turbine passage survival rates remained consistent for that route.
- Assumes the smoothing of the existing flume and addition of a dissipation lip to the end of the downstream bypass flume will improve immediate and latent survival to 98.8% and 95.6%, respectively; based on the (2012-2014) three-year weighted survival estimates for the Hydro Kennebec downstream bypass which has a similar configuration (Table 6).
- Assumes reprioritization of North Channel spill to utilize gates which discharge into deeper plunge depths versus areas of shallow or exposed ledge will improve immediate and latent survival to 100.0% and 97.3%, respectively; based on the (2013-2015) three-year weighted survival estimates observed for smolts passing on spill at Lockwood which has a similarly configured bypass reach (Table 8).

Shawmut:

- Assumes all smolts which approach the Project pass downstream through an available passage route.
- Assumes the percentage of smolts empirically identified as passing downstream via spill based on the three-year pooled route utilization distribution remains unchanged.
- Assumes all smolts empirically identified as passing downstream via the turbines or downstream bypass based on the three-year pooled route utilization distribution will approach the Shawmut gate structure.
- Assumes a similar percentage of fish identified at Weston and Hydro Kennebec as sounding below the comparable floating booms at those locations will do so at Shawmut and will enter the power canal (average of three-year pooled turbine entrainment at Weston and Hydro Kennebec = 29%).
- Assumes that the inverse (71%) percentage of those fish will be redirected by the fish boom to the AWS or hingeboard section of the dam.
- Assumes smolts passing downstream out of the Shawmut forebay during the daytime hours (defined as 8 am to 8 pm) will initially partition among the three exit routes (i.e., downstream bypass, Unit 1-6 or Unit 7&8) at the same ratio as observed for the three-year pooled route utilization data.
    - Assumes entrainment for the proportion of smolts approaching the propeller units will be reduced by 64% to account for the forebay boom (i.e. the three year

average effectiveness rate for smolts in the Lockwood power canal to use the downstream bypass).
    - Assumes the inverse (36%) percentage of those fish will sound below the boom, pass through the 2-inch rack spacing and be entrained through the Unit 7&8 propeller units.
    - Assumes entrainment for the proportion of smolts approaching the Unit 1-6 Francis units will be reduced by 93.4% to account for the 1-inch rack spacing. (i.e., assumes a comparable rate of turbine usage as observed for 1-inch rack entrainment data from the Orono A and Stillwater A Projects (2014-2018) which incorporate a perpendicular rack design and are characterized by an average entrainment rate of 6.6%).
    - Assumes the remainder of smolts having entered the power canal will pass downstream via the downstream bypass (surface sluice or Tainter gate).
- Assumes smolts passing downstream out of the Shawmut forebay during the nighttime hours (defined as 8 pm to 8 am) will initially partition among the two exit routes (i.e., downstream bypass or Unit 1-6) at the same ratio as observed for the three-year pooled route utilization data.
    - Assumes the proportion of smolts at the Unit 7&8 propeller units assumed to be zero due to offline status.
    - Assumes entrainment for the proportion of smolts approaching the Unit 1-6 Francis units will be reduced by 93.4% to account for the 1-inch rack spacing. (i.e., assumes a comparable rate of turbine usage as observed for 1-inch rack entrainment data from the Orono A and Stillwater A Projects (2014-2018) which incorporate a perpendicular rack design and are characterized by an average entrainment rate of 6.6%).
    - Assumes the remainder of smolts having entered the power canal will pass downstream via the downstream bypass (surface sluice or Tainter gate).
- Assumes the previously observed 2013-2015 proportional split of day and night passage events is representative of the diel split in smolt passage under future conditions (i.e., 60.1% of passage events during the day and 39.9% of passage events during the night).
    - Shawmut day-night ratio based on downstream passage timing of smolts originally released at Weston so as to reduce potential bias to passage distribution by including the subset of smolts released only 2 miles upstream of Shawmut.
- Assumes 97% of smolts pass during the targeted 4-week shutdown window.
- Assumes Shawmut (2013-2015) three-year weighted averages for turbine passage survival (propeller and Francis) remained consistent for immediate and latent survival estimates for those routes.
- Assumes efforts to smooth the spillway concrete at the hingeboards and the log sluice will improve immediate and latent survival to 98.8% and 98.7%, respectively; similar to rates observed for smolts passing on spill at Hydro Kennebec which has a similar configuration (Table 6).
- Assumes the installation of an excavated flume at the downstream end of the Tainter gate bypass will improve immediate and latent survival to 98.8 and 95.6%, respectively; similar to the latent survival rate observed for smolts passing through the bypass at the Hydro Kennebec Project which has a similar configuration (Table 6).

Hydro Kennebec:

- Assumes all smolts which approach the Project pass downstream through an available passage route.
- Assumes modification of the Hydro Kennebec (2012-2014) three-year pooled passage route utilization rates during daytime operations (0800 to 2000) will result in usage rates for both turbines equal to that estimated for Unit 2 (i.e., 5.3%) following relocation of the boom and elimination of the gap.
- Assumes that smolts passing downstream of Hydro Kennebec during the nighttime hours (defined as 8 pm to 8 am) will not utilize either Units 1 or 2 for downstream passage due to turbine shutdown.
- Assumes the percentage of smolts which would have passed downstream via the turbine units will instead pass downstream via spill during the nighttime hours when turbines are offline.
- Assumes the proportional split of day and night passage events for smolts originally released at Weston or Shawmut is representative of the diel split in smolt passage under future conditions (i.e., 27.7% of passage events during the day and 72.3% of passage events during the night).
- Assumes 97% of smolts pass during the targeted 4-week shutdown window.
- Assumes Hydro Kennebec (2012-2014) three-year weighted averages for turbine passage (Unit 1 and Unit 2) and spill remained consistent for immediate and latent survival estimates for that route.
- Assumes modifications to the downstream bypass at Hydro Kennebec will maintain existing Hydro Kennebec (2012-2014) three-year weighted average immediate and latent smolt survival estimates.

Lockwood:

- Assumes all smolts which approach the Project pass downstream through an available passage route.
- Assumes smolts passing downstream of Lockwood during the daytime hours (defined as 8 am to 8 pm) will do so following the three-year pooled route utilization distribution among Project passage routes (i.e., spill, downstream bypass, or Francis turbines or Kaplan turbine).
- Assumes that smolts passing downstream of Lockwood during the nighttime hours (defined as 8 pm to 8 am) will not utilize the six Francis units or single Kaplan unit for downstream passage due to turbine shutdown.
- Assumes the percentage of smolts which would have passed downstream via the turbine units will instead pass downstream via spill during the nighttime hours when turbines are offline.
- Assumes the proportional split of day and night passage events for smolts originally released at Weston, Shawmut, and Hydro Kennebec is representative of the diel split in smolt passage under future conditions (i.e., 25.0% of passage events during the day and 75.0% of passage events during the night).
- Assumes 97% of smolts pass during the targeted 4 week shutdown window.
- Assumes the (2013-2015) Lockwood three-year weighted averages for turbine passage (Francis and Kaplan), the downstream bypass, and spill remained consistent for immediate and latent survival estimates for those routes.

The following methods and assumptions were used for the calculation of the optimistic estimated immediate and latent survival following AMP implementation at each of the four Kennebec River Projects:

Weston:

- Assumes all smolts which approach the Project pass downstream through an available passage route.
- Assumes a smolt entrainment rate of 20% (i.e., the lowest annual rate observed at Weston during the 2013-2015 study period) and a subsequent 10.6% increase in use of the downstream bypass based on utilization of log sluice as the prioritized route for spill flows.
- Assumes Weston (2013-2015) three-year weighted average immediate (98.7%) and latent (98.3%) turbine passage survival rates remained consistent for that route.
- Assumes the smoothing of the existing flume and addition of a dissipation lip to the end of the downstream bypass flume will improve immediate and latent survival to 100.0% and 98.6%, respectively; equal to the observed single year high passage success rates for the Hydro Kennebec downstream bypass (see annual rates; Table 6) and based on similar fishway configuration.
- Assumes reprioritization of North Channel spill to utilize gates which discharge into deeper plunge depths versus areas of shallow or exposed ledge will improve immediate and latent survival to 100.0% and 100.0%, respectively; equal to the observed single year high passage success rates for smolts passing on spill at Lockwood (see annual rates; Table 8) and based on the similar bypass reach configuration for the two projects.

Shawmut:

- Assumes all smolts which approach the Project pass downstream through an available passage route.
- Assumes the percentage of smolts empirically identified as passing downstream via spill based on the three-year pooled route utilization distribution remains unchanged.
- Assumes all smolts empirically identified as passing downstream via the turbines or downstream bypass based on the three-year pooled route utilization distribution will approach the Shawmut gate structure.
- Assumes a similar percentage of fish identified at Weston and Hydro Kennebec as sounding below the comparable floating booms at those locations will do so at Shawmut and will enter the power canal (i.e., the lowest annual entrainment rate observed at either Weston or Hydro Kennebec [20%, Weston 2014]).
- Assumes that the inverse (80%) percentage of those fish will be redirected by the fish boom to the AWS or hingeboard section of the dam.
- Assumes smolts passing downstream out of the Shawmut forebay during the daytime hours (defined as 8 am to 8 pm) will initially partition among the three exit routes (i.e., downstream bypass, Unit 1-6 or Unit 7&8) at the same ratio as observed for the three-year pooled route utilization data.
    - Assumes entrainment for the proportion of smolts approaching the Unit 7&8 propeller units will be reduced by 68% to account for the forebay boom (i.e. highest single year effectiveness rate for the Lockwood boom [2013]).
    - Assumes the inverse (32%) percentage of those fish will sound below the boom, pass through the 2-inch rack spacing and be entrained through the Unit 7&8 propeller units.

    - Assumes entrainment for the proportion of smolts approaching the Unit 1-6 Francis units will be reduced by 93.4% to account for the 1-inch rack spacing. (i.e., assumes a comparable rate of turbine usage as observed for 1-inch rack entrainment data from the Orono A and Stillwater A Projects (2014-2018) which incorporate a perpendicular rack design and are characterized by an average entrainment rate of 6.6%).
    - Assumes the remainder of smolts having entered the power canal will pass downstream via the downstream bypass (surface sluice or Tainter gate).
- Assumes smolts passing downstream out of the Shawmut forebay during the nighttime hours (defined as 8 pm to 8 am) will initially partition among the two exit routes (i.e., downstream bypass or Unit 1-6) at the same ratio as observed for the three-year pooled route utilization data.
    - Assumes the proportion of smolts at Unit 7&8 propeller units assumed to be zero due to offline status.
    - Assumes entrainment for the proportion of smolts approaching the Unit 1-6 Francis units will be reduced by 93.4% to account for the 1-inch rack spacing. (i.e., assumes a comparable rate of turbine usage as observed for 1-inch rack entrainment data from the Orono A and Stillwater A Projects (2014-2018) which incorporate a perpendicular rack design and are characterized by an average entrainment rate of 6.6%).
    - Assumes the remainder of smolts having entered the power canal will pass downstream via the downstream bypass (surface sluice or Tainter gate).
- Assumes the previously observed 2013-2015 proportional split of day and night passage events is representative of the diel split in smolt passage under future conditions (i.e., 60.1% of passage events during the day and 39.9% of passage events during the night).
    - Percentages here based on downstream passage timing of smolts originally released at Weston so as to reduce potential bias to passage distribution by including the subset of smolts released only 2 miles upstream of Shawmut.
- Assumes 97% of smolts pass during the targeted 4-week shutdown window.
- Assumes Shawmut (2013-2015) three-year weighted average for turbine passage survival (propeller and Francis) remained consistent for immediate and latent survival estimates for those routes.
- Assumes efforts to smooth the spillway concrete at the hingeboards and the log sluice will improve immediate and latent survival to 100.0%; similar to single year high passage survival rates observed for smolts passing on spill at Hydro-Kennebec during the 2014 and 2013 study years, respectively (see Table 6).
- Assumes the installation of an excavated flume at the downstream end of the Tainter gate bypass will improve immediate and latent survival to 100.0% and 98.6%, respectively; similar to the single year high passage survival rate observed for smolts passing through the bypass at the Hydro Kennebec Project during 2013 & 2014 (immediate) and 2013 (latent) (see Table 6).

Hydro Kennebec:

- Assumes all smolts which approach the Project pass downstream through an available passage route.
- Assumes modification of the Hydro Kennebec (2012-2014) three-year pooled passage route utilization rates during daytime operations (0800 to 2000) will result in usage rates for both turbines equal to that estimated for Unit 2 (i.e., 5.3%) following relocation of the boom and elimination of the gap.

- Assumes that smolts passing downstream of Hydro Kennebec during the nighttime hours (defined as 8 pm to 8 am) will not utilize either Units 1 or 2 for downstream passage due to turbine shutdown.
- Assumes the percentage of smolts which would have passed downstream via the turbine units will instead pass downstream via spill during the nighttime hours when turbines are offline.
- Assumes the proportional split of day and night passage events for smolts originally released at Weston or Shawmut is representative of the diel split in smolt passage under future conditions (i.e., 27.7% of passage events during the day and 72.3% of passage events during the night).
- Assumes 97% of smolts pass during the targeted 4-week shutdown window.
- Assumes (2012-2014) Hydro Kennebec three-year weighted averages for turbine passage (Unit 1 and Unit 2) and spill remained consistent for immediate and latent survival estimates for that route.
- Assumes modifications to the downstream bypass at Hydro Kennebec will conservatively improve immediate survival to 100.0% and latent smolt survival to 98.6% (i.e., the highest single-year rates observed during the 2013/2014 and 2013 study years, respectively).

Lockwood:

- Assumes all smolts which approach the Project pass downstream through an available passage route.
- Assumes smolts passing downstream of Lockwood during the daytime hours (defined as 8 am to 8 pm) will do so following a modified route utilization distribution among Project passage routes (i.e., spill, downstream bypass, or Francis turbines or Kaplan turbine).
    - Assumes effectiveness of Lockwood boom to be 68% which is the highest observed single year rate [2013].
- Assumes that smolts passing downstream of Lockwood during the nighttime hours (defined as 8 pm to 8 am) will not utilize the six Francis units or single Kaplan unit for downstream passage due to turbine shutdown.
- Assumes the percentage of smolts which would have passed downstream via the turbine units will instead pass downstream via spill during the nighttime hours when turbines are offline.
- Assumes the proportional split of day and night passage events for smolts originally released at Weston, Shawmut, and Hydro Kennebec is representative of the diel split in smolt passage under future conditions (i.e., 25.0% of passage events during the day and 75.0% of passage events during the night).
- Assumes 97% of smolts pass during the targeted 4 week shutdown window.
- Assumes the (2013-2015) Lockwood three-year weighted averages for turbine passage (Francis and Kaplan), the downstream bypass, and spill remained consistent for immediate and latent survival estimates for those routes.