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June 12, 2018
VIA E-FILING

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

Pejepscot Hydroelectric Project (FERC No. 4784-095)
Revised Study Plan

Dear Secretary Bose:

Pursuant to the Commission's regulations at 18 C.F.R Section 5.13, Topsham Hydro Partners Limited Partnership (L.P.) (Topsham Hydro) herein files the Revised Study Plan (RSP) for the relicensing of the Pejepscot Hydroelectric Project (FERC No. 4784). A Proposed Study Plan (PSP) was filed on February 12, 2018 and study plan meeting was held on March 22, 2018. Topsham Hydro received timely comments on the PSP from the Maine Department of Environmental Protection, Maine Historic Preservation Commission, National Marine Fisheries Service, and the United States Fish and Wildlife Service. The RSP addresses the comments received.

Topsham Hydro is providing a copy of the RSP to the appropriate federal and state agencies, Indian tribes, local governments, and members of the public likely to be interested in the proceeding, as set forth on the attached distribution list.

Per the Commission's regulations, 18 C.F.R. Section 5.13, comments on the RSP are due to the Commission within 15 days of this filing (June 27, 2018).

If there are any questions or comments regarding the RSP, please contact me by phone at (207) 755-5605 or by email at Randy.Dorman@brookfieldrenewable.com.

Sincerely,

Randy Dorman
Licensing Specialist

Attachment: Pejepscot Hydroelectric Project RSP
cc: Distribution List

DISTRIBUTION LIST
Pejepscot Hydroelectric Project (FERC No. 4784)
Revised Study Plan

I, Randy Dorman, Licensing Specialist, Brookfield Renewable, hereby certify that copies of the foregoing document have been transmitted to the following parties on June 12, 2018.

Randy Dorman — June 12, 2018
Licensing Specialist

One copy, via e-filing to:

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Via email or electronic link, or one copy on compact disc,
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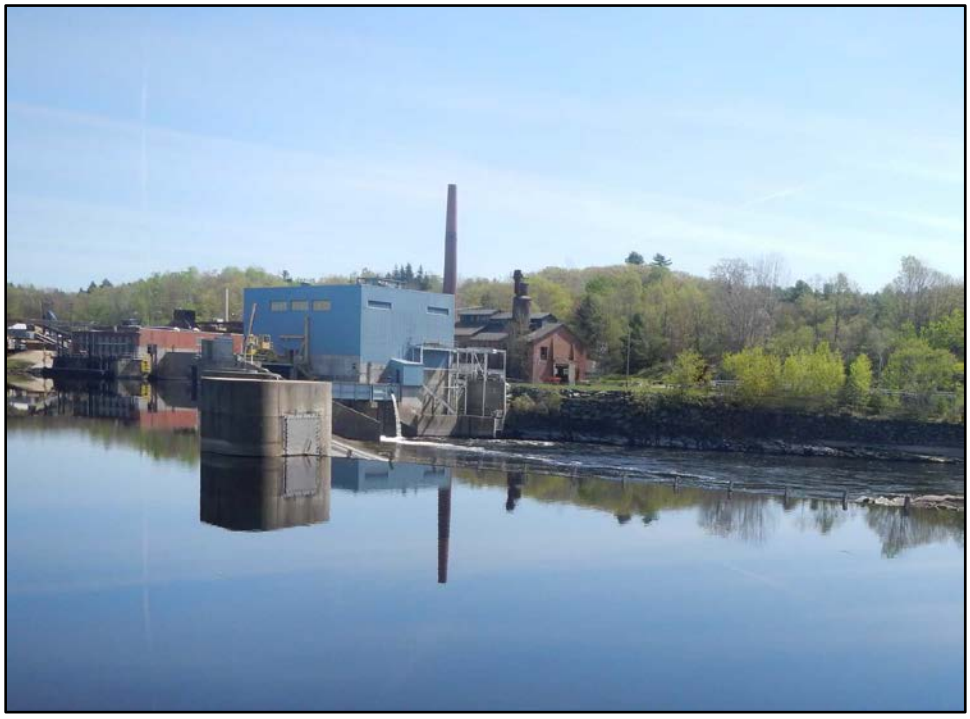
REVISED STUDY PLAN
PEJEPSCOT HYDROELECTRIC PROJECT
(FERC No. 4784)



Submitted by:

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150 Main Street
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Prepared by:

GOMEZ AND SULLIVAN ENGINEERS

June 2018

Brookfield

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LIST OF ABBREVIATIONS AND DEFINITIONS

AIC	Akaike's Information Criterion
APE	Area of Potential Effect
ARWC	Androscoggin River Watershed Council
ASMFC	Atlantic States Marine Fisheries Commission
Brookfield	Brookfield Renewable
CARMA	MHPC Cultural and Architectural Research Management Archive
CFR	Code of Federal Regulations
cfs	Cubic feet per second
CJS	Cormack-Jolly-Seber
Commission	Federal Energy Regulatory Commission
CWA	Clean Water Act
DO	Dissolved Oxygen
El.	Elevation
EPA	Environmental Protection Agency
EPT	Ephemeroptera, Plecoptera, and Trichoptera
ESA	Endangered Species Act
FERC	Federal Energy Regulatory Commission
FLA	Final License Application
Ft.	Foot
GOM DPS	Gulf of Maine Distinct Population Segment of Atlantic salmon
HPMP	Historic Properties Management Plan
ILP	Integrated Licensing Process
ISR	Initial Study Report
kW	kilowatt
License Application	Application for New License submitted to FERC no less than two years in advance of expiration of an existing license. See FLA
Licensee	Topsham Hydro Partners Limited Partnership
LWD	Large Woody Debris
Topsham Hydro	Topsham Hydro Partners Limited Partnership
m	Meter
MDDS	Maine Damselfly and Dragonfly Survey

MDEP	Maine Department of Environmental Protection
MDIFW	Maine Department of Inland Fisheries and Wildlife
MDMR	Marine Department of Marine Resources
ME	Maine
mg/l	Milligrams per liter
mgd	Million gallons per day
MHPC	Maine Historic Preservation Commission
ml	Milliliter
MNAP	Maine Natural Areas Program
MRSA	Maine Revised Statutes Annotated
MW	Megawatt
MWh	Megawatt hour
NEPA	National Environmental Policy Act
NGO	Non-Government Organization
NMFS	National Oceanic and Atmospheric Administration; National Marine Fisheries Service (aka NOAA Fisheries)
NOI	Notice of Intent
NRHP	National Register of Historic Places
NWI	National Wetlands Inventory
PA	Programmatic Agreement
PAD	Pre-Application Document
PCBs	Polychlorinated Biphenyls
PME	Protection, Mitigation and Enhancement Measures
ppm	Parts per million
Project	Pejepscot Hydroelectric Project (FERC No. 4784)
Project Area	The area within the FERC Project boundary for the Pejepscot Project
Project boundary	The boundary line defined in the Project license issued by FERC that surrounds those areas needed for operation of the Project. In the case of the Pejepscot Project, the Project boundary follows El. 75.0 (mean sea level) except in the vicinity of the dam and powerhouse and at the upstream limit of the reservoir.
Project Vicinity	The general geographic area in which the Project is located.
PSP	Proposed Study Plan
QA/QC	Quality Assurance/Quality Control

RM	River mile
RSP	Revised Study Plan
Run-of-river	A project that uses the flow of a river with little to no reservoir capacity for storing water
rpm	Revolutions per minute
RSP	Revised Study Plan
TE	Threatened or Endangered
SD1	Scoping Document 1
SD2	Scoping Document 2
SHPO	State Historic Preservation Officer
SPD	Study Plan Determination
sqm	Square mile
TMDL	Total Maximum Daily Load
USFWS	United States Fish and Wildlife Service
USGS	United States Geological Survey
VLMP	Volunteer Lake Monitoring Program
VRMP	Volunteer River Monitoring Program
WQC	Water Quality Certification
7Q10	Lowest seven-day average stream flow with a 1 in 10 probability of occurring in any year

PEJEPSCOT HYDROELECTRIC PROJECT

REVISED STUDY PLAN

1.0 INTRODUCTION

Topsham Hydro Partners Limited Partnership (L.P.) (Topsham Hydro or Licensee), an indirect member of Brookfield Renewable (Brookfield), is in the process of relicensing the 13.88-megawatt (MW) Pejepscot Hydroelectric Project (Project) (FERC No. 4784) with the Federal Energy Regulatory Commission (FERC or Commission). The Project is located on the Androscoggin River in the village of Pejepscot and the Town of Topsham, Maine (ME) to the east, the Town of Lisbon to the north, and the Town of Durham and the Town of Brunswick to the west. The Project straddles the border between Cumberland and Sagadahoc counties and extends into Androscoggin County. The current license was issued on September 16, 1982 and expires on August 31, 2022. Topsham Hydro is not currently proposing any changes to the Project as part of the relicensing.

Topsham Hydro is using FERC's Integrated Licensing Process (ILP) as established in Title 18 CFR, Part 5. Topsham Hydro filed a Pre-Application Document (PAD) and Notice of Intent (NOI) to seek a new license for the Project on August 31, 2017. The PAD provides a description of the Project, including its structures, operations, and potentially affected resources. Electronic copies of the PAD are available on FERC's website (www.ferc.gov).

Topsham Hydro distributed the PAD and NOI simultaneously to Federal and state resource agencies, local governments, Native American tribes, members of the public, and others thought to be interested in the relicensing proceeding. Following the filing of the PAD, FERC prepared and issued Scoping Document 1 (SD1) on October 30, 2017. FERC also held agency and public scoping meetings on November 28, 2017 and a site visit on November 29, 2017. The FERC Process Plan and Schedule provided agencies and interested parties an opportunity to file comments on the PAD and SD1 and request studies by December 29, 2017. FERC subsequently issued Scoping Document 2 on February 5, 2018. Topsham Hydro filed a Proposed Study Plan (PSP) on February 12, 2018 and held a Study Plan Meeting on March 22, 2018. Topsham Hydro received timely comments on the PSP from the Maine Department of Environmental Protection (MDEP), Maine Historic Preservation Commission (MHPC), National Marine Fisheries Service (NMFS), and the United States Fish and Wildlife Service (USFWS). In addition, on April 27, 2018, Topsham Hydro held a meeting with NMFS to further clarify their information needs and discuss potential modifications to the PSP and their study requests. Minutes from the meeting are included in Appendix A.

Based on the PSP comments and the focused discussions with agencies and interested parties, Topsham Hydro has prepared this Revised Study Plan (RSP) per FERC's regulations at 18 CFR § 5.13. The purpose of this RSP is to provide FERC and the agencies with a plan providing descriptions of the studies proposed by Topsham Hydro to inform the relicensing process. Section 7.0 of this RSP provides all the individual studies proposed by Topsham Hydro to gather additional information needed to adequately analyze the potential effects of relicensing the continued operation of the Project on project-related developmental and non-developmental

resources. The following study plans are included in this RSP for implementation during the 2018 and 2019 field seasons, as appropriate.

1. Water Quality Assessment: Update baseline information and document concentrations of dissolved oxygen, temperature, and other parameters, as appropriate, upstream and downstream of the Project facilities.

2. Tailwater Benthic Macroinvertebrate Survey: Survey the benthic macroinvertebrate community downstream within the Project tailwater.

3. Stranding Evaluation: Conduct a reconnaissance-level evaluation of the potential for stranding through a combination of photo-documentation and on-site flow demonstration with agency staff.

4. Eel Monitoring Survey: Conduct surveys of upstream migrating eel presence/abundance at the Project to identify where eels concentrate when staging in pools or attempting to ascend wetted structures; and identify potential locations for permanent eel trap/pass structures.

5. Largemouth and Smallmouth Bass Spawning Habitat Survey: Conduct an assessment of Largemouth and Smallmouth bass spawning habitat and nesting areas within the Project impoundment.

6. Fish Entrainment and Turbine Survival Assessment: Qualitatively assess the entrainment and impingement potential, as well as the turbine survival of fish at the Project.

7. Evaluation of Spring Migration Season Fish Passage Effectiveness: Evaluate the effectiveness of the existing upstream and downstream fish passage facilities for adult American shad and river herring during the migration season (May 1 - Jul 31).

8. Evaluation of Fall Migration Season Fish Passage Effectiveness: Determine the effectiveness of the existing downstream fish passage facilities for juvenile clupeids and adult American eel during the outmigration season (August 1- November 30).

9. Wildlife Resources Survey: Document observations of wildlife resources and habitat in the Project area and search for threatened or endangered (TE) species or unique habitat.

10. Botanical Resource Survey: Document the botanical resources within the Project area and search for TE and non-native invasive botanical species.

11. Recreation Facilities Inventory and Use Assessment: Conduct a recreation facilities inventory and condition assessment as well as an assessment of recreation use.

12. Historic Architectural Survey: Identify, locate, and evaluate historic architectural resources within the Area of Potential Effect (APE), and make recommendations about whether any additional sites are eligible or potentially eligible for listing to the National Register of Historic Places (NRHP).

13. Historic Archaeological Phase I Survey: Conduct a Phase I assessment survey on areas within the APE with a high likelihood for the presence of historic period archaeological resources, and make recommendations about whether any additional sites are eligible or potentially eligible for listing to the NRHP.

14. Precontact Period Archaeological Survey: Evaluate areas in the APE that have not been previously evaluated for Precontact period archaeological resources and make recommendations about whether any additional sites are eligible or potentially eligible for listing to the NRHP.

Section 7.0 also provides information on the goals and objectives of each study; the relationship of the study plan to the issues identified in the PAD, SD1 and scoping process; known resource management goals; methodology; and scope, schedule and budget information as per the requirements of 18 CFR § 5.11.

Note that, based upon FERC's Process Plan and Schedule, FERC's Study Plan Determination (SPD) will not be issued until July 12, 2018. In order to initiate study efforts during the 2018 field season, Topsham Hydro may undertake some studies in advance of the SPD, if there appears to be general support for the scope and methodology as described in this RSP.

2.0 COMMENTS ON THE PROPOSED STUDY PLAN

Comments on Topsham Hydro's PSP (including any revised information or study requests) were due May 13, 2018. As noted above, MDEP, MHPC, NMFS and USFWS all provided timely comments, which are summarized in Table 2.0-1.

Table 2.0-1: Summary of PSP Comments

Agency	Comments	Topsham Hydro Response
MDEP-1	**Trophic State Impoundment Survey:** The study plan proposal is in accordance with the Department's sampling protocols and is expected to provide data sufficient for an assessment of the impact of facility operations on the Project's impounded waters.	Comment noted.
MDEP-2	**Continuous Tailwater Monitoring Survey.** The applicant's study plan proposal substantially follows the Department's sampling protocols, however specifies that sampling would likely occur during a 9-week period of low flow, from July 1 to August 31. The Department's protocol indicates that sampling should be conducted during the summer when low flow is coupled with daily average water temperatures exceeding 24 degrees Celsius. The Department recognizes the likelihood that water temperatures may be highest during the months of July and August, however the study plan should target a period when the water temperature and flow characteristics both meet the sampling protocol, to ensure that the sampling effort collects data representative of target conditions. When reviewing both flow and temperature, the applicant may find that the window of optimal DO monitoring may occur from July through August, or may shift to mid-July to mid-September (or even later), depending on weather, precipitation and other factors.	As noted by MDEP, Topsham Hydro will conduct the sampling during the period when the water temperature and flow conditions meet MDEP's protocol. This has been clarified in the RSP (Section 7.1.1).
MDEP-3	**Tailwater Benthic Macroinvertebrate Study:** MDEP notes that while it has agreed that it may waive the requirement for sample evaluation by a professional freshwater macroinvertebrate taxonomist who is certified by the Society of Freshwater Science, a waiver should be sought prior to collecting the samples.	Comment noted. This has been clarified in the RSP (Section 7.1.2).
MHPC-1	The proposed scopes of work for architectural and archaeological surveys outlined in the proposed study plan dated February 2018 are acceptable to our office.	Comment noted.

Agency	Comments	Topsham Hydro Response
USFWS-1	In an April 3, 2018 email to the Licensee, my staff noted that in the most recent Pejepscot Fishway Annual report (2017), 212 white suckers were passed at the project. This new information reduces the need for the requested two-year telemetry study. In the email my staff requested that the fishway be opened as soon as flows allow and it is safe. Once the fishway is operating, water temperature and numbers of white suckers passing are to be collected on a daily basis. The Licensee agreed to collect this information and provide to the resource agencies.	Comment noted. Topsham Hydro has agreed to provide water temperature data and white sucker counts from the Project fish lift to USFWS in 2019, as conditions permit.
USFWS-2	**The NMFS's Downstream Fish Passage Effectiveness and Survival: Behavior, Entrainment and Impingement at the Intake Study**: The Service supports implementing this study because the effectiveness of the downstream passage facility at the new powerhouse has never been evaluated and survival of fish through the project's turbines is not known.	Topsham Hydro has proposed to conduct downstream migration studies for adult American shad and river herring, juvenile clupeids, and adult American eel, which will yield information on route of passage at the Project (i.e., downstream bypass, turbine, spill, etc.) as well as incidental information on survival rates via the various passage routes. Topsham Hydro is proposing to conduct a desktop entrainment, impingement, and turbine survival study at the Project, as opposed to a field based direct turbine injection study as requested by NMFS. Use of desktop entrainment, impingement, and turbine survival studies has long been a standard practice as part of FERC relicensing processes. The desktop analysis will provide reasonable estimates of entrainment, impingement and turbine survival at the Project at a much lower cost.
NMFS-1	**Study Request 7: Headpond Predation**: We disagree with Topsham Hydro's assessment of a lack of project nexus. As indicated in our December 28, 2017 request, operation of the Project, as currently	Per FERC's 2012 Guide to Understanding and Applying the Integrated Licensing Process Criteria, FERC uses current conditions as its

Agency	Comments	Topsham Hydro Response
	proposed, will continue to impose lacustrine conditions in the headpond. Those lacustrine conditions have the potential to benefit non-native predators and slow migration of anadromous species, thereby impacting survival of those migratory species through the project area, which include highly endangered Atlantic salmon. We note that requesting information to assess continuing project effects is consistent with FERC policy, outlined in FERC's 2012 Guide to Understanding and Applying the Integrated Licensing Process Criteria. In fact, we note that on page 14 of Topsham Hydro's Proposed Study Plan, Topsham Hydro identifies a project nexus for a study (Largemouth and Smallmouth Bass Spawning Habitat Survey) that proposes to gather baseline information on habitat for largemouth and smallmouth bass - the same non-native predators for which we are requesting predation information. We also disagree with Topsham Hydro's assessment that our requested study would not inform the development of license requirements. While we acknowledge that the management of nonnative species is not necessarily within the purview of a potential license requirement, we note that the project does directly affect the survival of anadromous fish by way of the project's efficacy for safe, timely, and effective passage. As such, structures and/or operations that affect the efficacy of the project for safe, timely, and effective fish passage are absolutely within the purview of FERC license requirements, and would represent a possible strategy for any mitigation or enhancement measures related to the Project's indirect effects on anadromous fish mortality in the project impoundment.	baseline for evaluating project effects and alternatives. This consists of the environment as it exists at the time of licensing. The lacustrine conditions described by NMFS in the headpond have existed since dam construction in the late 1800's, which predates the project by almost 100 years. FERC is required to assess continuing project effects, if the effects can be addressed under project operation. It is unclear to Topsham Hydro what change in project operation could mitigate any impacts associated with headpond predation by non-native species. The fish assemblage present in the Project area is largely a result of federal and state resource agency management efforts, and other than the movement of diadromous species, the Project has little impact. NMFS seems to imply a relationship between potentially poor downstream passage efficiency at the Project and predation impacts within the headpond. However, Topsham Hydro has proposed several studies to assess downstream passage effectiveness for a variety of diadromous fish species, which will be more than sufficient to inform any necessary mitigation measures during the next license term. Moreover, NMFS' study objectives include 1) validating the presence and estimate the relative abundance of non-native piscivorous predators in

Agency	Comments	Topsham Hydro Response
		the Project impoundment; 2) developing consumption and predation indices for non-native predators; and 3) developing a bioenergetics model to estimate prey consumption for non-native predators of different age cohorts during anadromous fish migration period. It is not clear how NMFS stated objectives for the headpond predation study would inform PME measures to project operations, as the proposed study appears to be a data gathering or research oriented exercise.
NMFS-2	**Study Request 9: Sediment Storage and Mobility**: We disagree with Topsham Hydro's assessment of a lack of project nexus. While we acknowledge that information offered by Topsham Hydro regarding headpond fluctuations would seem to suggest that the project exerts relatively little influence on sediment recruitment into the project area, the Project's 48-foot-high dam undoubtedly has trapped and will continue to trap sediment and affect sediment mobility over the term of any new license – thereby establishing a nexus to project effects. Topsham Hydro states that sediment transport at the Project is "...likely...in a state of equilibrium," and that the Project is "...likely to have little impact on sediment storage and transport." However, Topsham Hydro provides no data or existing information to support these statements, further highlighting the need for the information we requested. Topsham Hydro indicates that the results of the study would do little to inform the development of license requirements. We disagree. Understanding the project's effect on sediment storage and mobility could lead to a number of potential protection, mitigation, or enhancement measures, including, but not limited to a sediment management plan.	Per FERC's 2012 Guide to Understanding and Applying the Integrated Licensing Process Criteria, FERC uses current conditions as its baseline for evaluating project effects and alternatives. This consists of the environment as it exists at the time of licensing. The Project dam has been in place since the late 1800's, which predates the Project by almost 100 years, and has been trapping sediment since that time. FERC is required to assess continuing project effects, if the effects can be addressed under project operation. It is unclear to Topsham Hydro what change in project operation could mitigate any impacts associated with sediment storage and transport. For example, given the Project's run-of-river operation and lack of appreciable water storage, flushing flows are not applicable. In addition, the lack of low level gate(s) would preclude sediment flushing flows as well.

Agency	Comments	Topsham Hydro Response
NMFS-3	**Study Request 10: Large Woody Debris:** First, we disagree with Topsham Hydro's assessment of a lack of project nexus. While we acknowledge that information offered by Topsham Hydro regarding headpond fluctuations would seem to suggest that the project exerts relatively little influence on LWD recruitment into the project area, the Project's 48-foot-high dam undoubtedly has trapped and will continue to trap LWD and affect LWD mobility over the term of any new license thereby establishing a nexus to project effects. Furthermore, at the March 22, 2018 Study Plan Meeting, Topsham Hydro indicated that it currently disposes of a majority of LWD trapped at the dam. That Topsham Hydro actively manages LWD at the Pejepscot Project as part of its normal operations further establishes a nexus to the study of this project-affected resource. Second, we disagree with Topsham Hydro's implication that our study request represents a study of a pre-project condition and would not inform any potential license requirements. As indicated in our original study request, we are requesting information regarding the continuing effect of LWD entrapment. We note that requesting information to assess continuing project effects is consistent with FERC policy, outlined in FERC's 2012 Guide to Understanding and Applying the Integrated Licensing Process Criteria. Understanding the project's effect on LWD entrapment and mobility could lead to a number of potential protection, mitigation, or enhancement measures, including, but not limited to a LWD management plan. Finally, we disagree with Topsham Hydro that its proposed Largemouth and Smallmouth Bass Spawning Habitat Survey would gather information suitable to provide information regarding the Project's effects on LWD. The proposed bass study includes visual surveys, which at best would document the location of LWD associated with bass habitat in the project impoundment. It would not provide information regarding the volume, size, and type of wood trapped at the Project, nor	As stated previously and outlined in FERC's 2012 Guide to Understanding and Applying the Integrated Licensing Process Criteria, FERC uses current conditions as its baseline for evaluating project effects and alternatives. This consists of the environment as it exists at the time of licensing. The dam has trapped LWD since its original construction in the late 1800's, which predates the project by almost 100 years. FERC is required to assess continuing project effects, if the effects can be addressed under project operation. It is unclear to Topsham Hydro what change in project operation could mitigate any impacts associated with LWD movement. Topsham Hydro does remove some woody debris from the Project trashracks as part of normal operation and maintenance activities. However, state regulations require that woody debris when removed from the river, cannot be placed back into the waterway. LWD that is not removed by Topsham Hydro either remains in the Project impoundment or is passed over the spillway during high flow events. NMFS' study objectives include quantifying the volume, type, and location of large woody debris. It is not clear to Topsham Hydro how this information would be useful to inform PME measures to project operations to mitigate any impacts, as the proposed study appears to be a data gathering or research oriented exercise.

Agency	Comments	Topsham Hydro Response
	would it identify management alternatives associated with that trapped LWD, as requested by our study.	
NMFS-4	**Study Request 11: Indicators of Hydrologic Alteration (IHA)** *(also referred to as the Unimpaired Hydrology Study)***:** As discussed below under Study Request 6 Instream Flow Study, we now have a more complete understanding of the limits of flow control at the Pejepscot Project. However, in spite of the potential flow-setting limitations imposed by the run-of-river operation, where inflow= outflow, we note that the Project still has a broad capability to manipulate flows spatially across the river channel. In fact, the licensee currently adaptively manipulates flows in an attempt to maximize the survival of downstream migrating Atlantic salmon smolts. Results of the IHA will provide valuable information outside simple flow-setting applications. The evolutionary flow variables IHA provides information about, which are described in our study request, can be used to identify potential enhancements to project operations, including, but not limited to informing the timing and duration of flows directed towards attraction for upstream migration, or spill for downstream migration. For these reasons, we disagree with Topsham Hydro that the requested IHA study demonstrates no nexus to project effects and that the study would not inform the development of license requirements. We also disagree with Topsham Hydro that the conduct of an IHA study is contrary to FERC precedent regarding gathering information on pre-project conditions. While IHA utilizes pre-project conditions as an element of the overall analysis, the application of the information produced by the IHA is not confined to pre-project conditions. In fact, FERC has approved IHA studies as a tool for obtaining information on environmental flow variables at a number of FERC relicensing proceedings, including, but not limited to: Jackson (P-2157); McCloud-	Topsham Hydro maintains that the study has no nexus to Project operations. The Project operates in a run-of-river mode and does not manipulate the overall flow volume passing the Project. NMFS noted that Topsham Hydro is currently testing various spill scenarios in order to enhance downstream passage for Atlantic salmon smolts, and thus manipulating the specific discharge point of water at the Project (i.e., turbine versus spillway). However, the appropriate spillage volumes that are conducive to passing fish downstream efficiently will largely be informed by the results of radio telemetry studies. An IHA study would do little to assist in this effort. Similarly, the upstream attraction flows cited by NMFS are typically prescribed based on USFWS/NMFS design criteria for fish passage facilities. It is unclear to Topsham Hydro how the results of the IHA study would override or otherwise assist in informing the attraction flow criteria set by USFWS/NMFS. NMFS asserts that FERC has set precedent in requiring IHA studies at other licensing proceedings, and cites several projects. The examples cited by NMFS have no bearing or relevance to the Pejepscot Project and further bolster Topsham Hydro's belief that this study is unnecessary. Review of available information

Agency	Comments	Topsham Hydro Response
	Pit (P-2106); Drum-Spaulding/Yuba-Bear (P-2310, P-2266); and Merced River (P-2179). Finally, referring to a statement in our study request, Topsham Hydro notes that it is not responsible for the mitigation of the impacts of other hydroelectric projects. We acknowledge that current regulatory limitations prevent Topsham Hydro from any requirement to protect, mitigate, or enhance for the direct effects of other hydroelectric projects. However, we note our section 7 Endangered Species Act (ESA) consultation will evaluate the direct and indirect effects of the project, as well as the effects of other activities that are interrelated or interdependent with that action. Additionally, FERC evaluates cumulative impacts of hydropower projects in its National Environmental Policy Act analysis, and when needed, has employed the inclusion of either standard or special re-opener articles in each license to address the effects of cumulative effects of multiple hydropower projects in a river basin. As described here and in our study request, project operations can manipulate flows within the river channel. Migratory fish rely on hydrologic cues to aid them in their migration, cues which an IHA study is designed to assess.	pertaining to the projects cited by NMFS illustrates numerous significant differences between the cited projects and the Pejepscot Project. These differences are summarized in Table 2.0-2. For example, the cited project examples range in size from 104-MW to 368-MW, are multi-development projects that span multiple river systems and rely on various water diversions and transfers, and operate as peaking facilities. The results of the IHA analyses conducted at the cited example projects were used to characterize peak and base flow hydrographs in project bypasses, evaluate future flow release scenarios, and inform instream flow conditions, among other uses - none of which are relevant to this relicensing proceeding. As noted above, the results of the proposed fish passage evaluation studies combined with the existing USFWS/NMFS design criteria will be adequate to accomplish NMFS' stated objectives for the IHA analysis (i.e., informing the timing and duration of flows directed towards attraction for upstream migration, or spill for downstream migration). Finally, it should be noted that during the relicensing proceeding for the Hawk's Nest Hydroelectric Project (P-2512), stakeholders requested that an IHA analysis be conducted in addition to the IFIM and PHABSIM methodologies proposed by the applicant to examine bypass reach aquatic habitat use and instream flow. The applicant did not incorporate

Agency	Comments	Topsham Hydro Response
		the stakeholder request into their study plan. In the Study Plan Determination, FERC agreed with the applicant and noted that "*IHA and ELOHA studies would be unnecessary because the IFIM and PHABSIM approach would provide the information necessary to inform a determination of appropriate flows for the Hawks Nest bypass reach.*" Although the Hawks Nest Project layout and the application of IHA in the cited example is different from that of Pejepscot, the underlying argument remains the same. In this case, the IHA analysis is unnecessary given that the proposed fish passage evaluation studies will provide the information necessary to inform upstream and downstream passage enhancements, if necessary.
NMFS-5	**Study 1: Anadromous Fish Upstream Passage Efficiency Study:** However, we note that Topsham Hydro is not proposing to include any analysis of adult Atlantic salmon passage, as we requested. Topsham Hydro states that it "... feels that the measures contained in the SPP are more than adequate to inform the development of license requirements related to this issue." The potential license term for this project will be 30-50 years, and therefore, our consultation will consider effects of the action over that term. The 30-50 year term is considerably lengthier than the other actions we previously considered for this project. As such, our information needs to evaluate the project effects to salmon and the ecosystem they depend on over that term are necessarily different. While we appreciate Topsham Hydro's collaboration on the development of the Project's existing Species Protection Plan (SPP), we would like to clarify that while the information and analysis developed under the existing SPP will certainly help to inform the next SPP, we do not concur with the	Topsham Hydro does not believe a desktop evaluation of upstream passage effectiveness for adult Atlantic salmon would provide meaningful results. It is more likely that the proposed radio telemetry based upstream passage evaluations for other species (e.g., American shad and river herring) will be more informative in terms of approximating the efficiency of the Project fish lift. Moreover, Topsham Hydro's commitment to upstream passage effectiveness studies for Atlantic is described in the existing SPP. The existing SPP states, "*The Licensee will continue consultation with NMFS and resource agencies regarding the*

Agency	Comments	Topsham Hydro Response
	assessment here that our information needs with regard to the project's impacts on salmon have been fulfilled. Topsham Hydro correctly indicates that they were not able to conduct upstream passage efficiency studies for Atlantic salmon, as required under the interim SPP (2012 - 2016), due to insufficient adult returns to the Androscoggin River; and that the focus of their studies has therefore been on downstream survival of salmon smolts. As continued low returns are expected over the remaining 5 years of the current SPP, we do not expect that it will provide any information at all regarding upstream passage efficiency for Atlantic salmon at the Pejepscot Project. As such, we still request a subjective expert analysis regarding the effectiveness of the Project for upstream adult Atlantic salmon passage.	*protection of Atlantic salmon during the term of this SPP and will re-initiate Section 7 consultation with NMFS during the relicensing process which begins in 2017."* And further, the NMFS Biological Opinion states that *"Because this Opinion only considers the effects of continued operation of the project pursuant to the proposed amended license, the accompanying Incidental Take Statement only exempts take until the license expires in 2022. After that time, this Opinion will no longer be valid. We expect a new consultation will be necessary to consider effects of any future proposed relicensing of the Pejepscot Project."* Topsham Hydro fully expects to continue consultation with NMFS to develop an SPP that will cover the period of the next license term. Topsham Hydro anticipates that the new SPP will contain measures to address upstream passage efficiency for adult Atlantic salmon. As such, and for the reasons stated above, Topsham Hydro does not believe the proposed study is appropriate at this time.

Agency	Comments	Topsham Hydro Response
NMFS-6	**Study 2: Downstream Fish Passage Effectiveness and Survival: Behavior, Entrainment and Impingement at the Intake** Topsham Hydro is proposing to conduct a desktop entrainment, impingement, and turbine survival study, as opposed to an empirical test, which we requested. Topsham Hydro states that such desktop studies 1) have been commonly used as part of FERC relicensings; 2) will provide "reasonable" estimates of entrainment, impingement and turbine survival; and 3) will be less costly, while providing similar results as our requested empirical evaluation. We disagree with Topsham Hydro that its proposed desktop evaluation is likely to render an estimate of the project-related entrainment effects that is suitable and representative of existing real-world effects. Specifically, we note that: 1) Topsham Hydro's proposed methodology will not provide information regarding the type or source of mortality associated with its project's effects; 2) it is known that the efficacy of turbines for safe passage may change over time, thus potentially biasing the results of any desktop evaluation; and 3) the Pejepscot Project's four turbine units (three Francis and one Kaplan) do not operate with equal consistency (i.e. some units operate more frequently than others; some units may not operate at all during the study period), therefore, the study as proposed would be unlikely to gather the information necessary to fully evaluate the efficacy of all possible passage routes at the project. For these reasons, we continue to request a direct empirical evaluation of turbine entrainment.	Topsham Hydro has proposed to conduct downstream migration studies for adult American shad and river herring, juvenile clupeids, and adult American eel, as well as Atlantic salmon smolts, which will yield information on route of passage (i.e., downstream bypass, turbine, spill, etc.), as well as incidental information on survival rates via the various passage routes. Topsham Hydro is proposing to conduct a desktop entrainment, impingement, and turbine survival study at the Project, as opposed to a field based direct turbine injection study as requested by NMFS. The proposed desktop and empirical passage studies for downstream passage will provide adequate information on the existing downstream passage survival success at the Project for a variety of species. In addition, review of available Project operations data combined with the results of the empirical downstream migration study can be used to determine the impact, if any, of the varied operation of the units. The desktop technique for evaluating downstream passage survival at hydropower facilities has regularly been accepted by FERC as a valid approach during numerous licensing efforts.

Agency	Comments	Topsham Hydro Response
NMFS-7	S**tudy Requests 4, 5, 12: Downstream Passage Alternatives, Computational Fluid Dynamics Study, and Project Acoustic Effects** At the March 22, 2018 Study Plan Meeting, we agreed with Topsham Hydro that the three studies we requested above were intended to gather information on potential protection, mitigation and enhancement measures and thus, their necessity and specific methodology would most appropriately be evaluated upon the conclusion of its proposed passage effectiveness studies. At both the March 22, 2018 meeting and our April 27, 2018 meeting with Topsham Hydro, we clarified that our three requested studies should be included in the Final Study Plan as an element of a phased study approach in conjunction with the two proposed passage effectiveness studies. As such, we request a requirement for Topsham Hydro consult with resource agencies upon the conclusion of its proposed passage effectiveness studies regarding the need for the downstream passage alternatives study, the acoustic effects study, and the CFD study in the second study season.	Topsham Hydro has proposed several upstream and downstream fish passage studies to identify whether a passage issue exists currently at the Project passage facilities. The three referenced studies may not be necessary should the proposed upstream and downstream passage effectiveness studies show that the Project provides safe, timely and effective upstream and downstream fish passage. However, Topsham Hydro has modified the RSP to clarify the position that the referenced studies might be appropriate in the future but are, at this point, premature. Once the upstream and downstream passage effectiveness studies have been conducted, the necessary information gathered, and the extent of the problem (if any) understood, then Topsham Hydro would consider conducting the downstream passage alternatives and Project acoustics effects studies, in consultation with stakeholders during either the 2019 or 2020 study seasons, prior to the filing of the Final License Application. With regard to the CFD study, Topsham Hydro believes this effort would be best utilized as a tool to support the final design phase of any upstream or downstream fish passage facility improvements at Project. As such, Topsham Hydro is proposing to conduct this study, if needed, as part of a post-licensing design effort.

Agency	Comments	Topsham Hydro Response
NMFS-8	**Study 8: Stranding** We requested a study of potential stranding areas related to project effects. Topsham Hydro's February 12, 2018 Proposed Study Plan did not include any proposal to study stranding. However, in our April 27, 2018 meeting, Topsham Hydro proposed to conduct a reconnaissance level stranding evaluation of stranding through a combination of photo-documentation and onsite flow demonstration in consultation with us. We believe that this method will effectively identify stranding-prone areas and associated project operational scenarios, consistent with the intent of our original study request. As such, we are no longer requesting an evaluation of stranding using surface or hydraulic modeling methods.	Topsham Hydro proposes to conduct a reconnaissance level stranding evaluation through a combination of photo-documentation and on-site flow demonstration in consultation with NMFS (see Section 7.2.6).
NMFS-9	**Study Request 3: Downstream Fish Passage Effectiveness Study for Atlantic salmon Smolts** At both the PSP meeting and our April 27, 2018 meeting, Topsham Hydro signaled its intent to 1) conduct a follow-up study of downstream fish passage effectiveness for Atlantic salmon smolts, if the current study is unable to demonstrate passage efficiency sufficient to meet or exceed the 92% survival standard dictated by the Project's existing SPP; and 2) consult with us to develop a new SPP during relicensing that would presumably include a new survival standard as well as provisions to study the passage effectiveness of any facility or operational modifications proposed in the license application and in light of any new survival standard. Given that Topsham Hydro intends to express these commitments in the Revised Study Plan, which indicate Topsham Hydro's expectation that the relicensing process will likely result in facility modifications and/or project operations, we are no longer requesting an additional study season of downstream smolt passage effectiveness at this time.	Topsham Hydro acknowledges that a second year of Atlantic salmon smolt study may be necessary if the 2018 study indicates that the Project (even with additional spill measures) results in an exceedance of take. Topsham Hydro fully expects to continue consultation with NMFS to develop an SPP that will cover the period of the next license term. Topsham Hydro anticipates that the new SPP will contain measures to address any facility or operational modifications proposed in the license application.

Agency	Comments	Topsham Hydro Response
NMFS-10	**Study Request 6: Instream Flow Study** Upon review of Topsham Hydro's comments included in their Proposed Study Plan, as well as information gathered during discussions at the March 22, 2018 PSP meeting, we now understand that the Pejepscot Project does not demonstrate the capability to control the volume of flow downstream of the project to any appreciable degree, regardless of the minimum flow requirement imposed by the current license. As such, we are no longer requesting a study of instream flow.	Comment noted.

Table 2.0-2: Comparison of Example Projects Cited by NMFS with Pejepscot

	Pejepscot	Jackson	McCloud-Pit	Drum-Spaulding / Yuba-Bear	Merced River
FERC No.	4784	2157	2106	2310 / 2266	2179
Size	13.88-MW	112-MW	368-MW	270-MW	103.5-MW
Project Layout	• 3,278 acre-ft. reservoir • No bypass • 1 dam • 2 powerhouses located at dam	• 153,260 acre-ft. reservoir • 3.8-mile diversion tunnel to powerhouse • 12-mile-long bypass reach • discharge from two turbines diverted to another reservoir for public water supply	• 3 power generating developments • 2 Storage Reservoirs • 2 Regulating Reservoirs • 1 afterbay • 3 powerhouses • 5 dams • 2 tunnels (7.2 and 2.9 mi.) • 2 different rivers	• 40+ interconnected reservoirs • 13 open-channel conveyances • 16 powerhouses • 3 different watersheds	• 2 dams • 2 storage reservoirs - combined capacity 1,029,497 acre-ft.
Mode of Operation	Run-of-River	Reservoir rule curve, peaking	Operates as both a peaking system and load-following system	Storage reservoirs, regulating reservoirs, base-load generating, peaking	Storage reservoirs, peaking

3.0 STUDY PLAN MEETING

Topsham Hydro held the PSP meeting required by the ILP (18 CFR § 5.12) on March 22, 2018 at 9:00 am at the Hampton Inn, 15 Lincoln St, Lewiston, ME 04240. The purpose of the PSP meeting was to clarify the intent and contents of Topsham Hydro's PSP, share initial information or study responses, and identify any outstanding issues with respect to the PSP. In addition, on April 27, 2018, Topsham Hydro held a meeting with NMFS to further clarify their information needs and discuss potential modifications to the PSP and their study requests.

4.0 PROGRESS REPORTS, STUDY REPORTING, MEETINGS

Periodic progress reports for studies implemented during the 2018 field season will be filed with the FERC and provided to agencies and stakeholders, approximately on a quarterly basis, starting after issuance of FERC's SPD. The formal Initial Study Report is scheduled for preparation following the 2018 field season and in no case later than one year following FERC's SPD, which is anticipated by July 12, 2018. Topsham Hydro will schedule the Initial Study Report meeting once the date for the availability of the Initial Study Report is known. Using the schedule in Scoping Document 2, Topsham Hydro anticipates that the Initial Study Report will be available by July 12, 2019 and the Initial Study Report meeting will occur in late July 2019. Topsham Hydro will file an Updated Study Report (year two studies) within the time limits provided in 18 CFR § 5.15(f) as detailed in FERC's Project Process Plan and Schedule published in SD2.

The estimated start and completion dates for studies are provided in Table 4.0-1.

Table 4.0-1: Estimated Start and Completion Field Dates for Proposed Studies

Proposed Study	Estimated Start Date	Estimated Completion Date
Water Quality Assessment	June 2018	October 2018
Tailwater Benthic Macroinvertebrate Survey	July 2018	September 2018
Eel Monitoring Survey	June 2019	August 2019
Largemouth and Smallmouth Bass Spawning Habitat Survey	June 2019	July 2019
Fish Entrainment and Turbine Survival Assessment	August 2019	November 2019
Evaluation of Spring Migration Season Fish Passage Effectiveness	May 2019	July 2019
Evaluation of Fall Migration Season Fish Passage Effectiveness	October 2019	November 2019
Stranding Evaluation	September 2018	October 2018
Wildlife Resources Survey	August 2018	September 2018
Botanical Resource Survey	August 2018	September 2018
Recreation Facilities Inventory and Use Assessment	May 2019	October 2019
Historic Architectural Survey	July 2018	November 2018
Historic Archaeological Phase I Survey	July 2018	November 2018
Precontact Period Archaeological Survey	July 2018	November 2018

5.0 REQUESTED STUDIES NOT ADOPTED

As required by 18 CFR § 5.11(b)(4), if Topsham Hydro does not adopt a requested study, an explanation of why the request was not adopted, with reference to the criteria set forth in §5.9(b), must be included in the RSP.

5.1 Studies Proposed by Topsham Hydro in the PAD with Modification

In the PAD, Topsham Hydro proposed to conduct an adult Alewife and American shad Upstream Passage Evaluation. The methodology for the study consisted of conducting counts of upstream migrating alewife, American shad and other migratory species at the Project fish lift. Counts were to be completed by real-time visual observation and/or video recording during one upstream passage season, in order to ascertain an overall effectiveness of the fish lift. No comments were submitted on this proposal; however, USFWS, NMFS, and MDMR suggested a similar study utilizing a combination of radio telemetry, PIT-tag technology, and split beam hydroacoustics. Topsham Hydro is proposing to conduct this study (see Section 7.2.4) using some of the methodologies proposed by the resource agencies, and as such will not be conducting the study using its previously proposed methodology.

5.2 Study Requests Not Adopted by Topsham Hydro

5.2.1 White Sucker Passage Study

USFWS requested a study to investigate migration timing and passage, and to determine spawning locations for white sucker using radio telemetry technology. As cited by USFWS, white sucker has the most biomass and is the second most abundant native species (behind alosines) within reaches near the Project.

After further consultation with USFWS, in lieu of conducting this study Topsham Hydro has agreed to provide water temperature data and white sucker counts from the Project fish lift to USFWS. Although originally intended for 2018, Topsham Hydro will provide this data in 2019 as conditions permit. Accordingly, per their May 11, 2018 PSP comment letter, USFWS agreed to withdraw the study request.

5.2.2 Downstream Fish Passage Effectiveness Study for Atlantic salmon Smolts

As noted in the PAD, and discussed further below, Topsham Hydro is planning to conduct a one-year downstream passage effectiveness study of Atlantic salmon smolts in 2018, in accordance with the Species Protection Plan (SPP) for the Project. In their study request letter for relicensing, NMFS requested a second year of study. Per the NMFS request, the objective of the additional field season would be to evaluate and validate the effectiveness of the operational spill scenario chosen during the initial study season.

As described in Section 5.3 of the PAD, Topsham Hydro has been engaged in several ongoing studies associated with Atlantic salmon fish passage; these efforts are separate from the relicensing process though they are expected to inform the eventual relicensing proposal. These efforts were included in the five-year interim SPP (2012-2016) that proposed, among other

things, monitoring studies of downstream migrating Atlantic salmon smolts for three years (2013-2015). A subsequent SPP was developed in 2016 and contained measures to protect Atlantic salmon for the period from 2017 to when a new license is issued (current license expires August 31, 2022). Topsham Hydro fully expects to continue consultation with NMFS to develop an SPP that will cover the period of the next license term. Topsham Hydro anticipates that the new SPP will contain measures to address any facility or operational modifications proposed in the license application.

Among the measures proposed in the current SPP (2017-2022) was a one-year downstream passage effectiveness study to be conducted in 2018 to evaluate whole station survival under additional spill conditions and confirm a performance improvement of 3.2 percent over the baseline survival estimate of 88.8 percent, to bring the whole station survival up to a minimum 92 percent. Results of this study will be valuable in determining if any additional operational modifications are appropriate to enhance smolt passage survival at the Project. At this time, the field study has been completed, and study results are pending.

Given this, it is premature to discuss, or commit to, a second season of study until the first year has been completed and the results have been processed and analyzed. However, Topsham Hydro acknowledges that a second year of Atlantic salmon smolt study may be necessary if the 2018 study indicates that the Project (even with additional spill measures) results in an exceedance of take. Until that time, Topsham Hydro has not adopted the study request.

5.2.3 **Downstream Passage Alternatives Study**

NMFS requested a study to develop conceptual engineering designs and expected performance for improved downstream passage facilities at the Project that would reduce delay, increase passage efficiency, and increase survival for downstream migrating adult American eels, river herring, American shad, and Atlantic salmon. NMFS suggested that the following alternatives be analyzed 1) one-inch clear spaced angled racks; 2) 0.5-inch clear spaced racks or less to physically exclude some species, 3) Alden type weirs leading to downstream passages and additional downstream passage near the old powerhouse intake, and 4) other alternatives such as partial depth exclusion screens, surface collectors, and other newer technology.

Topsham Hydro is proposing to conduct downstream migration studies for adult American shad and river herring, juvenile clupeids, and adult American eel, which will yield information on route of passage (i.e., downstream bypass, turbine, spill, etc.) and survival. In addition, Topsham Hydro is proposing to conduct a desktop entrainment, impingement, and turbine survival study for the Project. These studies are described in Section 7.2. This information will be used to determine the overall effectiveness of downstream passage at the Project, and to inform the development of future license requirements. Until these study results become available and any impacts are identified, it is premature to evaluate potential additional downstream passage Protection, Mitigation, and Enhancement (PME) measures. However, once the downstream passage effectiveness studies have been conducted, the necessary information gathered, and the extent of the problem (if any) understood, then Topsham Hydro would consider conducting this follow up study, in consultation with stakeholders. Until that time, Topsham Hydro has not adopted the study request.

5.2.4 **Computational Fluid Dynamics Study**

NMFS requested a CFD modeling study to determine the flow field conditions that exist upstream of the Project powerhouse.

As described previously, Topsham Hydro is proposing to conduct downstream migration studies for adult American shad and river herring, juvenile clupeids, and adult American eel, which will yield information on route of passage (i.e., downstream bypass, turbine, spill, etc.) and survival. In addition, Topsham Hydro is proposing to conduct a desktop entrainment, impingement, and turbine survival study for the Project. These studies are described in Section 7.2.5. This information will be used to determine the overall effectiveness of downstream passage at the Project, and to inform the development of future license requirements. Topsham Hydro is proposing to use these proposed studies in lieu of the development of a CFD model to assess downstream passage effectiveness and identify potential passage impediments. Topsham Hydro believes the results of the proposed radio telemetry studies will be sufficient to assess downstream passage conditions at the Project. However, once the downstream passage effectiveness studies have been conducted, the necessary information gathered, and the extent of the problem (if any) understood, then Topsham Hydro would consider conducting this follow up study, in consultation with stakeholders. Moreover, Topsham Hydro believes the CFD study would be best utilized as a tool to support the final design phase of any upstream or downstream fish passage facility improvements at Project. As such, Topsham Hydro is proposing to conduct this study, if needed, as part of a post-licensing design effort. Until that time, Topsham Hydro has not adopted the study request.

5.2.5 **Instream Flow Study**

NMFS requested a study to assess the relationship between Project discharges and aquatic habitat for Atlantic salmon, alewife, and American shad in the Project tailwater utilizing the IFIM methodology. NMFS suggested quantitatively estimating the effects of a range of flows from approximately the Aquatic Base Flow (ABF) up to the April median flow on the spawning, rearing, and juvenile life stages of Atlantic salmon, alewife, and American shad.

In their subsequent May 14, 2018 PSP comment letter, NMFS withdrew this study request.

5.2.6 **Headpond Predation Study**

NMFS requested a study to evaluate the effect of predation by non-native predators on native anadromous fish in the Project impoundment. NMFS suggested 1) validating the presence and estimate the relative abundance of non-native piscivorous predators in the Project impoundment; 2) developing consumption and predation indices for non-native predators; and 3) developing a bioenergetics model to estimate prey consumption for non-native predators of different age cohorts during anadromous fish migration period. It is not clear how NMFS stated objectives for the headpond predation study would inform PME measures to Project operations, as the proposed study appears to be a data gathering or research oriented exercise.

There is no nexus between Project operations and effects on the predation by non-native predators on native anadromous fish in the Project impoundment, nor would the study inform the

development of license requirements as required by FERC's study plan criteria. The fish assemblage present in the Project area is largely a result of federal and state resource agency management efforts, and other than the movement of diadromous species, the Project has little impact.

Per FERC's 2012 Guide to Understanding and Applying the Integrated Licensing Process Criteria, FERC uses current conditions as its baseline for evaluating project effects and alternatives. This consists of the environment as it exists at the time of licensing. The Project impoundment was created at the time of dam construction over 120 years ago, and Topsham Hydro is proposing no changes to run of river operations.

FERC is required to assess continuing project effects, if the effects can be addressed under project operation. It is unclear to Topsham Hydro what change in project operation could mitigate any impacts associated with headpond predation by non-native species. NMFS seems to imply a relationship between potentially poor downstream passage efficiency at the Project and predation impacts within the headpond. However, Topsham Hydro has proposed several studies to assess downstream passage effectiveness for a variety of diadromous fish species, which will be more than sufficient to inform any necessary mitigation measures during the next license term.

The relicensing and continuation of Project operations is not expected to contribute to the factors that would increase predation at the Project over the environmental baseline. As such, Topsham Hydro has not adopted the study request.

5.2.7 **Sediment Storage and Mobility**

NMFS requested a study to evaluate the Project effects on the sediment budget within the Project area. The requested study would quantify sediment storage and grain size distribution in the Project impoundment, characterize channel morphology and bed surface texture in the reach downstream of the Project, estimate bedload transport downstream of the Project, and identify potential sediment management alternatives.

There is no nexus between Project operations and effects on the sediment budget within the Project area. As discussed in Section 5.2.5, the Project is operated in a run-of-river mode, which does not result in any artificial water level fluctuations which may cause erosion or sedimentation within the impoundment or tailwater. Per FERC's 2012 Guide to Understanding and Applying the Integrated Licensing Process Criteria, FERC uses current conditions as its baseline for evaluating project effects and alternatives. This consists of the environment as it exists at the time of licensing. The Project dam has been in place since the late 1800's, and has been trapping sediment since that time. Given these circumstances, it is likely that sediment transport in the Project area is in a state of equilibrium.

FERC is required to assess continuing project effects, if the effects can be addressed under project operation. It is unclear to Topsham Hydro what change in project operation could mitigate any impacts associated sediment storage and transport. For example, given the Project's run-of-river operation and lack of appreciable water storage, flushing flows are not applicable. In addition, the lack of low level gate(s) would preclude sediment flushing flows as well.

The relicensing and continued operation of the Project is likely to have little impact on sediment storage and transport. This study would do little to inform the development of license requirements as required by FERC's study plan criteria. As such, Topsham Hydro has not adopted the study request.

5.2.8 **Large Woody Debris Study**

NMFS requested a study to evaluate the Project effects on large woody debris. The requested study would quantify the volume, type, and location of large woody debris trapped by the Project, and identify potential debris management alternatives. It is not clear to Topsham Hydro how this information would be useful to inform PME measures to project operations to mitigate any impacts, as the proposed study appears to be a data gathering or research oriented exercise.

There is no nexus between Project operations and effects on large woody debris. The Project is operated in a run-of-river mode, which does not result in any artificial water level fluctuations in the Project impoundment or tailwater that would change the dynamics of large woody debris movement.

As stated previously and outlined in FERC's 2012 Guide to Understanding and Applying the Integrated Licensing Process Criteria, FERC uses current conditions as its baseline for evaluating project effects and alternatives. This consists of the environment as it exists at the time of licensing. The dam has trapped LWD since its original construction in the late 1800's.

FERC is required to assess continuing project effects, if the effects can be addressed under project operation. It is unclear to Topsham Hydro what change in project operation could mitigate any impacts associated LWD movement. Topsham Hydro does remove some woody debris from the Project trashracks as part of normal operation and maintenance activities. However, state regulations require that woody debris when removed from the river, cannot be placed back into the waterway. LWD that is not removed by Topsham Hydro either remains in the Project impoundment or is passed over the spillway during high flow events.

This study would do little to inform the development of license requirements as required by FERC's study plan criteria. As such, Topsham Hydro has not adopted the study request.

5.2.9 **Unimpaired Hydrology Study (IHA)**

NMFS requested a study to characterize metrics of hydrologic alteration due to Project operational effects. NMFS suggested that to assess the impacts of flow regulation on Project-affected streams, flow characteristics should be computed and comparison tables prepared for the regulated and unimpaired flow condition on the stream locations within the Project boundary.

There is no established nexus between Project operations and hydrologic alteration in the Project area, nor would the study inform the development of license requirements as required by FERC's study plan criteria. The Project is operated in a run-of-river mode, which does not result in any artificial water level fluctuations in the Project impoundment or tailwater. The requested study is apparently intended to compare the current operations to pre-Project conditions. As affirmed in American Rivers v. FERC, 187 F.3d 1007 (1999), among other decisions, the baseline condition

for relicensing studies is clearly established as existing conditions. As such, examination of pre-project conditions would go against precedent and would not inform the development of license requirements. Furthermore, the NMFS study request notes that *"With so many projects upstream operating in a manner as to substantially alter flow, the Pejepscot Project could serve as a project that could mitigate some of the environmental effects of these upstream projects."* It is not the responsibility of the Pejepscot Project to mitigate the suggested impacts of other hydroelectric projects nor does the mitigation of other hydroelectric projects have any nexus to Pejepscot Project operations.

In their May 14, 2018 PSP comment letter, NMFS noted that Topsham Hydro is currently testing various spill scenarios in order to enhance downstream passage for Atlantic salmon smolts, and thus manipulating the specific discharge point of water at the Project (i.e., turbine versus spillway). However, the appropriate spillage volumes that are conducive to passing fish downstream efficiently will largely be informed by the results of radio telemetry studies. An IHA study is not required and would do little to assist in this effort. Similarly, the upstream attraction flows cited by NMFS are typically prescribed based on USFWS/NMFS design criteria for fish passage facilities. It is unclear to Topsham Hydro how the results of the IHA study would override or otherwise assist in informing the attraction flow criteria set by USFWS/NMFS.

Finally, in their PSP comment letter, NMFS asserts that FERC has set precedent in requiring IHA studies at other licensing proceedings, and cites several projects. The examples cited by NMFS have no bearing or relevance to the Pejepscot Project and further bolster Topsham Hydro's belief that this study is unnecessary. Review of available information pertaining to the projects cited by NMFS illustrates numerous significant differences between the cited projects and the Pejepscot Project. These differences are summarized in Table 2.0-2. For example, the cited project examples range in size from 104-MW to 368-MW, are multi-development projects that span multiple river systems and rely on various water diversions and transfers, and operate as peaking facilities. The results of the IHA analyses conducted at the cited example projects were used to characterize peak and base flow hydrographs in project bypasses, evaluate future flow release scenarios, and inform instream flow conditions, among other uses - none of which are relevant to this relicensing proceeding. As previously noted, the results of the proposed fish passage evaluation studies combined with the existing USFWS/NMFS design criteria will be adequate to accomplish NMFS' stated objectives for the IHA analysis (i.e., informing the timing and duration of flows directed towards attraction for upstream migration, or spill for downstream migration).

It should also be noted that during the relicensing proceeding for the Hawk's Nest Hydroelectric Project (P-2512), stakeholders requested that an IHA analysis be conducted in addition to the IFIM and PHABSIM methodologies proposed by the applicant to examine bypass reach aquatic habitat use and instream flow. The applicant did not incorporate the stakeholder request into their study plan. In the Study Plan Determination, FERC agreed with the applicant and noted that "*IHA and ELOHA studies would be unnecessary because the IFIM and PHABSIM approach would provide the information necessary to inform a determination of appropriate flows for the Hawks Nest bypass reach.*" Although the Hawks Nest Project layout and the application of IHA in the cited example is different from that of Pejepscot, the underlying argument remains the

same. In this case, the IHA analysis is unnecessary given that the proposed fish passage evaluation studies will provide the information necessary to inform upstream and downstream passage enhancements, if necessary. For the reason's noted above Topsham Hydro has not adopted the study request.

5.2.10 **Project Acoustic Effects Study**

NMFS requested a study to determine if audible and ultrasonic sounds created by the turbine generator units and/or the attraction water pumps have an effect on the passage efficiencies of American shad through the Project fish lift.

Topsham Hydro is proposing to conduct upstream migration studies for adult American shad and river herring, which will yield information on the timing and effectiveness of upstream passage at the Project. Topsham Hydro believes the results of the proposed adult American shad and river herring radio telemetry studies will provide sufficient information to assess upstream passage conditions at the Project, as well as inform the development of license requirements. Pending the results of the downstream passage effectiveness studies, Topsham Hydro has not adopted the study request.

5.3 Study Requests Adopted by Topsham Hydro with Modification

Topsham Hydro has adopted the following study requests with certain modifications to the study methodology and/or level of effort requested by the respective resource agencies. These modifications are described in more detail in the sections below.

1. Bass Population Study
2. Upstream and Downstream Fish Passage Effectiveness for Diadromous Species
3. Anadromous Fish Upstream Passage Effectiveness Study
4. Downstream Fish Passage Effectiveness and Survival: Behavior, Entrainment and Impingement at the Intake
5. Stranding Evaluation

5.3.1 **Bass Population Study**

MDIFW requested a study to collect biometric data to characterize bass population dynamics and relative abundance of other fish species, and conduct an assessment of bass spawning habitat and nesting areas with differentiation by species (largemouth and smallmouth bass).

There is no nexus between Project operations and effects on bass populations, nor would the study inform the development of license requirements as required by FERC's study plan criteria. The Project's normal run-of-river operation does not result in any significant artificial water level fluctuations within the impoundment. Furthermore, per FERC's study plan criteria, a study is warranted only if the applicable existing information is inadequate to inform the development

of license requirements, thus necessitating the need for additional information. As described in Section 5.3 of the PAD, there is recent sufficient data available (Yoder, 2006) describing the bass population and overall fish assemblage in the Project waters thus making additional data collection unwarranted. As such, in response to MDIFW's request, Topsham Hydro proposes to only conduct the bass spawning habitat survey in the Project impoundment. This study is described in Section 7.2.2.

5.3.2 Upstream and Downstream Fish Passage Effectiveness for Diadromous Species

MDMR requested a study to evaluate the effectiveness of the existing upstream fish passage facility for adult American shad and river herring, adult sea lamprey, and juvenile striped bass. In addition, MDMR requested a study to determine the effectiveness of the existing downstream fish passage facility for adult American shad and river herring, juvenile clupeids, adult sea lamprey, juvenile striped bass, and adult American eel.

Topsham Hydro proposes to conduct a radio telemetry study for adult American shad and river herring to determine the timeliness and effectiveness of passage at the Project fish lift. This study is described in Section 7.2. Topsham Hydro is also proposing to conduct downstream migration studies for adult American shad and river herring, juvenile clupeids, and adult American eel, which will yield information on route of passage (i.e., downstream bypass, turbine, spill, etc.) and survival. In addition, Topsham Hydro is proposing to conduct a desktop entrainment, impingement, and turbine survival study at the Project. These studies are described in Section 7.2.

Topsham Hydro does not propose to evaluate the effectiveness of the existing upstream or downstream fish passage facilities for sea lamprey or striped bass. Regarding striped bass, the relatively low number (zero to 103 individuals per season since the year 2000) captured at the downstream Brunswick facility were not passed upstream. Given that striped bass are not passed at the Brunswick facility and the number of captured fish over the past 18 years is minimal, this portion of the proposed study is not necessary to inform the development of license requirements. Regarding the downstream passage of adult sea lamprey, upon completing the migration and spawning process, all adult sea lamprey die, thus eliminating the need for downstream passage of post-spawn lamprey to complete their life cycle. As such, an evaluation of downstream passage effectiveness is not proposed. Conversely, evaluation of upstream passage effectiveness is not proposed as sea lamprey passed at the downstream Brunswick facility have been in relatively low abundance, with zero to 132 individuals passed per season since the year 2000. As such, the level of effort required to complete this portion of the requested study is not commensurate with the number of sea lamprey potentially available for upstream passage.

5.3.3 Anadromous Fish Upstream Passage Effectiveness Study

NMFS requested a study to collect information related to upstream passage effectiveness, the extent of injury and mortality that occurs during passage, and the extent of delay migrating fish may experience at the Project fish lift. For species that are available in sufficient numbers (i.e., river herring and American shad) NMFS recommended using radio telemetry techniques.

However, due to the low numbers of Atlantic salmon in the Androscoggin River, NMFS requested conducting a desktop analysis to assess upstream passage effectiveness.

Topsham Hydro proposes to conduct a radio telemetry study for adult American shad and river herring to determine the timeliness and effectiveness of passage at the Project fish lift. This study is described in Section 7.2.4. Topsham Hydro does not believe a desktop evaluation of upstream passage effectiveness for adult Atlantic salmon would provide meaningful results. It is more likely that the proposed radio telemetry based upstream passage evaluations for other species (e.g., American shad and river herring) will be more informative in terms of approximating the efficiency of the Project fish lift.

Regarding Atlantic salmon, as described in Section 5.3 of the PAD, Topsham Hydro has been engaged in several ongoing studies associated with Atlantic salmon fish passage; these efforts are separate from the relicensing process though they are expected to inform the eventual relicensing proposal.

These efforts were included in the five-year interim SPP (2012-2016) that proposed monitoring studies of upstream (pre-spawn adults) and downstream (smolts and kelts) migrating Atlantic salmon for three years (2013-2015). Due to the low numbers of adult salmon passed at Brunswick Dam, efforts thus far have only evaluated smolt survival through the Project.

A subsequent SPP was developed in 2016 and contained measures to protect Atlantic salmon for the period from 2017 to when a new license is issued (current license expires August 31, 2022). These measures include 1) video camera monitoring of the number of Atlantic salmon using the Project's fish lift starting in 2017 and continuing to 2022 and 2) implementation of an adaptive management approach to conduct an adult upstream passage effectiveness study (using radio tagging and tracking methodology) in consultation with the fisheries agencies when at least 40 adult Atlantic salmon of Androscoggin River origin are counted at the Brunswick fish trap for two consecutive years.

Topsham Hydro feels that the measures contained in the SPP are more than adequate to inform the development of license requirements related to this issue. Moreover, Topsham Hydro's commitment to upstream passage effectiveness studies for Atlantic is described in the existing SPP. The existing SPP states, *"The Licensee will continue consultation with NMFS and resource agencies regarding the protection of Atlantic salmon during the term of this SPP and will re-initiate Section 7 consultation with NMFS during the relicensing process which begins in 2017."* And further, the NMFS Biological Opinion states that *"Because this Opinion only considers the effects of continued operation of the project pursuant to the proposed amended license, the accompanying Incidental Take Statement only exempts take until the license expires in 2022. After that time, this Opinion will no longer be valid. We expect a new consultation will be necessary to consider effects of any future proposed relicensing of the Pejepscot Project."*

Topsham Hydro fully expects to continue consultation with NMFS to develop an SPP that will cover the period of the next license term. Topsham Hydro anticipates that the new SPP will contain measures to address upstream passage efficiency for adult Atlantic salmon.

As such, Topsham Hydro has not adopted the study request related to the desktop analysis of Atlantic salmon upstream passage effectiveness.

5.3.4 Downstream Fish Passage Effectiveness and Survival: Behavior, Entrainment and Impingement at the Intake

NMFS requested both radio telemetry and direct turbine injection studies (e.g., Hi-Z Tag) be performed to determine routes of passage, effectiveness of existing downstream fishways, and survival through project turbines, spillway, and other routes of passage for adult American eel, adult American shad and river herring, as well as juvenile clupeids.

Topsham Hydro is proposing to conduct downstream migration studies for adult American shad and river herring, juvenile clupeids, and adult American eel, which will yield information on route of passage (i.e., downstream bypass, turbine, spill, etc.). These studies are described in Section 7.2.

Topsham Hydro is proposing to conduct a desktop entrainment, impingement, and turbine survival study at the Project, as opposed to a field based direct turbine injection study as requested by NMFS. Per FERC's study plan criteria, a proposed study must be consistent with generally accepted scientific practice and must be done at a higher level of effort only if a lower level of effort would not be sufficient to meet the information needs. Use of desktop entrainment, impingement, and turbine survival studies has long been a standard practice as part of FERC relicensing processes. The desktop analysis will provide reasonable estimates of entrainment, impingement and turbine survival at the Project at a much lower cost. Imposition of the costs associated with a field based study would be unduly burdensome since the study results can be achieved through the alternative and less costly means described above. As such, Topsham Hydro has not adopted the study request related to field based direct turbine injection studies.

5.3.5 Stranding Evaluation

NMFS requested a study to evaluate the potential effect of Project operations on diadromous fish stranding in the ledges along the western shore immediately downstream of the dam. NMFS suggested 1) collecting detailed three-dimensional data in areas identified as sensitive to flow fluctuations; 2) developing hydraulic models to analyze the relationship between flow and water surface elevation, and 3) identifying areas where fish standing could occur.

Topsham Hydro is proposing to conduct a reconnaissance level evaluation of stranding through a combination of photo-documentation and onsite flow demonstration in consultation with NMFS. Following the April 27, 2018 meeting with NMFS, and as noted in their May 14, 2018 PSP comment letter, NMFS is no longer requesting an evaluation of stranding using surface or hydraulic modeling methods, but would rely on the results of reconnaissance level stranding. The study is described further in Section 7.2.6.

6.0 ADDITIONAL INFORMATION REQUESTED

Topsham Hydro's responses to stakeholder additional information requests are contained herein.

6.1 Project Facilities

Request Regarding Powerhouse and Intake Information

In their letters, MDMR (December 18, 2017), NMFS (December 28, 2017), and USFWS (January 3, 2018) requested the following information related to the powerhouse and intakes.

Additional Information Request	Topsham Hydro Response
Minimum hydraulic capacity of the Kaplan unit. (MDMR, USFWS) Minimum and maximum hydraulic capacity of the three Francis units. (MDMR, USFWS) The maximum hydraulic capacity and minimum hydraulic turndown of each turbine/generator unit. (NMFS)	The minimum and maximum hydraulic capacities of Unit No. 1 (Kaplan unit) are 1,170 cfs, and 7,550 cfs. The minimum and maximum hydraulic capacities of Unit Nos. 21, 22, and 23 (Francis units) requires further research and will be provided in a supplemental filing.
Depth to which the 1.5" bar rack in the new powerhouse extends. (MDMR) The depth of the 1.5-inch clear spaced racks (NMFS) The depth of the 2.5-inch clear spaced racks (NMFS) Dimensions and percent cover of the 1.5-inch bar rack for the Francis units. (USFWS)	The bar racks on Unit No. 1 (Kaplan unit) have a top elevation of 61.15 feet and extend down to an elevation of 36.0 feet. The racks are approximately 91.6 feet wide. The bar racks have a clear-bar spacing of 1.5 inches from elevation 61.35 feet down to elevation 55.1 feet (total of 6.25 feet). The remaining portion of the bar rack from elevation 55.1 feet down to elevation 36.0 feet (total of 19.1 feet) has a clear-bar spacing of 2.5 inches. The 1.5-inch bar racks on Unit Nos. 21, 22, and 23 (Francis units) have a top elevation of 69.7 feet and extend down to an elevation of 43.3 feet. The racks are approximately 71.4 feet wide.
Sequencing of unit operation during various flow conditions. (MDMR)	The Project is operated as a run-of-river facility. The Kaplan unit (Unit No. 1) is operated on pond level control. Unit 1 controls the turbine wicket gates to maintain a preset pond level which is normally at about El. 67.2 or 0.3 feet below the top of the spill gates. When Unit 1 nears its maximum flow capacity of 7,550 cfs, one or more of the three Francis units (Units Nos. 21, 22 and

	23) is manually started. The Francis units are mainly operated during high spring runoff and after large storm events that increase river flow.
Turbine rotational speed in revolutions per minute for all 4 turbine/generator units. (NMFS)	The rotational speed of Unit No. 1 (Kaplan unit) is 81.8 rpm. The rotational speed of Unit Nos. 21, 22, and 23 (Francis Units) is 180 rpm.
The number of turbines [runners] associated with each turbine generator unit. (NMFS)	There is one (1) turbine runner associated with Unit No. 1 (Kaplan unit). Unit Nos. 21, 22, and 23 each have four (4) Francis runners attached to a single turbine shaft.
The number of blades on each turbine (NMFS) The diameter of each turbine (NMFS)	Unit No. 1 (Kaplan unit) has four blades and the runner diameter is 18 feet. The number of runner blades and the runner diameter of Unit Nos. 21, 22, and 23 (Francis units) requires further research and will be provided in a supplemental filing
The rated net head for each turbine/generator unit (NMFS)	The rated head of Unit No. 1 (Kaplan unit) is 24 feet. The rated head of Unit Nos. 21, 22, and 23 (Francis units) requires further research and will be provided in a supplemental filing.
If a turbine/generator unit has more than one turbine [runner], the ability or non-ability to operate with fewer turbines [runners] per unit and still be able to rotate the generator and generate power. (NMFS)	Unit Nos. 21, 22, and 23 were each originally installed with four (4) turbine runners attached to a single turbine shaft. These units do not have the ability to selectively operate with fewer than four (4) turbine runners. However, one of the Francis units was damaged several years ago, and the turbine shaft was cut, so that only two (2) runners on that particular unit are now in operation.
The means of throttling flows through the turbines, i.e. intake gates, wicket gates etc. (NMFS)	Wicket gates are used to adjust the flow settings on Unit No. 1 (Kaplan unit), and Unit Nos. 21, 22, and 23 (Francis units).

Request Regarding Upstream Fish Passage Facility Information

In their letters, USFWS (January 3, 2018) and NMFS (December 28, 2017), requested the following information related to the upstream fish passage facilities.

Additional Information Request	**Topsham Hydro Response**
The percent of total station hydraulic capacity that is apportioned for the upstream fishway and how much is provided by the pumps. (USFWS) The total attraction water including the flow out of the attraction pumps and the upper flume flow and any other flow that may be exiting the fish lift entrance. (NMFS)	Four water pumps are used to create a maximum flow up to 160 cfs through the entrance channel to attract fish to the lift. These pumps are sequenced to change the volume of water passing through the entrance channel, depending on the flow out of the powerhouse tailrace. Also, there is additional attraction flow of approximately 30 cfs provided from the impoundment via the exit trough. This total of 190 cfs represents approximately 2.2% of the Project maximum turbine discharge capacity (8,550 cfs).
The operating range of the upstream fishway in cfs and pond elevation; (MDMR, USFWS) The river flow and corresponding pond elevation at which the fishway is shut down to protect the fish lift. (NMFS)	This item requires further research and will be provided in a supplemental filing.
The operational rules used to determine how much water and how many pumps are used for fishway attraction. (USFWS)	When river flows are less than 1,700 cfs, one pump is operated (total attraction flow 30 cfs). When river flows are between 1,700 cfs and 3,500 cfs, two pumps are operated (total attraction flow 110 cfs). When river flows are between 3,500 cfs and 5,200 cfs, three pumps are operated (total attraction flow 150 cfs). When river flows are greater than 5,200 cfs, four pumps are operated (total attraction flow 190 cfs).
The flow through the upper flume at high, normal, and low headpond elevations. Currently it is described as 30 cfs, however, that is only under one pond elevation condition. (NMFS)	The headpond elevation is managed such that there is very little headpond variation during normal operations, see Appendix B.
The design population for American shad, alewife, blueback herring, and Atlantic salmon. (NMFS)	This item requires further research and will be provided in a supplemental filing.

Request Regarding Downstream Fish Passage Facility Information

In their letters, MDMR (December 18, 2017) and NMFS (December 28, 2017) requested the following information related to the downstream fish passage facilities:

Additional Information Request	**Topsham Hydro Response**
The invert elevation of the entrances to the downstream bypasses. (NMFS)	The invert elevation of each entrance is 65.5 feet.
The flow through the downstream bypasses at high, normal and low headpond elevations. (NMFS)	Each downstream bypass can pass approximately 13 cfs, 29 cfs, and 87 cfs at headpond elevations of 66.5 feet (low), 67.2 feet (normal), and 69.0 feet (high), respectively. This assumes that the entrance gate at each downstream bypass is in the fully opened position.
The flow and corresponding headpond elevation that the downstream bypasses are closed. (NMFS, MDMR)	This item requires further research and will be provided in a supplemental filing.
The clear spacing of the grizzly racks at the entrance to the downstream bypasses. (NMFS)	The clear spacing is approximately 7 inches.
The elevation of any horizontal steel members on the grizzly racks. (NMFS)	There is one horizontal steel member on the grizzly racks. Its elevation is approximately 67.3 feet.

6.2 Project Operations

Request Regarding Impoundment Water Level Information

In their letter dated December 29, 2017, MDIFW requested a summary of impoundment water level information for the past 5 years, to determine the frequency and duration of drawdown events that exceeded 1 foot from the "typical" impoundment elevation.

Response

Hourly impoundment elevation data for the period 2015 through 2017 are shown in Appendix B.

Request Regarding the Basis for the Current Minimum Flow Requirement

In their letter dated December 29, 2017, MDIFW requested information regarding the basis for determining the 1,710 cfs minimum flow used in the current license and proposed for the relicense, as well as more detailed flow data to examine how frequently the Project operates at

the current minimum flow level or less. In their letter dated January 3, 2018, the USFWS requested the most recent three years of minimum flows provided to the tailrace.

Response

The current 1,710 cfs minimum flow was determined during the previous licensing process for the Project. Article 32 of the current Project license required the previous Project owner, in cooperation with appropriate fishery resource agencies, to determine the need for a minimum flow release from the Project for protection and enhancement of downstream water quality and fishery resources. This 1,710 cfs minimum flow requirement approximates the USFWS 1981 Aquatic Base Flow (ABF) policy[1], which stipulates a flow release equaling 0.5 cfs per square mile of the Project's drainage area. The drainage area at the Pejepscot Project is 3,420 square miles. The USFWS ABF policy is a standard-setting technique used to provide flow recommendations that are protective of habitat and the associated aquatic biota without the need to conduct any site-specific studies. The USFWS has previously utilized ABF-based streamflow recommendations at numerous hydroelectric projects throughout New England.

Hourly Project outflow data for the period 2015 through 2017 are shown in Appendix B.

6.3 Other Project Information

Request Regarding Dependable Capacity

In their letter dated December 28, 2017, NMFS requested information related to the duration of time the Project dependable capacity can be achieved.

Response

The dependable capacity (seasonal claimed capability) for the Project is 5.566 MW[2] (summer) and 7.941 MW (winter). These are calculated based on the average of the previous 5 years to determine qualified capacity; for summer (June –September) for the 5 hours between 1 p.m. and 6 p.m.; and for winter (October-May) for the 2 hours between 5 p.m. and 7 p.m.

6.4 Water Resources

Request Regarding Streamflow, Gage Data, and Flow Statistics

In their letter dated December 28, 2017, NMFS requested that the flow duration curves presented in the PAD match the period of record that was provided for the generation data (2007 to 2016). Additionally, NMFS requested a description of the proration factors used to prorate the U.S. Geological Survey gage data to the site and ensure that evaporation, infiltration, etc.is included.

[1] USFWS, 1981. Interim Regional Policy for New England Streamflow Recommendations.
[2] The dependable capacity for the summer period was recently updated to be 5.566 MW. It was previously reported in the PAD as 7.976 MW.

Response

Monthly and annual flow duration curves for the period 2006 to 2016 are presented in Appendix C. This is the same period that generation data were presented (Table 4.4.4-1) in the PAD. As described in Section 5.2.1.2 of the PAD, the U.S. Geological Survey (USGS) streamflow gaging station (No. 01059000) on Androscoggin River near Auburn, ME, located approximately 17 miles upstream of the Pejepscot Dam was used to develop the flow duration curves. This gage has a drainage area of 3,263 square miles and the drainage area at the Project is 3,420 square miles. Therefore, flow data from the USGS gage was multiplied by a ratio of the drainage areas at each point (3,420 square miles/3,263 square miles). No adjustments have been made for infiltration or evaporation.

6.5 Recreation and Land Use

Request Regarding Recreation Facility Information

In their letter dated December 29, 2017, MDIFW requested more information on the availability of shoreline access at the east bank of the Pejepscot tailrace, as well as, foot access opportunities to the west bank of the Worumbo tailrace/Pejepscot impoundment interface.

MDIFW also requested information on the Pejepscot boat ramp seasonal opening and closing dates, hours of operation, as well as, the frequency and duration of ramp closures due to hazardous conditions.

MDIFW also requested the location and description of the "Fish Pier" access described in the 1997, 2003, and 2009 FERC Form 80 reports.

Response

There are no formal recreation facilities or access at the east bank of the Pejepscot tailrace or the west bank of the Worumbo tailrace/Pejepscot impoundment interface. However, access by recreational users is not prohibited.

The boat barrier at the Project is typically installed on May 15 and removed on October 15, flow conditions permitting. This timeframe generally defines the typical boating season on the Project impoundment as well as the seasonal operating period for the boat ramp. On a daily basis, although the gate normally remains open, use of the boat ramp is permitted between one hour before sunrise and one hour after sunset. For safety purposes, the boat ramp is closed during high flow conditions or other periods for safety considerations based on the discretion of Project operating and safety staff.

The reference to the "Fish Pier" in the Form 80 reports requires further research and will be provided in a supplemental filing.

7.0 INDIVIDUAL STUDY PLAN PROPOSALS

7.1 Water Quality

7.1.1 Water Quality Assessment

Topsham Hydro proposes to conduct water quality monitoring consisting of a two-part water quality assessment, including an Impoundment Trophic State Study and a Tailwater Temperature and Dissolved Oxygen (DO) Study. A Benthic Macroinvertebrate Study will investigate water quality as well, and is discussed in Section 7.1.2.

Goals and Objectives

The goal of the water quality assessment is to update baseline information and document water quality conditions upstream and downstream of the Project dam.

The objectives of the study are to: 1) collect periodic water quality data in the Project impoundment, and 2) collect continuous water temperature and DO data in the Androscoggin River downstream of the Project dam during low flow, warm water temperature conditions.

Known Resource Management Goals

MDEP's resource management goal is to ensure attainment of Maine's Water Quality Standards pursuant to the provisions of the Water Classification Program (38 MRSA, Sections 464 – 468), and to certify this attainment with any necessary conditions as per Section 401 of the Clean Water Act.

Androscoggin River Water Quality Standards

The Androscoggin River is classified by MDEP as Class C from its confluence with the Atlantic Ocean at Merrymeeting Bay, upstream, through Project waters, until its confluence with the Ellis River at Rumford Point in Maine about 75 miles upstream of the Project. Class C waters must be of such quality that they are suitable for the designated uses of drinking water supply after treatment, fishing, agriculture, recreation in and on the water, industrial process and cooling water supply, hydroelectric power generation (except as prohibited under Title 12, section 403), navigation, and as a habitat for fish and other aquatic life.

The DO content of Class C water may be no less than 5 parts per million (ppm) or 60% of saturation, whichever is higher, except in identified salmonid spawning areas where water quality is sufficient to ensure spawning, egg incubation and survival of early life stages. Water quality in these areas must be sufficient for these purposes to be maintained.

Per the state standards, discharges to Class C waters may cause some changes to aquatic life, provided that the receiving waters shall be of sufficient quality to support all species of fish indigenous to the receiving waters and maintain the structure and function of the resident biological community.

Background and Existing Information

Available water quality data for the Androscoggin River within the vicinity of the Project were collected by MDEP in 2010 as part of an Aquatic Life Classification Attainment Study and from 2010 to 2016 by the Volunteer River Monitoring Program (VRMP) as part of their routine water quality monitoring program. Data were collected within the impoundment and downstream of the Project dam by both MDEP and the VRMP. MDEP data includes macroinvertebrate analyses and limited field collected water quality data such as DO, specific conductivity and temperature. VRMP data includes *E. coli* concentrations, Secchi disk depth, vertical profiles for temperature and DO, and other field parameters such as specific conductivity, pH, DO concentration, and DO saturation. Vertical profile data collected just upstream of the Project dam indicate the water column is well-mixed with little, if any, variation in temperature, pH, DO or specific conductivity during July and August. Water quality standards for the tested parameters were met based on available data.

The reach of the Androscoggin River from the Little Androscoggin River confluence above the Project to the Brunswick Dam below the Project is impaired by legacy Polychlorinated Biphenyls (PCBs) and dioxin contamination. The Total Maximum Daily Load (TMDL) for these contaminants is expected to be attained by 2020 (MDEP, 2016).

MDEP stated in their study request that additional data are required to ensure Class C Water Quality Standards are being met within the vicinity of the Project.

Project Nexus

The Project is run-of-river and has no bypass reach. Continued operation of the Project is not expected to impact water quality negatively; however, the information obtained from this study will help confirm that the Project meets Maine's Class C designated uses and water quality criteria.

Methodology

This will be a two-part water quality study consisting of impoundment trophic state sampling (Task 1) and continuous DO and temperature monitoring in the Project tailwater (Task 2). Other tasks are for data analysis (Task 3) and a report (Task 4). Water quality parameters will be collected based on MDEP's Sampling Protocol for Hydropower Studies (November 2014).

Task 1: Trophic State Impoundment Survey

This study will be performed per the MDEP Sampling Protocol for Hydropower Studies (MDEP, 2014).

The Trophic State data collection will be performed twice per month from June through October 2018 at the deepest location of the impoundment (i.e., AR-01 within close proximity of the MDEP sampling location S-956, Figure 7.1.1-1). Field personnel involved with this study will be certified by MDEP's Division of Environmental Assessment Lakes Section for the sampling protocol. Certification will likely entail a qualified member of MDEP visiting the field crew on-

site for training prior to or on the first day of the study (as per conversations with MDEP). Arrangements for this training will be made in advance, guaranteeing someone from MDEP will be available during that time of the field season.

Sampling will involve the collection of: (1) Secchi disk transparency depth, (2) vertical profiles for temperature and DO, and (3) water samples (i.e., total phosphorus, chlorophyll a, color, pH and total alkalinity, and potentially others if the impoundment stratifies). These parameters are discussed further as follows.

Water Clarity

Water clarity will be measured at the impoundment sampling location during each field visit using a Secchi disk and an Aquascope. The depth at which the Secchi disk is no longer visible through the Aquascope will be recorded.

Vertical Profiles

A vertical profile will be collected at the sampling location during each field visit. DO and water temperature will be collected every meter up to 15 meters (m). (Note: based on previous data, the profile is expected be up to approximately 5.5 m.) One replicate profile measurement will be made for every profile collected. Replicates will be obtained outside of the metalimnion (if applicable) to avoid remeasuring parameters when they are in a transitional state. A profile will be remeasured if replicate values are not within 0.3 mg/L and 0.3^{o}C, as stated in the Volunteer Lake Monitoring Program (VLMP) instructions (received from MDEP) or within water quality meter instrumentation error value.

Water Sample Collection

Water samples will be collected each visit from the epilimnion using an integrated core sampler at a depth between the surface and two times the Secchi disk depth, or within 1 m of the bottom, whichever is less. Water samples will be sent to a lab and tested for total phosphorus, chlorophyll a, color, pH and total alkalinity. Detection limits required for each parameter (as per MDEP, 2014) are listed in Table 7.1.1-1.

One additional set of samples with additional parameters (as listed in Table 7.1.1-1) will be collected during the late summer (i.e., mid to late August, possibly into September):

- Thermal stratification is not expected based on previous data collected in 2010 in July and August, however, should it occur (with a change in temperature $\geq$1^{o}C per meter at any depth below the top 3 m as per MDEP protocol), additional water samples will be collected one time towards the end of the stratification period, coinciding with late summer. Thermal stratification samples will be collected from up to three depths: (1) the epilimnion, (2) the top of the hypolimnion, and (3) one meter above the sediment. An integrated core sampler will be used for the water sample collection in the epilimnion, and a Kemmerer sampler will preferably be used for sub-epilimnion sample collection.

- Should thermal stratification not occur, a set of samples will be collected from the epilimnion during late summer with an integrated core sampler at a depth between the surface and two times the Secchi disk depth, or within 1 m of the bottom, whichever is less.

Task 2: Continuous Tailwater Monitoring Survey

This study will be performed as per the MDEP Sampling Protocol for Hydropower Studies (MDEP, 2014). A minimum of one location within the tailwater of the Project (i.e., AR-02 in Figure 7.1.1-1) will be monitored continuously during warm, low flow months. The monthly flow duration data for the Project, as presented in the PAD, indicates flow estimates to be lowest from July through September. The estimated median monthly flow values are shown below, based on the calculated flow at the Project using USGS gage data from the Androscoggin River near Auburn, ME. Sampling would likely occur during a 9-week period of low flow based on the estimated data, from July 1 to August 31[3].

	May	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
Median Flow (cfs)	8,626	5,366	3,417	2,977	2,819	3,868

Deployment

DO measurements will initially be made at AR-02 along a transect across the stream, at the first, second and third quarter points, to determine an appropriate deployment location. If there are no violations of DO criteria and no significant (<0.2 mg/l) differences in concentrations among the quarter points, the water quality sonde may be deployed at the location shown to be representative of the main flow. Otherwise, the water quality sonde will be deployed at the location with the lowest DO concentration and also at the location of the main flow, resulting in two tailrace monitoring locations (MDEP, 2014).

The water quality meter(s) (HOBO U26 with temperature and optical DO sensor) will be set to record temperature and DO in one-hour increments continuously throughout the study period. The meter will be deployed mid-depth, given that the water is anticipated to be less than 2 m deep during the low flow period. The meter location(s) will be geo-referenced using a GPS. Approximately every two weeks, the meters will be cleaned, maintained, and offloaded per manufacturer recommendations, during which spot check measurements will also be recorded for DO and temperature using an alternate water quality meter.

[3] The study will be conducted during the summer when low flow is coupled with daily average water temperatures exceeding 24 degrees Celsius. The study will target a period when the water temperature and flow characteristics both meet the sampling protocol, to ensure that the sampling effort collects data representative of target conditions. Given this, the window of optimal DO monitoring may occur from July through August, or may shift to mid-July to mid-September (or even later), depending on weather, precipitation and other factors

Task 3: Data Analysis

QA/QC

Data will be reviewed for quality assurance/quality control (QA/QC) upon completion of the field monitoring portion of the study. Field spot checks will be used to determine if data need to be adjusted (through spot-check calibration) or flagged for accuracy. Any erroneous data will be removed from the final dataset and an explanation will be provided for the reason the data were rejected.

Task 4: Report

A study report will be prepared, describing monitoring methods and presenting the results. Topsham Hydro will provide flow data for the water quality monitoring study period. Quality assurance procedures will be detailed and an explanation will be provided for any deviations from the study plan, if appropriate.

Consistency with Generally Accepted Scientific Practice

The proposed methods are based on MDEP's Sampling Protocol for Hydropower Studies (November 2014) which is a standard protocol in Maine for use in hydroelectric power relicensing.

Deliverables and Schedule

The water quality monitoring will be conducted in 2018 during periods of low flows and relatively warm river temperatures. The Trophic State Study will begin in June and end in October, and the DO and Temperature Study will be performed from July 1 to August 31, though data collection may continue later into the season to ensure that low flow conditions have been adequately sampled. Data and results will be reported in the Initial Study Report to be filed with FERC in July 2019.

Cost and Level of Effort

Topsham Hydro is proposing to conduct the study during the course of one study year. Estimated costs for this study are $25,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information to characterize water quality in these areas.

Table 7.1.1-1: Water Quality Parameter Detection Limits

Parameter	Detection Limit
Field Parameters	
Secchi disk transparency	0.1 m
Temperature	0.1°C
Dissolved Oxygen	0.1 mg/L
Twice Monthly Lab Analytes	
Total phosphorus	0.001 mg/L
Chlorophyll a	0.001 mg/L
Color	1.0 SPU
pH	0.1 SU
Total alkalinity	1.0 mg/L
One-Time Late Summer Sample Analytes	
Total phosphorus	0.001 mg/L
Chlorophyll a (uncorrected*)	0.002 mg/L
Color	1.0 SPU
pH	0.1 SU
Total alkalinity	1.0 mg/L
Nitrate	0.01 mg/L
Dissolved Organic Carbon	0.25 mg/L
Total iron	0.005 mg/L
Total and dissolved aluminum	0.010 mg/L
Total calcium	1.0 mg/L
Total magnesium	0.1 mg/L
Total sodium	0.05 mg/L
Total potassium	0.05 mg/L
Total silica	0.05 mg/L
Specific conductance	1 mS/cm
Chloride	1.0 mg/L
Sulfate	0.5 mg/L

* Chlorophyll a is not needed in stratification samples below the epilimnion. Uncorrected chlorophyll a will be tested via trichromatic determination

Source: MDEP, 2014

Brookfield

PEJEPSCOT HYDROELECTRIC PROJECT
(FERC No. 4784)
REVISED STUDY PLAN

0 250 500 1,000 Feet

N

Figure 7.1.1-1:
Proposed Water Quality Locations

Path: P:\1925\maps\RSP\Figure_7_1_1-1_Proposed_Water_Quality.mxd

References

Maine Department of Environmental Protection (MDEP). 2014. DEP Sampling Protocol for Hydropower Studies. November 2014.

Maine Department of Environmental Protection (MDEP). 2016. 2016 Integrated Water Quality Monitoring and Assessment Report. Online: http://www.maine.gov/dep/water/monitoring/305b/2016/2016-draft-final-report.pdf. Date Accessed: 10/23/17

7.1.2 **Tailwater Benthic Macroinvertebrate Study**

Topsham Hydro proposes to conduct a benthic macroinvertebrate study at the Project in accordance with the MDEP protocol, "Methods for Biological Sampling and Analysis of Maine's Rivers and Streams" (April 2014).

Goals and Objectives

The goal of this study is to determine if the attainment of Class C habitat and aquatic life criteria is being met in the river reach below the Project dam. The study objective is to determine the composition of the benthic macroinvertebrate community within the tailrace reach of the dam in accordance with the MDEP protocol.

Known Resource Management Goals

MDEP's resource management goal is to ensure attainment of Maine Water Quality Standards pursuant to the provisions of the Water Classification Program (38 MRSA, Sections 464 – 468), and to certify this attainment with any necessary conditions as per Section 401 of the Clean Water Act.

Background and Existing Information

Macroinvertebrate data within the vicinity of the Project were most recently collected in 2010 by MDEP as part of the Lower Androscoggin River Basin Water Quality Study Modeling Report (MDEP, 2011). Cone rock samplers[4] were deployed at a sampling location within the Project impoundment (i.e., S-956) and at a riverine sampling location just downstream of the Project (i.e., S-954). Two cones were deployed at the downstream location for 28 days and three cones were deployed at the impoundment location for 43 days (2010 MDEP reports retrieved from MDEP, 2016).

The results of both sampling locations were similar in diversity but the downstream location was higher in abundance and Ephemeroptera, Plecoptera and Trichoptera (EPT) tolerance. EPT tolerance indicates a higher richness of pollutant-sensitive species (see Table 7.1.2-1, a simplified version of Table 5.3.7-1 from the PAD). Aquatic communities met Class C water quality standards at the upstream location and Class B water quality standards at the downstream location (MDEP, 2011).

[4] It is recommended to use cone samplers in deep, non-wadeable rivers (MDEP, 2014). Rock baskets will likely be used for the Pejepscot tailwater study due to the presence of a riffle at the proposed sampling location that is expected to be shallow enough for rock basket use, according to MDEP criteria.

Table 7.1.2-1: MDEP 2010 Study Macroinvertebrate Results

Variable	Impoundment/Upstream (S-956)	Tailwater/Downstream (S-954)
Total Mean Abundance	75.33	956.0
Generic Richness	36.0	37.0
Ephemeroptera Mean Abundance	18.0	278.0
EPT Generic Richness	10.0	21.0
Dominate Substrate	Sand	Rubble/Cobble

Source: 2010 MDEP report retrieved from MDEP, 2016

Other applicable macroinvertebrate studies include county-wide damselfly and dragonfly surveys conducted from 1999 to 2005, supplemented with volunteer records from 2006 to 2016 (MDDS, 2016), and a statewide mussel atlas survey performed along the Lower Androscoggin River (Nedeau et al., 2000), as stated in the PAD.

Project Nexus

Project operations may have an effect on the water quality downstream. The information gained from this study will be used to determine if the Project waters meet the designated aquatic habitat and aquatic life criteria.

Methodology

The proposed tailwater macroinvertebrate study will be designed following MDEP's Methods for Biological Sampling and Analysis of Maine's Rivers and Streams (April 2014). A sampling station will be established within representative habitat downstream of the Project facilities. Rock filled wire baskets will be deployed for macroinvertebrate collection[5]. A total of three samplers will be deployed at the site with their long axis parallel to water flow. Sampling will be conducted during the summer, low flow period (July 1 – September 30th) for 28 days ± 4 days.

Task 1: Preparation and Deployment of Rock Samplers

Three rock basket replicates will be prepared for deployment as per MDEP, 2014. The three rock baskets will be installed at one location downstream of the Project tailrace within representative habitat, and within close proximity to the MDEP S-954 location. The proposed location (i.e., AR-03 in Figure 7.1.2-1) is adjacent to a forested section of shoreline downstream of the powerhouse. If alternating riffle/pool habitat is representative of the location, a riffle/run will be chosen as the sample location if possible. Prior to deployment, the sample location will be confirmed to have a high degree of certainty of allowing the samplers to remain fully

[5] Mesh bags will be deployed instead, should the location be determined to be too shallow for baskets, or cone samplers if the location is determined to be too deep for baskets (MDEP, 2014).

submerged, even if water levels drop significantly. Bank effects will be avoided by targeting the halfway point between the wetted width if appropriate. Eddies immediately upstream or downstream of large rocks or debris and "slackwater" will be avoided as the deployment location (as per MDEP, 2014).

The rock baskets will be deployed for 28 days (±4 days) in the tailrace reach of the Project, starting by the end of August to ensure targeted conditions are met for the sampling period[6]. The targeted conditions are the low flow, high temperature conditions likely to occur sometime between July 1 and September 30, 2018. Samplers will be marked, secured and positioned appropriately (as per MDEP, 2014).

Field Data Sheets

A field data sheet (Attachment 1 received 9/18/17 from Kathy Howatt, MDEP via email) will be completed with site-specific information concurrently with sampler deployment. This data sheet includes the following fields:

- Sample location coordinates
- Substrate composition
- Canopy coverage
- Land use and terrain characteristics
- Habitat characteristics (i.e., specific conductivity, dissolved oxygen, temperature, pH, flow, depth, bank full and wetted width)
- Other observations (e.g., fish, algae, macrophytes, habitat quality)

Task 2: Rock Sampler Retrieval and Processing

Basket samplers will be retrieved by approaching the sample location from downstream. A 600-micron mesh aquatic net will be positioned downstream of a sampler prior to collection. The sampler will then be placed quickly into the net. The basket will be opened and all contents will carefully be transferred into a 600-micron sieve bucket. The wire cages will be rinsed into the sieve bucket before removing, rinsing and placing each rock back into the basket. All sieve bucket contents will then be transferred into sample jars and preserved with approximately 70% ethyl alcohol. Samples will be labeled in the field immediately upon collection to include the date of retrieval, waterbody, and replicate (i.e., sampler) number. A slip of rite-in-the-rain paper with the same information (written in pencil) will also be placed into each sample jar. Each sample will be treated as consistently as possible. Sample jars will be sent to a contracting laboratory for evaluation by or under the supervision of a professional freshwater

[6] An extended exposure period (>28 days) may be necessary to allow for adequate colonization, should there be particularly low flow velocities at the sampling location. This will be determined with MDEP's guidance if needed.

macroinvertebrate taxonomist who is certified by the Society of Freshwater Science (MDEP, 2014). MDEP may waive this requirement if the company can show documentation of experience and training (as per 9/18/17 email forwarded by Kathy Howatt, from Leon Tsomides, MDEP)[7].

Task 3: Report

A study report will be prepared, describing macroinvertebrate community sampling results, along with a summary of the Project operations that occurred during the rock basket deployment period. Prior to preparation of the report the numeric results of the study will be provided to the MDEP for analysis using the Department's linear discriminant analysis to assess the attainment of aquatic life standards. The resulting Aquatic Life Classification Attainment Report generated by MDEP will be included as an appendix to the study report. Laboratory quality assurance procedures will be detailed if applicable and an explanation will be provided for any deviations from the study plan, if appropriate.

Consistency with Generally Accepted Scientific Practice

MDEP's Methods for Biological Sampling and Analysis of Maine's Rivers and Streams is a standard protocol for macroinvertebrate sampling. It has been used throughout Maine for many years and for many studies.

Deliverables and Schedule

The field deployment and retrieval will occur between July 1st and September 30th, 2018, with rock basket installation occurring by the end of August to help ensure sampling occurs during low flow conditions. Data and results will be included in the Initial Study Report to be filed with FERC in July 2019.

Cost and Level of Effort

Topsham Hydro is proposing to conduct the study during the course of one study year with the provision for another year of study should anomalous environmental conditions affect the initial study effort. Estimated costs for this study are $20,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information to determine attainment with the MDEP aquatic life standards.

[7] While MDEP has agreed that it may waive the requirement for sample evaluation by a professional freshwater macroinvertebrate taxonomist who is certified by the Society of Freshwater Science, a waiver should be sought prior to collecting the samples.

Maine DEP Biological Monitoring Unit
Stream Macroinvertebrate Field Data Sheet

Location: _____

_____

Potential Stressor: _____

_____

Log Number _____
Station Number_____
Waterbody_____
River Basin_____
Town_____
Stream Order_____

Directions_____
_____
_____
Lat-Long Coordinates (WGS84, meters)
Latitude_____
Longitude_____

Type of Sampler_____
Date Deployed_____
Number Deployed_____
Date Retrieved_____
Number Retrieved_____
Agency/Collector(s) Put-In:
Take-Out:

1. Land Use (surrounding watershed)
- ☐ Urban
- ☐ Cultivated
- ☐ Pasture
- ☐ Upland hardwood
- ☐ Upland conifer
- ☐ Swamp hardwood
- ☐ Swamp conifer
- ☐ Marsh

2. Terrain (surrounding watershed)
- ☐ Flat
- ☐ Rolling
- ☐ Hilly
- ☐ Mountains

3. Canopy Cover (surrounding view)
- ☐ Dense (75-100% shaded)
- ☐ Partly open (25-75% shaded)
- ☐ Open (0-25% shaded)

(% daily direct sun) _____

4. Physical Characteristics of Bottom (estimate % of each component over 12 m stretch of site; total = 100%)

[ ] Bedrock [ ] Cobble (2.5" – 10") [ ] Sand (<1/8") [ ] Clay
[ ] Boulders (>10") [ ] Gravel (1/8" – 2.5") [ ] Silt [ ] Muck [ ] Detritus

5. Habitat Characteristics (immediate area)

Flag location where measured

Time _____ AM PM	Time _____ AM PM
Wetted Width (m)_____	Wetted Width (m) _____
Bank Full Width (m) _____	Bank Full Width (m) _____
Depth (cm) _____	Depth (cm) _____
Velocity (cm/s) _____	Velocity (cm/s) _____
Diss. O_2 ___ (ppm) ___ (%)	Diss. O_2 ___ (ppm) ___ (%)
Temp (°C) _____	Temp (°C) _____
SPC (µS/cm) _____	SPC (µS/cm) _____
pH _____	pH _____
DO Meter #_____ Cal? Y / N	DO Meter #_____ Cal? Y / N
SPC Meter # _____ Cal? Y / N	SPC Meter # _____ Cal? Y / N

Temperature Probe # _____
☐ deployed ☐ retrieved

6. Observations (describe, note date)

7. Water Samples
- ☐ Standard
- ☐ Other

Lab Number:

8. Photograph #

Put-In
- Up
- Down

Take-Out
- Up
- Down

9. Landmarks of Sampler Placement (illustrate or describe landmarks to be used for relocation)

Options for Potential Stressor:

Agricultural Runoff
Altered Habitat
Altered Hydrology
BOD (Low DO)
Bog Headwaters
Chlorine
Gravel Pit
Impounded
Inorganic Solids
Lake Outlet
Logging
Low Gradient
Low pH
Metals
NPS Pollution
Nutrients
Organic Solids
Pesticides
Regulated Flows
Sedimentation
Superfund Site
Thermal
Tidal/Estuary
Toxic Organics
Urban Runoff

Options for 6. Observations:

Fish
Algae
Macrophytes
Habitat quality
Dams/impoundments
Discharges
Nonpoint stressors

Options for Location:

Above Road Crossing
Below Road Crossing
Above Town
Below Town
Above Fish Hatchery
Below Fish Hatchery
Above POTW
Below POTW
Above Landfill
Below Landfill
Below Airport
Below In-Place Contamination
Above In-Place Contamination
Above Point Source
Below Point Source
Above Urban NPS
Below Urban NPS
Above Agriculture NPS
Below Agriculture NPS
Above Forestry NPS
Below Forestry NPS
Above Dam
Below Dam
Impoundment
Lake Outlet
Main Stem (only for larger systems)
Above Confluence
Below Confluence
Below Falls
Pristine Landscape
Designated Ecoreserve
Minimally Disturbed

Brookfield

PEJEPSCOT HYDROELECTRIC PROJECT
(FERC No. 4784)
REVISED STUDY PLAN

N

0 750 1,500 3,000 Feet

Figure 7.1.2-1:
Proposed Macroinvertebrate Sample Location

Path: P:\1925\maps\RSP\Figure_7_1_2-1_Proposed_Macroinvertebrates.mxd

References

Maine Damselfly and Dragonfly Survey. 2016. Maine Damselfly and Dragonfly Survey Data. http://mdds.umf.maine.edu/ Accessed 12/6/16.

Maine Department of Environmental Protection (MDEP). 2011. Lower Androscoggin River Basin Water Quality Study Modeling Report. Prepared by Peter Newkirk. March 2011. Online: http://www.maine.gov/dep/water/monitoring/rivers_and_streams/modelinganddatareports/androscoggin/2011/lowerandromodelreport_final_march_2011.pdf. Date Accessed: 12/28/16

Maine Department of Environmental Protection (MDEP). 2014. Methods for Biological Sampling and Analysis of Maine's Rivers and Streams. Prepared by: Davies, S. P. and Tsomides, L. These MDEP Methods were originally developed in 1987. Latest Revision: April 2014.

Maine Department of Environmental Protection (MDEP). 2016. GIS Maps and Other Data Files. Biomonitoring Stream and Wetland Sampling Data GIS layer (3/3/2016). Online: http://www.maine.gov/dep/gis/datamaps/. Date Accessed: 10/24/16

Nedeau, E.J., McCollough, M.A., and B.I. Swartz. 2000. *The Freshwater Mussels of Maine*. Maine Department of Inland Fisheries and Wildlife: Augusta Maine, 2000.

7.2 Fishery Resources

7.2.1 Eel Monitoring Surveys

Topsham Hydro proposes to conduct nighttime visual monitoring surveys to investigate upstream migrating American eel movements at the Project.

Goals and Objectives

The goal of the study is to evaluate the need and potential location for an upstream eel passage facility at the Project. The objectives for the study include:

- conducting systematic surveys of eel presence/abundance at the Project to identify where eels concentrate when staging in pools or attempting to ascend wetted structures; and
- identify potential locations that may be viable sites for a permanent eel trap/pass structure.

Known Resource Management Goals

While there is no specific management plan for American eel in the state of Maine, all Atlantic states must, when regulating commercial and recreational fishing activity, comply with the management goals and objectives set forth by the Atlantic States Marine Fisheries Commission (ASMFC), which include:

- Protect and enhance the abundance of American eel in inland and territorial waters of the Atlantic States and jurisdictions and contribute to the viability of the American eel spawning population.
- Provide for sustainable commercial, subsistence, and recreational fisheries by preventing overharvest of any eel life stage (ASMFC, 2012).

In support of these goals, the following objectives were included in the ASMFC's eel management plan:

- Improve knowledge of eel utilization at all life stages through mandatory reporting of harvest and effort by commercial fishers and dealers, and enhanced recreational fisheries monitoring.
- Increase understanding of factors affecting eel population dynamics and life history through increased research and monitoring.
- Protect and enhance American eel abundance in all watersheds where eel now occur.
- Where practical, restore American eel to those waters where they had historical abundance but may now be absent by providing access to inland waters for glass eel, elvers, and yellow eel and adequate escapement to the ocean for pre-spawning adult eel.

- Investigate the abundance level of eel at the various life stages, necessary to provide adequate forage for natural predators and support ecosystem health and food chain structure.

In a 2008 addendum to the ASMFC eel management plan, the following specific language was included regarding hydroelectric facilities (ASMFC, 2012):

> *The ASMFC recognizes that many factors influence the American eel population, including harvest, barriers to migration, habitat loss, and natural climatic variation. The ASMFC authority, through its member states, is limited to controlling commercial and recreational fishing activity; however, to further promote the rebuilding of the American eel population, the ASMFC strongly encourages member states and jurisdictions, as well as the U.S. Fish and Wildlife Service, to consider and mitigate, if possible, other factors that limit eel survival. Specifically, the ASMFC requests that member states and jurisdictions request special consideration for American eel in the Federal Energy Regulatory Commission relicensing process. This consideration should include, but not be limited to, improving upstream passage and downstream passage, and collecting data on both means of passage.*

Background and Existing Information

The fish assemblage assessment by Yoder et al., (2006) of the Lower Androscoggin River found that American eel were most abundant in the tidal river, downstream of Brunswick Dam. Though eels have been captured in the fishway at Brunswick Dam (see Table 5.3.1-3 in the PAD), no specific eel passage facilities are operated there. Eels may also pass the Brunswick Dam by climbing over the spillway, as they often do at many low-head dams. Most eels captured further upstream by Yoder et al., (2006) on the Androscoggin River were large specimens. Upstream eel passage measures were installed at the Worumbo Fishway in 2012, after which 17 eels were captured in 2012 and 131 eels in 2013, according to annual fish passage reports filed with FERC (Miller Hydro, 2013; Miller Hydro, 2014).

Project Nexus

The Project is located within the historic range of American eel. As such, the Project structures may hinder the upstream and downstream movement of American eel and passage measures may be beneficial to improve their ability to migrate past the Project.

Methodology

Topsham Hydro proposes to conduct a total of 12 nighttime visual monitoring surveys during the primary period of upstream eel migration (June 15 - August 31). Surveys will be conducted twice weekly from June 15 to July 15, once weekly from July 15 to August 15 and a final survey during the last two weeks of August. All surveys will be conducted immediately following sunset. In an effort to limit personnel moving around in the reach downstream of the Project spillway during the night hours, eel surveys will be conducted from safely accessible locations. Field personnel will be equipped with spotlights and binoculars for the surveys. Identified vantage points include (1) the lower deck in the vicinity of the fish lift entrance, (2) the eastern

corner of the upper working deck overlooking the spillway section, and (3) a point overlooking the western corner of the spillway section. The extent of area surveyed will be driven by operations at the Project. High flows and the presence of spill may limit or prevent effective searching of some or all areas downstream of the Project on any given day.

On each survey date, the duration and timing of searches will be recorded and representative water quality data will be collected (i.e., temperature, DO). A pre-determined set of information will be recorded at each survey point and observations of eels (i.e., presence/absence, abundance, and distribution among pre-defined size classes) will be recorded. Information related to weather and lunar cycle will be recorded for each survey. The field crew conducting the surveys will also maintain notes related to observations on Project operations (i.e., generation and spill).

Consistency with Generally Accepted Scientific Practice

The proposed methodology to evaluate the location and relative abundance of upstream migrating American eel that approach Project facilities to seek a passage route is consistent with those employed at other hydropower projects.

Deliverables and Schedule

The survey effort will be conducted during the summer of 2019. Data and results will be included in the Initial Study Report to be filed with FERC in July 2020.

Cost and Level of Effort

Estimated costs for this study are $20,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information related to upstream migrating American eel movement at the Project.

References

Atlantic States Marine Fisheries Commission, 2012. American Eel Stock Assessment Overview.

Yoder, C.O., B.H. Kulik, J.M. Audet, and J.D. Bagley. 2006. The Spatial and Relative Abundance Characteristics of the Fish Assemblages in Three Maine Rivers. Technical Report MBI/12-05-1. September 1, 2006.

7.2.2 **Largemouth and Smallmouth Bass Spawning Habitat Survey**

Topsham Hydro proposes to conduct a survey within the Project impoundment to document bass spawning habitat and nesting areas.

Goals and Objectives

The study will provide information regarding the spawning activities of largemouth and smallmouth bass in the Project impoundment. The study objective is to document bass spawning habitat, and nesting areas with differentiation by species (largemouth and smallmouth bass) within the Project impoundment.

Known Resource Management Goals

MDIFW is a cabinet level agency of the State of Maine, and under Maine State Law (12 MRSA, §10051) MDIFW's mandate is "…to preserve, protect, and enhance the inland fisheries and wildlife resources of the State; to encourage the wise use of these resources; to ensure coordinated planning for the future use and preservation of these resources; and to provide for effective management of these resources." Bass are one of the most sought sport fish species by Maine recreational anglers. Data from the PAD indicate smallmouth bass are one of the most abundant resident sport fish located in the Project area, and they likely provide the predominant recreational fishery resource.

Background and Existing Information

Electrofishing surveys were performed along 0.6 miles of shoreline at each of three sites in the vicinity of the Project by Yoder et al., (2006) in late July 2003. Because of the timing of the surveys, data were primarily representative of the resident fish assemblage. Overall, 16 species were captured from the areas downstream of Worumbo Dam to the areas downstream of Pejepscot Dam, and relative abundance varied between the sites sampled. Overall, the catch was dominated by cyprinids and/or centrarchids. The highest abundance was observed in the impoundment, primarily due to large numbers of spottail shiner captured there. Because many individuals collected during the surveys were small or juvenile fish, biomass by species shows a different pattern, with smallmouth bass and white sucker dominating the overall fish biomass in the riverine areas upstream of the Project impoundment and below the Project. Smallmouth bass and yellow perch, followed by redbreast sunfish dominated the fish biomass in the Project impoundment.

Project Nexus

There is assumed to be suitable habitat for largemouth and smallmouth bass in the Project impoundment. The study would provide baseline information related to this topic.

Methodology

Task 1: Literature Review:

Prior to conducting the field investigation, a desktop literature review will be performed to determine when largemouth and smallmouth bass in the Project area typically spawn. In addition to the timing of spawning, the literature review will also be helpful for identifying typical habitat-types used by largemouth and smallmouth bass for spawning, as well as spawning behavior or habits to aid in subsequent field identification.

Task 2: Field Surveys:

Once spawning periods have been identified, the field survey effort will be scheduled to maximize potential observations of largemouth and smallmouth bass spawning activities. Topsham Hydro anticipates two surveying events to capture the spawning periods of both species. The study area will encompass the Pejepscot impoundment from the Pejepscot Dam upstream to the Route 125 bridge, which is approximately 600 feet downstream of the Worumbo Dam. The survey area will include the littoral zone of the Project impoundment relative to its normal elevation of 67.2 feet, msl. This will be a general guideline, as the observable characteristics of the littoral zone can vary with water clarity, water level, time of day, and the prevailing weather conditions.

Assuming the water clarity is conducive for visual assessment, field sampling will be conducted by systematically traversing the littoral zone of the Pejepscot impoundment via boat and/or foot (wading) to visually identify any largemouth and smallmouth bass nests, egg masses/deposits, and/or spawning habitat. Additional necessary equipment and data collection will include:

- a digital camera for photo-documentation of habitat types, egg deposits, and identified nests;
- an underwater Atlantis™ Panning Camera and/or view tubes to identify spawning nests/habitats in those instances where they cannot be easily identified from the surface;
- a handheld GPS unit to geo-reference the locations of identified habitats, egg deposits, and nests;
- a handheld water quality meter to measure water temperature;
- a Marsh-McBirney flow meter to measure velocity at identified spawning habitats, egg deposits, and nests;
- a secchi disk to estimate water clarity;
- a stadia rod and/or depth meter for recording depth of identified spawning habitats, egg deposits, and nests; and
- data sheets for recording water quality parameters, general observations, weather conditions, and other relevant descriptive information (e.g., sediment/grain sizes

associated with nests, embeddedness, approximate diameter of identified nests, presence of fish at nests, presence of aquatic vegetation, nest abandonment, sedimentation of eggs, etc.).

These data will be recorded on standardized, waterproof field data sheets. Upon completion of the field survey, all data sheets will be reviewed for quality assurance. Data necessary to develop a map of the observed spawning habitat, egg deposits and fish nests relative to the survey area will be electronically transcribed.

Consistency with Generally Accepted Scientific Practice

The proposed survey to document largemouth and smallmouth bass habitat and spawning areas is an accepted means of documenting species use in the Project area.

Deliverables and Schedule

The survey effort will be conducted during the summer of 2019. Data and results will be included in the Initial Study Report to be filed with FERC in July 2020.

Cost and Level of Effort

The estimated cost for the habitat and spawning survey is approximately $15,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information on largemouth and smallmouth bass habitat and spawning in the Project impoundment.

References

Yoder, C.O., B.H. Kulik, J.M. Audet, and J.D. Bagley. 2006. The Spatial and Relative Abundance Characteristics of the Fish Assemblages in Three Maine Rivers. Technical Report MBI/12-05-1. September 1, 2006.

7.2.3 **Fish Entrainment and Turbine Survival Assessment**

Topsham Hydro proposes to conduct a qualitative desktop analysis to assess the entrainment and impingement potential and the turbine survival of diadromous fish at the Project.

Goals and Objectives

NMFS requested an evaluation of downstream fish passage to examine:

- The behavior of outmigrating juvenile and adult alewife, blueback herring, shad and American eel at the Project intakes;
- The potential level of entrainment and impingement of the species/lifestages at the Project intakes;
- The survival of these species and lifestages that pass through the downstream fish bypass, turbines and spillway; and
- Delays in downstream passage at the project for these species and lifestages.

The spring and fall fish passage effectiveness studies discussed in Section 7.2.4 (spring) and Section 7.2.5 (fall) are designed to provide estimates of Project and route-specific survival estimates and residence time upstream of the dam prior to passage for adult and juvenile alosine species and adult (silver-phase) American eels. Topsham Hydro proposes to conduct a desktop evaluation to examine the potential level of impingement and entrainment for diadromous fish species at the Project.

The objectives of this desktop evaluation are to:

- Provide a description of the physical characteristics of the Project (including forebay characteristics, intake location and dimensions, calculated approach velocities, and rack spacing);
- Analyze target species for factors that may influence vulnerability to entrainment and mortality;
- Assess the potential for the impingement or entrainment of target species; and
- Evaluate turbine entrainment passage survival using available site-specific estimates, comparable project estimates and calculated values.

Known Resource Management Goals

NMFS is a federal resource agency with a mandate to protect and conserve fisheries resources and associated habitat. Resource management goals and plans are codified in their regulatory statues. NMFS relies on the best available data to support conservation recommendations and management decisions.

Background and Existing Information

The PAD summarized available downstream fish passage effectiveness information for diadromous fish species at the Project, which to date have been limited to Atlantic salmon smolts. Radio-telemetry evaluations of downstream smolt passage were conducted during 2013, 2014, and 2015 and generated agency approved total project survival rates of 81.4-91.3%. During the final study year (2015), 70% of radio-tagged Atlantic salmon smolts passed the Project via Unit 1 (Kaplan turbine).

Project Nexus

Site specific information on the passage effectiveness and survival for the suite of diadromous species and life stages inhabiting the Project area is not available. Analyses from this desktop impingement and entrainment assessment for diadromous fish species will provide information that can be evaluated in conjunction with the studies outlined in Section 7.2.4 and 7.2.5 for a determination as to the effectiveness of the existing fish passage measures at the Project.

Methodology

The assessment of impingement, entrainment, and survival will be conducted as a desktop analysis and used to support studies regarding passage and survival at the Project. The potential for impingement or entrainment will be characterized based on the relationship of site-specific intake characteristics along with swim speed and life history characteristics of target fish species. Site-specific factors likely to influence the potential for entrainment include: intake location relative to shore and littoral habitat, depth of project intakes, degree of natural water level fluctuations, hydraulic capacity of the facilities, and intake velocities. This assessment will rely on intake velocities calculated using the velocity equation Q = V*A where Q = flow rate (cfs), V = velocity (feet per second) and A = area (square feet). Life history characteristics and species/life stage specific swim speed information for target fish species will be obtained from peer-reviewed literature. The likelihood of impingement or entrainment for a particular species-life stage will be qualitatively assessed through the comparison of site-specific intake characteristics to literature reported swim speeds, body dimensions and other life history characteristics.

A review of entrainment studies conducted at other hydroelectric projects (i.e., EPRI, 1997) will be conducted to derive entrainment rates for target fish species. EPRI (1997) summarizes entrainment rate data for hydroelectric projects which relied on full-flow tailrace netting to sample the entire flow passing from one or more units at a project. Partial flow sampling was not included in that database due to the higher potential for sample contamination as a result of collection of resident tailrace fish or net avoidance. Each of the 43 projects contained in the EPRI (1997) data compilation will be reviewed for similarity in project characteristics to those in operation at the Pejepscot Project. Following determination of appropriate project(s) for use as surrogates, available entrainment rate data will be summarized for the fish species – life stages of interest. Literature-obtained entrainment rates will be combined with Project-specific discharge data to generate qualitative assessments of potential of entrainment for target species.

Entrainment survival for target fish species will be estimated using data from survival studies conducted at hydroelectric facilities with similar characteristics (e.g., EPRI, 1997; Winchell et al., 2000) and the Franke blade strike probability equation (Franke et al., 1997). In addition to literature-based and calculated passage survival rates, results from the site-specific downstream passage studies described in Section 7.2.4 and 7.2.5 will be incorporated. Where data is available, survival estimates obtained during the site-specific downstream passage studies will be compared to literature-obtained and calculated passage survival rates to evaluate the precision of the two predictive methods.

Consistency with Generally Accepted Scientific Practice

A desktop approach has been previously used and is a widely accepted technique for the assessment of impingement, entrainment and turbine survival as part of the FERC relicensing of hydropower projects. Recent examples include the Claytor Hydroelectric Project (FERC No. 739), Brassua Hydroelectric Project (FERC No. 2615), Santee Cooper Hydroelectric Project (FERC No. 199), Wilder Hydroelectric Project (FERC No. 1892), Bellows Falls Hydroelectric Project (FERC No. 1855), and Vernon Hydroelectric Project (FERC No. 1904).

Deliverables and Schedule

A report will be prepared that presents methods, analyses, and results of the study. It is expected that this report will be included in the Updated Study Report which is due for filing in July 2020. This will permit the incorporation of results from the downstream passage effectiveness studies currently planned to occur during the spring and fall of 2019.

Cost and Level of Effort

Estimated costs for this study are $20,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information related to the potential level of impingement and entrainment at the Project.

References

Electric Power Research Institute (EPRI). 1997. Turbine entrainment and survival database-field tests. Prepared by Alden Research Laboratory, Inc. EPRI Report No. TR-108630. 13 pp. (plus two 3.5” diskettes), Palo Alto, CA.

Franke, G.F., D.R. Webb, R.K. Fisher, Jr., D. Mathur, P.N. Hopping, P.A. March, M.R. Headrick, I.T. Laczo, Y. Ventikos, and F. Sotiropoulos. 1997. Development of environmentally advanced hydropower turbine system design concepts. Prepared for U.S. Dept. Energy, Idaho Operations Office. Contract DE-AC07-94ID13223.

Winchell, F., S. Amaral, and D. Dixon. 2000. Hydroelectric turbine entrainment and survival database: an alternative to field studies. In: HydroVision 2000: New Realities, New Responses. HCI Publications, Kansas City, MO.

7.2.4 **Evaluation of Spring Migration Season Fish Passage Effectiveness**

Topsham Hydro proposes to conduct an upstream and downstream passage evaluation study at the Project for adult river herring and American shad during the spring migration season (May 1 - July 31).

Goals and Objectives

NMFS, USFWS, and MDMR requested an evaluation of the effectiveness of the existing upstream and downstream fish passage facilities at the Project for adult river herring (i.e., alewife and blueback herring) and American shad. This evaluation is to occur during the spring migration period of May 1 – July 31. Ideally, the evaluation of safe, timely, and effective upstream passage at the fish lift will include period(s) of time where river flows exceed the station capacity of 8,550 cfs, resulting in spill flows downstream of the Project, as well as a period(s) of time where river flows are below the station capacity of 8,550 cfs, resulting in a lack of spill flows at the Project. Specific objectives are to:

- Estimate the proportion of adult river herring and American shad which approach and successfully pass upstream via the existing Project fish lift.

- Estimate the residence time for adult river herring and American shad in the area immediately downstream of the Project, prior to successful passage in the upstream fish lift or downstream departure from the study area.

- Estimate the survival or passage success for adult river herring and American shad passing upstream through defined river reaches as they approach the Project.

- Describe the spatial and temporal distribution of adult river herring and American shad presence within the tailwater downstream of the Project during the period of residence time prior to successful passage in the upstream fish lift or downstream departure from the study area.

- Describe the extent of mortality which occurs to adult river herring and American shad during upstream passage.

- Estimate downstream passage survival for outmigrating adult river herring and American shad at the Project.

- Evaluate the use of available downstream passage routes by outmigrating adult river herring and American shad at the Project.

- Estimate the residence time for outmigrating adult river herring and American shad in the area immediately upstream of the Project, prior to downstream passage.

- Examine the temporal distribution of arrival times for outmigrating adult river herring and American shad to the Project area upstream of the dam.

- Estimate transit times for outmigrating adult river herring and American shad through defined reaches upstream and downstream of the Project.

Known Resource Management Goals

In their study requests, federal and state resource agencies described various jurisdictional resource management goals for this study, as summarized below.

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

MDMR's management goal is to restore alewife, blueback herring, American shad, Atlantic salmon, American eel, striped bass, and sea lamprey to their historic habitat in the Androscoggin River watershed (MDMR and MDIFW 2017). The waters upstream of the Project represent nearly all of the spawning habitat historically used by alewife and Atlantic salmon and approximately 86% of historical spawning habitat used by blueback herring and American shad. MDMR's restoration efforts rely on safe, timely, and effective upstream and downstream fish passage at the Pejepscot Project.

NMFS is a federal resource agency with a mandate to protect and conserve fisheries resources and associated habitat. Resource management goals and plans are codified in their regulatory statues. NMFS relies on the best available data to support conservation recommendations and management decisions.

USFWS general relicensing goals include:

- Ensure that protection, mitigation, and enhancement measures are commensurate with the Project's effects and contribute to meeting state and federal fish and wildlife objectives;

- Recover federally proposed and listed species and prevent the listing of additional species;

- Conserve, protect, and enhance the habitats for fish, wildlife, and plants that continue to be affected by the Project; and

- Ensure that once the relicensing process is complete, there is an adaptive management plan to incorporate new information and implement new management strategies over the term of the license, bringing us close to the desired level of protection for fish and wildlife resources.

USFWS objectives for Aquatic Ecosystems include:

- Protect, enhance, or restore diverse high-quality aquatic and riparian habitats for plants, animals, food webs, and communities in the watershed and mitigate for loss or degradation of these habitats;

- Maintain and/or restore aquatic habitat connectivity in the watershed to provide movement, migration, and dispersal corridors resident fish and other aquatic organisms and provide longitudinal connectivity for nutrient cycling processes;

- Restore naturally reproducing stocks of migratory fish and resident fish, to historically accessible riverine and lake habitats;

- Provide an instream flow regime that meets the spawning, incubation, rearing, and migration requirements of resident fish and amphibian species, throughout the Project area, and for diadromous fish in downstream waters of the Androscoggin River that may be affected by the Project's water management releases;

- Meet or exceed Federal and State regulatory standards and objectives for water quality in the basin; and

- Minimize Project operation effects on water temperature and the potential negative effects to downstream fishery resources.

Background and Existing Information

The PAD summarized available fish passage effectiveness information for upstream and downstream passage of adult river herring and American shad. Studies to determine the effectiveness of the Project upstream fish passage facility for alewife were conducted in 1991 and 1992 during non-spill or very limited spill conditions (Charles Ritzi Associates, 1992). Passage rates were determined for five release cohorts based on the success of marked (floy-tagged) alewife that were tagged at the Brunswick Project, which were then tallied as they passed the Project fishway viewing window. Four of the cohorts released were considered suitable for analysis, at an average passage efficiency of 87%. This number was determined to be an underestimate, and the agencies concluded that the efficiency of the upstream passage facility at the Project was close to the agency goal of 90% for alewife. Rapid passage at the Project was noted, with 90% or greater of the fish passing the Project within 2-6 days of being passed at the Brunswick Project. One of the cohorts exhibited 66% passage from Brunswick through the Project on the first fishway lift after release at Brunswick, which was over a span of 20 hours after release.

Project Nexus

The Project dam is within the migration route of these species and may affect upstream and downstream passage. Information on the passage effectiveness for the some of the suite of diadromous species and life stages inhabiting the Project area is available. Results of the proposed upstream and downstream passage evaluation for spring migrating diadromous fish species (i.e., adult river herring and American shad) will allow for further determination as to

whether or not the existing passage facilities allow for safe, timely, and effective passage at the Project for these study species.

Methodology

1. Study Approach:

Effectiveness of the existing upstream and downstream passage facilities for spring migrants at the Project will be evaluated for adult alosines via radio-telemetry. Diadromous alosine species present in the Androscoggin River include American shad and the closely related alewife and blueback herring (collectively termed "river herring"). Topsham Hydro is proposing to utilize radio-tagged adult American shad and alewives[8] for evaluation of upstream and downstream passage effectiveness performance at the Project.

Following the release of radio-tagged adult alewives and American shad into the Androscoggin River, their movements will be evaluated using a series of stationary radio-telemetry receivers in place at the Project as well as at several additional stationary monitoring stations installed at bank-side locations upstream and downstream of the Project to inform on fish movements and Project passage success.

2. Radio-Telemetry Equipment:

Installed radio telemetry equipment will include Orion receivers, manufactured by Sigma Eight, as well as SRX receivers manufactured by Lotek. Receivers will be installed following consideration of the detection requirements for the specific area of coverage, as well as the attributes of the receiver model. The Orion receiver is a broadband receiver capable of monitoring multiple frequencies simultaneously within a 1-MHz band; it will be most useful for monitoring tagged fish in areas where movement through the monitoring zone can occur quickly (e.g., for downstream passage through a turbine unit intake or a downstream bypass). Although Lotek receivers have a greater detection range than Orion receivers, they can only monitor a single frequency at a time and require frequency switching, which decreases detection efficiency in areas where fish may pass at high rates of speed. As part of monitoring adult alosine passage at the Project, Lotek receivers will be used at locations requiring longer range and where the intended detection areas can be characterized by relatively slow transit speeds for tagged fish (e.g., approach to the tailrace area for fish moving in an upstream direction or approach to headpond area for fish moving in a downstream direction). Antennas types will include Yagi aerial antennas and underwater drop antennas custom built on site with RG58 coaxial cable.

Adult alewives and American shad tagged during this study will be fitted with radio transmitters (e.g., Sigma Eight, Pisces model TX-PSC-I-80-D, or an equivalent model). The TX-PSC-I-80-D

[8] This approach was proposed and accepted by the resource agencies as part of the evaluations of upstream movements of river herring at the Shawmut Project and downstream river herring passage at the Hydro Kennebec Project during 2016 (Normandeau 2017a and 2017b). The use of alewife instead of blueback herring is supported by considerably better post-tagging survival of alewife in a pre-release tagging assessment at the Lockwood Project (Normandeau 2016a). This approach will be selected for all in-river releases of test fish so as to not introduce bias into estimates of Project passage success due to mortality associated with handling and tagging.

transmitter measures approximately 22 x 10 x 10 mm, weighs 3.3 g, and has an estimated battery life of 64 days when set at a 2.0 second burst rate. This model has been successfully used in alosine studies conducted by Normandeau Associates, Inc. on the Kennebec and Penobscot Rivers in Maine. Transmitters for this evaluation will be uniquely coded and divided between two or three unique frequencies.

3. Monitoring Stations:

Radio telemetry antennas and receivers will be set up at locations on and around the Project, as well as at locations upstream and downstream of the Project. Each monitoring station will consist of a data-logging receiver, one or more antennas, and a power source. Each will be configured to receive transmitter signals from a designated area continuously throughout the study period. During installation of each station, range testing will be conducted to configure the antennas and receivers in a manner which maximizes detection efficiencies at each location. The operation of the system will be confirmed during installation and throughout the study period by using beacon tags. These beacon tags will be stationed at strategic locations within the detection range of either multiple or single antennas and will emit a signal at a programmed time interval. These signals will be detected and logged by the receivers and used to record the functionality of the system throughout the study period. Although each monitoring station will be installed in a manner which limits the ability to detect transmitters from unwanted areas, the possibility of such detections does still exist. As a result, behavioral data collected in this study (i.e., duration at a specific location or passage route) will be inferred based on the signal strength and the duration and pattern of contacts documented across the entire detection array.

The locations of proposed monitoring stations for upstream and downstream passage of adult alosines at the Project are outlined below and presented visually in Figure 7.2.4-1. As with any telemetry study, monitoring station locations described here will be evaluated in the field prior to initialization of the study and, if necessary, may be modified to enhance the collection of passage information. Landowner permissions will be required for the installation of several the remote monitoring locations.

Monitoring Station S1: This station will be installed at a location downstream of the Brunswick Project (FERC No. 2284) and will be used to inform on the departure of radio-tagged adult alosines from the lower Pejepscot Project study area (i.e., the 4.6-mile reach between the Pejepscot and Brunswick Dams). This location will aid in the identification of potential “fall back” events for alosines (primarily American shad) which move downstream immediately following tag and release. This station will consist of a single receiver coupled to an aerial antenna oriented perpendicular to the river channel.

Monitoring Station S2: This station will detect radio-tagged adult alosines approaching the Brunswick Project from upriver. S2 will consist of a single receiver coupled to an aerial antenna oriented in an upstream direction and attached to a section of railing adjacent to the powerhouse along the western bank. Detection information from this location is required for evaluation of downstream passage success at the Pejepscot Project.

Monitoring Station S3: This station will consist of a single receiver coupled to an aerial antenna and will be located bankside at a point upstream of Station S2 and downstream of Station S4 (exact location to be determined pending landowner permission). Detection information from this location is required for evaluation of downstream passage success at the Pejepscot Project and will also inform on upstream passage success for radio-tagged alosines through a section of the 4.6-mile reach between Pejepscot and Brunswick Dams.

Monitoring Station S4: Station S4 will detect radio-tagged adult alosines passing a point approximately 1.8 miles downstream of the Pejepscot Project. This monitoring station will consist of a receiver coupled to an aerial antenna and will be located on the Brunswick & Topsham Water District property along the eastern bank of the river (pending permission). Detection information from this location is required for evaluation of downstream passage success at the Pejepscot Project and will also inform on upstream passage success for radio-tagged alosines through a section of the 4.6-mile reach between Pejepscot and Brunswick Dams.

Monitoring Station S5: This station will detect radio-tagged adult alosines approaching the reach immediately downstream of the Pejepscot Project and will consist of a single receiver and aerial antenna providing coverage at a point approximately 500 feet downstream of the powerhouse. Tag detections from this location will establish the initiation of residence times for radio-tagged adult alosines approaching the Project from points downstream.

Monitoring Station S6: This station will detect radio-tagged adult alosines as they (1) approach the area of powerhouse discharge and the nearfield area adjacent to the fish lift entry and (2) identify adult alosines which pass downstream of the Project via Unit 1. This station will consist of a single receiver and aerial antenna. With regards to determination of downstream passage via Unit 1 (Kaplan unit), gate well slots for that turbine are not accessible for the insertion of underwater drop antennas. As a result, it will be necessary to use process of elimination to distinguish radio-tagged alosines passing via Unit 1 (Kaplan unit) from other passage routes. This approach was utilized during the most recent Atlantic salmon smolt passage evaluation at the Project (Normandeau 2016b).

Monitoring Station S7: This station will detect radio-tagged adult alosines that are (1) utilizing the area below the spillway during their period of residence downstream of the Project prior to upstream passage and (2) have passed downstream of the Project via the spillway.

Monitoring Station S8: Station S8 will consist of a single receiver and an underwater drop antenna. It will be positioned inside of the entrance to the fish lift and will be used to provide detection information for individuals which have entered into the entrance flume.

Monitoring Station S9: Station S9 will consist of a single receiver and an underwater drop antenna. It will be positioned in the vicinity of the counting window and will detect radio-tagged alosines which have exited the lift hopper. Detection information from this location will also be used to determine the potential downstream passage for radio-tagged adult alosines which may exit via this route.

Monitoring Station S10: Station S10 will consist of a single receiver and an underwater drop antenna. It will be positioned at the end of the exit flume prior to entry into the headpond. This receiver will provide detection information for individuals which have exited the upstream end of the fish lift.

Monitoring Station S11: This station will be installed at a location approximately 650 feet upstream of the dam and will provide (1) arrival timing information on radio-tagged adult alosines as they enter the Project area prior to downstream passage and (2) headpond departure timing for radio-tagged adult alosines having recently passed upstream via the fish lift. Station S11 will consist of a single receiver and aerial antenna oriented perpendicular to the river channel.

Monitoring Station S12: This station will monitor downstream passage through the three horizontal Francis units in the northern powerhouse. It will consist of a single receiver and a number of custom-made underwater drops. The dropper antennas will be positioned at equally spaced intervals across the width of Units 21, 22, and 23 (Francis units) and combine to create a single large underwater antenna for full coverage of the units. Detections of a transmitter passing through Units 21, 22 or 23 (Francis units) will be collected as a single data set and not identified to a particular turbine.

Monitoring Station S13: This station will monitor downstream passage of radio-tagged adult alosines through the left side weir (i.e., downstream bypass). It will consist of a single receiver connected to a pair of staggered, custom built drop antennas. The drop antennas will be installed through the weir entrance and into the outlet pipe to ensure detections are of fish committed to the route.

Monitoring Station S14: This station will monitor downstream passage of radio-tagged adult alosines through the right side weir (i.e., downstream bypass). It will consist of a single receiver connected to a pair of staggered, custom built drop antennas. The drop antennas will be installed through the weir entrance and into the outlet pipe to ensure detections are of fish committed to the route.

Monitoring Station S15: This station will be installed at a location upstream of the Worumbo Project (FERC No. 3428) and will be used to inform on the movement of radio-tagged adult alosines upstream and out of the Pejepscot impoundment. This station will consist of a single receiver coupled to an aerial antenna oriented perpendicular to the river channel. The exact location for this station will be determined in the field.

4. Tagging and Release Procedures:

Adult alewives and American shad tagged as part of this evaluation will be obtained from the Brunswick fishway. Timing of tagging efforts for alewife and American shad will be based on the current observed run timing for returning alosines at Brunswick which runs from the first week of May until mid-June. Adult American shad passage at Brunswick has varied over the period from 2000-2017 from a low of 0 individuals during 2005, 2009, 2011, and 2014 to a high of over 1,000 individuals during 2016. The ability to tag and release adult American shad for

evaluation of upstream and downstream passage effectiveness at the Pejepscot Project will be limited by the ability to obtain an adequate sample size from fishway captures at Brunswick.

Following capture in the lift, adult alewives and American shad will be dip-netted from the sorting tanks and visually assessed to ascertain their suitability for tagging. Any individuals exhibiting excessive scale loss or other signs of significant stress will not be considered for tagging. Individuals deemed acceptable for tagging will be quickly measured (total length, nearest mm), and gender will be determined (when possible) by gently expressing eggs or milt from running-ripe fish. Radio transmitters will be inserted gastrically into both adult alewives and American shad. To facilitate gastric implantation, transmitters will be affixed to a flexible tube with their trailing antenna running through the hollow center. The transmitter and leading edge of the flexible tube will be pushed through the mouth and down to the stomach. Once in place, the tube will be removed leaving the transmitter antenna trailing from the mouth. Following tagging, fish will be immediately transferred to a stocking vehicle filled with aerated Androscoggin River water. Salt will be added to the transport tank to reduce osmotic stress of tagged fish.

Pending availability, a total of 200 radio-tagged adult alewives and up to 250 radio-tagged adult American shad will be transported by truck to one of two release locations. A minimum of four separate release groups of radio-tagged adult alewives (100 individuals total) and American shad (150 individuals total) will be transported via stocking truck from the Brunswick upstream fishway to the Mill Street public boat launch located 0.6 miles upstream of Brunswick. These 250 radio-tagged alosines will be free to volitionally move upstream and approach the Pejepscot Project for evaluating upstream passage effectiveness. Similarly, a minimum of four separate release groups of radio-tagged adult alewives (100 individuals total) and American shad (100 individuals total) will be transported via stocking truck from the Brunswick upstream fishway to the Pejepscot public boat launch located 2.6 miles upstream of the Pejepscot Project. These 200 radio-tagged alosines will be free to move downstream and approach the Pejepscot Project for evaluating downstream passage effectiveness. Downstream passage of any radio-tagged alosines originally released below the Pejepscot Project at the Mill Street boat launch and having successfully moving upstream via the fish lift will be recorded.

Each group of radio-tagged alewives will be accompanied by an additional number of untagged adult river herring. The exact number of untagged fish will be dependent on availability at the time of tagging, and an estimate of the final release size will be recorded. To reduce potential crowding and associated stress during the trip from Brunswick to the release locations, each stocked group of American shad will be limited to only radio-tagged individuals. Following arrival of the stocking truck at the release locations, the tank contents will be sluiced directly into the river to avoid any further netting or handling. The date and time of each release will be recorded.

5. Project Data Collection:

Active Radio-transmitters: Data will be offloaded from the receivers at each monitoring station using a laptop computer and will be stored on removable memory sticks. Data downloads will occur at least one time weekly during the period from the initial tag and release date until the last

week of July. Backup copies of all telemetry data will be made prior to receiver initialization. Field tests to ensure data integrity and receiver performance will include confirmation of file integrity, confirmation that the last record is consistent with the downloaded data (beacon tags will be critical to this step), and lastly, to confirm that the receiver is operational upon restart and actively collecting data post download. Within a data file, transmitter detections will be stored as a single event (i.e., single data line). Each event will include the date and time of detection, frequency, ID code, and signal strength. Supplemental detection information will be collected during manual tracking events covering the section of the Androscoggin River between Worumbo and Brunswick. These tracking events will be conducted once every other week from the initial tag and release date until the end of July.

Downstream Drift Assessment: A total of five freshly dead adult herring and five freshly dead adult shad will be radio-tagged and released downstream of the Pejepscot Project during the release period to simulate "movements" of adult alosines killed during downstream passage. The downstream progression of these known mortalities will be recorded via both the stationary receivers as well as during manual tracking events and will help inform on the probability that downstream receivers may record false positive detections associated with dead study fish drifting passed the receiver (this would result in biased estimates of downstream passage survival). A summary of downstream drift distances at the Project will be provided in the study report.

River and Project Operational Data: In addition to the manual and stationary radio telemetry data, river and Project operations data will be reported for the duration of the evaluation period. Mainstem river temperature will be recorded via a thermal logger installed at the Project. Project discharge (generation and spill), unit operations (total cfs and percent gate), downstream bypass settings, and extent and location of spill will be obtained from Topsham Hydro at the completion of the study period.

Project Data Processing and Analysis:

Data Processing: Tag detections in each downloaded stationary telemetry data file will be validated through a series of site-specific and logical criteria: These criteria will include:

1. Signal strength threshold level of the detection,
2. Frequency of the radio tag signals per unit of time, and
3. Spatial and temporal characteristics of each individual detection with respect to the full series of detections at monitoring stations within the entire detection array.

To determine the signal strength threshold for a valid tag signal, power levels associated with background noise will be recorded at each monitoring station prior to the release of radio-tagged fish. These "false" signals are typically received at relatively low power levels, and they will be removed from the analysis using a series of data filters. The frequency of the signal detections for an individual radio tag will be examined at each monitoring station, to ensure that there are an adequate number of detections to rule out an isolated false detection (e.g., at least 3 detections within 1 minute). Finally, the spatial and temporal distribution of detections across multiple monitoring stations will be examined to verify that the pattern of detections is not occurring in a

manner that is unreasonable (i.e., time for a fish to have relocated within the time between the detections).

Upstream Analysis: Upstream passage success at the Project will be estimated using a standard Cormack-Jolly-Seber (CJS) model run for the set of individual encounter histories (i.e., the series of detection/no detection through the linear sequence of receivers from downstream to upstream) for each species evaluated. This approach will provide a series of reach-specific "survival" or passage success estimates for:

- Release location to Monitoring station S3;
- Monitoring station S3 to Monitoring station S4;
- Monitoring station S4 to Monitoring station S5 (i.e., lower tailrace);
- Monitoring station S5 (i.e., lower tailrace) to Monitoring station S6 (i.e., nearfield);
- Monitoring station S6 (i.e., nearfield) to Monitoring station S8 (i.e., lift entrance);
- Monitoring station S8 (i.e., lift entrance) to Monitoring station S9 (i.e., upper exit flume);
- Monitoring station S9 (i.e., upper exit flume) to Monitoring station S10 (i.e., flume exit);

Standard error and confidence bounds for each estimate will be generated. The product of adjacent reach-specific estimates will be used to evaluate passage success. Nearfield effectiveness will be defined as the product of (StnS5 to StnS6)*(StnS6 to StnS8). Internal effectiveness will be defined as the product (StnS8 to StnS9)*(StnS9 to StnS10). Total effectiveness will be defined as the product of (StnS5 to StnS6)*(StnS6 to StnS8)*(StnS8 to StnS9)*(StnS9 to StnS10).

To evaluate passage success using the CJS models, a suite of candidate models will be developed in Program MARK (White and Burnham 1999) based on whether survival (i.e., passage success), recapture (i.e., detection), or both vary or are constant among stations. Models will include:

- *Phi*(t)*p*(t): survival and recapture may vary between receiver stations;
- *Phi*(t)*p*(.): survival may vary between stations; recapture is constant between stations;
- *Phi*(.)*p*(t): survival is constant between stations; recapture may vary between stations;
- *Phi*(.)*p*(.): survival and recapture are constant between stations;

Where;

- *Phi* = probability of survival
- *p* = probability of detection
- (t) = parameter varies
- (.) = parameter is constant

Prior to comparison among models, goodness of fit testing will be conducted for the "starting model" (i.e., the fully parameterized model) using the function RELEASE within Program MARK. Within RELEASE, outputs from Test 2 and Test 3 combine to provide goodness of fit information for the fully time dependent model. If the χ^2 results from Test 2, Test 3, or the overall result (Test 2 + Test 3) are significant, then the test assumptions are violated and the fully time-dependent model does not provide adequate goodness of fit. To accommodate for the lack

of fit, a measure of how much extra binomial noise (i.e., variation) exists in the data is needed. This value, the variance inflation factor (ĉ), can be estimated within MARK and used to correct for any minor over-dispersion.

Akaike's Information Criterion (AIC) will be used to rank the models as to how well they fit the observed mark-recapture data. Lower AIC values denote a more explanatory yet parsimonious fit than higher AIC values. Assuming the assumptions of the model with the lowest AIC value are reasonable with regards to this study, it will be selected for the purposes of generating MARK-derived survival estimates.

The stationary telemetry data set collected using the monitoring stations described above will also permit the evaluation of downstream residence time for radio-tagged adult alosines. That will be defined as the duration of time from initial entry into the lower Project area (i.e., detection at Monitoring station 5) until successful upstream passage or departure from the study area. The proportions of time spent in the immediate discharge area or in the reach downstream of the spillway will also be examined.

Downstream Analysis: Similar to upstream passage success, springtime downstream passage survival at the Project will be evaluated using a CJS model. Candidate models, goodness of fit testing and model ranking for the downstream CJS model will be identical to those processes described above for the upstream CJS model. Downstream parameter estimates for *Phi* and *p* will be obtained using the encounter histories constructed for each radio-tagged fish indicating their presence or absence at detection locations from the approach receiver (i.e., Monitoring station 11) through the second receiver located downstream of the Project (i.e., Monitoring station 3). The CJS model will generate reach-specific survival estimates for radio-tagged adult American shad and alewives from:

- Release location to Monitoring station S11 (i.e., upstream approach);
- Monitoring station S11 (i.e., upstream approach) to downstream passage;
- Downstream passage to Monitoring station S4;
- Monitoring station S4 to Monitoring station S3.

The joint probability of the two Project reach survival estimates (i.e., (StnS11 to Passage)*(Passage to StnS4)) will be used as the estimate of total passage survival for the Project. This approach will result in mortality estimates that include both background mortality (i.e., natural mortality such as predation) and mortality due to Project effects for radio-tagged adult alosines in the 650-foot section upstream of the Project dam as well as in the reach downstream of the Project dam extending to the first downstream receiver. Thus, the results will reflect a minimum estimate of survival attributable to Project effects for adult river herring and American shad.

Dependent on the distribution of downstream passage events among potential passage routes (i.e., Unit 1, Units 21-23, downstream bypasses, spill, and upstream fishway), route-specific estimates of passage survival may be available. The availability of these estimates will be driven by sample size and will be a function of passage route selection by the radio-tagged fish.

A complete record of all valid detections for each uniquely coded radio-tagged adult alosine will be generated. The pattern and timing of detections in these individual records will be reviewed, and a route of passage as well as arrival and passage times will be determined. In instances where a specific passage route is not clearly defined by the available data, the passage route for that individual will be classified as unknown. The stationary telemetry data set collected using the monitoring stations described above will also permit the evaluation of upstream residence time for radio-tagged adult alosines. Upstream residence time will be defined as the duration of time from initial entry into the upper Project area (i.e., detection at Monitoring station 11) until successful downstream passage at the Project. Passage duration through each of the defined reaches will be calculated as the duration from initial detection at the stationary receiver on the upstream end of the reach until initial detection at the stationary receiver on the downstream end of the reach.

Consistency with Generally Accepted Scientific Practice

The proposed approach to evaluate upstream and downstream passage effectiveness for spring migrating diadromous fish species at the Project is consistent with those employed during the FERC relicensing process for other hydroelectric facilities such as Vernon (FERC No. 1904), Bellows Falls (FERC No. 1855), and Wilder (FERC No. 1892).

Deliverables and Schedule

Installation of telemetry monitoring stations will occur during late April 2019 with tagging and releases of adult alewives and American shad occurring during May-June of that year. Field monitoring is proposed to extend through July 2019. A full report of findings will be included in the Updated Study Report which is due for filing in July 2020.

Cost and Level of Effort

Topsham Hydro is proposing to conduct the field study during the course of one passage season. Estimated costs for this study are $184,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information to evaluate safe, timely and effective upstream and downstream passage for adult river herring and American shad at the Project.

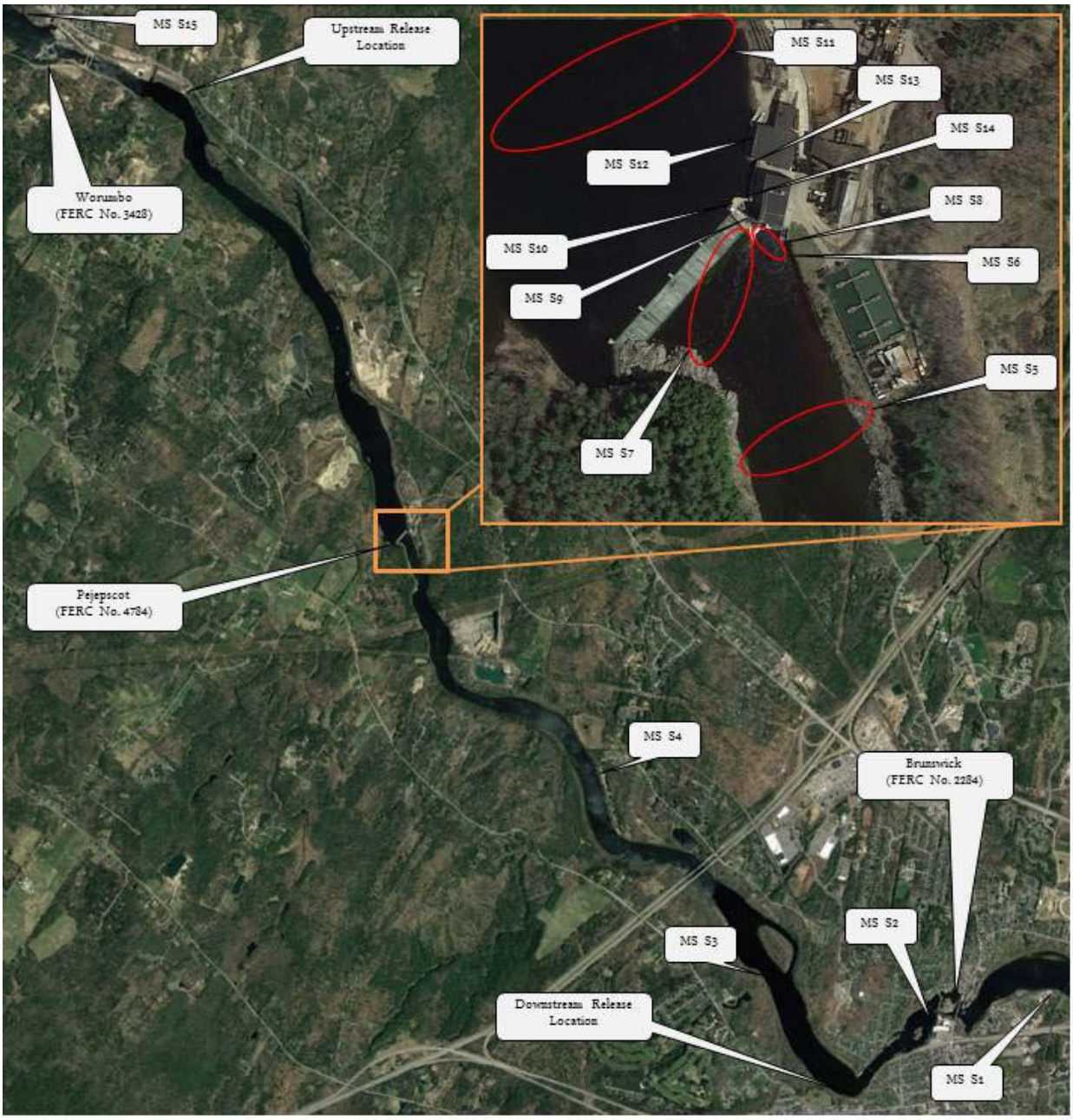

Figure 7.2.4-1: Project Release and Monitoring Station (MS) Locations for Evaluation of Upstream and Downstream Effectiveness for Passage of Spring Season Diadromous Species.

Red ovals represent intended detection zones for aerial antenna coverage in vicinity of Pejepscot.

References

Normandeau (Normandeau Associates, Inc.). 2016a. Evaluation of downstream passage for adult and juvenile river herring at the Lockwood Project, Kennebec River, Maine. Report Prepared for Merimil Limited Partnership.

Normandeau (Normandeau Associates, Inc.). 2016b. Evaluation of Atlantic salmon passage at the Weston, Shawmut, and Lockwood Projects, Kennebec River, and Pejepscot and Brunswick Projects, Androscoggin River, Spring 2015. Report Prepared for Brookfield White Pine Hydro, LLC, The Merimil Limited Partnership, and Black Bear Hydro Partners.

Normandeau (Normandeau Associates, Inc.). 2016c. Assessment of upstream American shad passage at the Lockwood Project, Kennebec River, Maine. Report Prepared for The Merimil Limited Partnership.

Normandeau (Normandeau Associates, Inc.). 2017a. Radio-telemetry evaluation for upstream fish passage entrance placement at the Shawumt Project, Kennebec River, Maine. Report Prepared for Brookfield White Pine Hydro.

Normandeau (Normandeau Associates, Inc.). 2017b. Radio-telemetry evaluation of downstream passage and survival of adult river herring at Hydro Kennebec (FERC No. 2611). Report Prepared for Hydro Kennebec, LLC.

White, G.C., and K.P. Burnham. 1999. Program MARK: survival estimation from populations of marked animals. Bird Study 46: 120-138.

7.2.5 **Evaluation of Fall Migration Season Fish Passage Effectiveness**

Topsham Hydro proposes to conduct a downstream passage evaluation study at the Project for juvenile alosines and adult (silver-phase) American eels during the fall outmigration season (August 1 to November 30).

Goals and Objectives

NMFS, USFWS, and MDMR requested an evaluation of the effectiveness of the existing downstream fish passage facilities at the Project for juvenile alosines and adult (silver-phase) American eels. This evaluation will occur during the fall outmigration period (August 1 to November 30). Specific objectives are to:

- Estimate downstream project passage survival for outmigrating juvenile alosines and adult American eels at the Project.
- Evaluate the use of available downstream passage routes by outmigrating juvenile alosines and adult American eels at the Project.
- Estimate the residence time for outmigrating juvenile alosines and adult American eels in the area immediately upstream of the Project prior to downstream passage.
- Examine the distribution for the hour of arrival at the Project for outmigrating juvenile alosines and adult American eels to the Project area upstream of the dam.
- Estimate transit times for outmigrating adult American eels through defined reaches immediately upstream and downstream of the Project.

Known Resource Management Goals

In their study requests, federal and state resource agencies described various jurisdictional resource management goals for this study, as summarized below.

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

MDMR's management goal is to restore alewife, blueback herring, American shad, Atlantic salmon, American eel, striped bass, and sea lamprey to their historic habitat in the Androscoggin River watershed (MDMR and MDIFW 2017). The waters upstream of the Pejepscot Project represent nearly all of the spawning habitat historically used by alewife and Atlantic salmon and approximately 86% of historical spawning habitat used by blueback herring and American shad.

MDMR's restoration efforts rely on safe, timely, and effective upstream and downstream fish passage at the Pejepscot Project.

NMFS is a federal resource agency with a mandate to protect and conserve fisheries resources and associated habitat. Resource management goals and plans are codified in their regulatory statues. NMFS relies on the best available data to support conservation recommendations and management decisions.

USFWS general relicensing goals include:

- Ensure that protection, mitigation, and enhancement measures are commensurate with the Project's effects and contribute to meeting state and federal fish and wildlife objectives;
- Recover federally proposed and listed species and prevent the listing of additional species;
- Conserve, protect, and enhance the habitats for fish, wildlife, and plants that continue to be affected by the Project; and
- Ensure that once the relicensing process is complete, there is an adaptive management plan to incorporate new information and implement new management strategies over the term of the license, bringing us close to the desired level of protection for fish and wildlife resources.

USFWS objectives for Aquatic Ecosystems include:

- Protect, enhance, or restore diverse high-quality aquatic and riparian habitats for plants, animals, food webs, and communities in the watershed and mitigate for loss or degradation of these habitats;
- Maintain and/or restore aquatic habitat connectivity in the watershed to provide movement, migration, and dispersal corridors resident fish and other aquatic organisms and provide longitudinal connectivity for nutrient cycling processes;
- Restore naturally reproducing stocks of migratory fish and resident fish, to historically accessible riverine and lake habitats;
- Provide an instream flow regime that meets the spawning, incubation, rearing, and migration requirements of resident fish and amphibian species, throughout the Project area, and for diadromous fish in downstream waters of the Androscoggin River that may be affected by the Project's water management releases;
- Meet or exceed Federal and State regulatory standards and objectives for water quality in the basin; and
- Minimize Project operation effects on water temperature and the potential negative effects to downstream fishery resources.

Background and Existing Information

The PAD summarized available downstream fish passage effectiveness information for diadromous fish species at the Project which is limited to Atlantic salmon smolts. Radio-telemetry evaluations of downstream smolt passage were conducted during 2013, 2014, and 2015 and generated agency approved total project survival rates of 81.4-91.3%. Radio-tagged smolts typically arrived at the Project during the evening, night or early morning hours 1-2 days following release and were resident in the area immediately upstream of the Project for a median duration of 0.3 hours (range = 0.1-35.4 hours). Distribution of passage route use varied among study years.

Project Nexus

The Project dam is within the migration route of these species and may affect upstream and downstream passage. Site specific information on the passage effectiveness for the suite of diadromous species and life stages inhabiting the Project area is not available. Results of the downstream passage evaluation for fall outmigrating diadromous fish species (i.e., juvenile alosines and adult silver-phase American eels) will allow for further determination as to the effectiveness of the existing downstream passage facilities at the Project.

Methodology

1. Study Approach:

Effectiveness of the existing downstream passage facilities at the Project will be evaluated for juvenile alosines and adult American eels via radio-telemetry. Radio-telemetry has proven to be the most effective at determining project residency duration of individual fish upstream of the dam as well as downstream passage routes and is the proposed approach for the Pejepscot Project. Similarly, radio-telemetry is the preferred manner for evaluating passage success of outmigrating adult American eels and that approach will be employed at the Pejepscot Project.

Following the release of radio-tagged juvenile alosines and adult American eels into the Androscoggin River, their movements will be evaluated using a series of stationary radio telemetry receivers in place at the Project as well as at several additional stationary monitoring stations installed at bank-side locations upstream and downstream of the Project to inform on fish movements and Project passage success.

2. Radio-Telemetry Equipment:

Installed radio telemetry equipment will include Orion receivers, manufactured by Sigma Eight, as well as SRX receivers manufactured by Lotek. Receivers will be installed following consideration of the detection requirements for the specific area of coverage, as well as the attributes of the receiver model. The Orion receiver is a broadband receiver capable of monitoring multiple frequencies simultaneously within a 1-MHz band; it will be most useful for monitoring tagged fish in areas where movement through the monitoring zone can occur quickly (e.g., for downstream passage through a turbine unit intake or a downstream bypass). Although

Lotek receivers have a greater detection range than Orion receivers, they can only monitor a single frequency at a time and require frequency switching, which decreases detection efficiency in areas where fish may pass at high rates of speed. As part of monitoring juvenile alosine or adult silver eel passage at the Project, Lotek receivers will be used at locations requiring longer range and where the intended detection areas can be characterized by relatively slow transit speeds for tagged fish (e.g., approach to headpond area for fish moving in a downstream direction). Antenna types will include Yagi aerial antennas and underwater drop antennas custom built on site with RG58 coaxial cable.

Juvenile alosines and adult American eels tagged during this study will be fitted with radio transmitters. Juvenile alosines will be tagged using Lotek NTQ-1 transmitters. The NTQ-1 transmitter measures approximately 5 x 3 x 10 mm, weights 0.25 g and has an estimated battery life of 10 days when set at a 2.0 second burst rate. This model has been successfully used by Normandeau Associates, Inc. in juvenile alosine studies on the Connecticut (Normandeau 2015a) and Merrimack (Normandeau 2015b) Rivers. Adult silver-phase eels will be tagged using transmitters manufactured by Sigma-Eight (model TX-PSC-I-450, or equivalent). The TX-PSC-I-450 measures approximately 12 x 12 x 46 mm, weights 8.5 g and has an estimated battery life of 357 days when set at a 2.0 second burst rate. This model has been successfully used by Normandeau Associates, Inc. in adult American eel studies on the Kennebec (Normandeau 2012), Connecticut (Normandeau 2015c) and Merrimack (Normandeau 2016) Rivers.

3. Monitoring Stations:

Radio telemetry antennas and receivers will be set up at locations on and around the Project, as well as at locations upstream and downstream of the Project. Each monitoring station will consist of a data-logging receiver, one or more antennas, and a power source. Each will be configured to receive transmitter signals from a designated area continuously throughout the study period. During installation of each station, range testing will be conducted to configure the antennas and receivers in a manner which maximizes detection efficiencies at each location. The operation of the system as a whole will be confirmed during installation and throughout the study period by using beacon tags. These beacon tags will be stationed at strategic locations within the detection range of either multiple or single antennas and will emit a signal at a programmed time interval. These signals will be detected and logged by the receivers and used to record the functionality of the system throughout the study period. Although each monitoring station will be installed in a manner which limits the ability to detect transmitters from unwanted areas, the possibility of such detections does still exist. As a result, behavioral data collected in this study (i.e., duration at a specific location or passage route) will be inferred based on the signal strength and the duration and pattern of contacts documented across the entire detection array.

The locations of proposed monitoring stations for downstream passage of juvenile alosines and adult American eels at the Project are outlined below and presented visually in Figure 7.2.5-1. As with any telemetry study, monitoring station locations described here will be evaluated in the field prior to initialization of the study and, if necessary, may be modified to enhance the collection of passage information. Landowner permissions will be required for the installation of a number of the remote monitoring locations.

Monitoring Station F1: This station will be installed at a location approximately 650 feet upstream of the Project dam and will provide arrival timing information on radio-tagged juvenile alosines and adult American eels as they enter the Project area prior to downstream passage. Station F1 will consist of a single receiver and aerial antenna oriented perpendicular to the river channel.

Monitoring Station F2: Station F2 will consist of a single receiver and an underwater drop antenna and will be positioned in the vicinity of the counting window located within the exit flume of the upstream fish lift. Detection information at this location will be used to confirm downstream passage for radio-tagged juvenile alosines and adult silver eels which may exit via this route.

Monitoring Station F3: This station will monitor downstream passage through the Unit Nos. 21, 22, and 23 (Francis units) in the northern powerhouse. It will consist of a single receiver and a number of custom-made underwater drops. The dropper antennas will be positioned at equally spaced intervals across the width of Unit Nos. 21, 22, and 23 and combine to create a single large underwater antenna for full coverage of the units. Detections of a transmitter passing through Unit Nos. 21, 22 or 23 will be collected as a single data set and not identified to a particular turbine.

Monitoring Station F4: This station will monitor downstream passage of radio-tagged juvenile alosines and adult American eels through the left side weir (i.e., downstream bypass). It will consist of a single receiver connected to a pair of custom built drop antennas. The drop antennas will be installed through the weir entrance and into the outlet pipe to ensure detections are of fish committed to the route.

Monitoring Station F5: This station will monitor downstream passage of radio-tagged juvenile alosines and adult American eels through the right side weir (i.e., downstream bypass). It will consist of a single receiver connected to a pair of custom built drop antennas. The drop antennas will be installed through the weir entrance and into the outlet pipe to ensure detections are of fish committed to the route.

Monitoring Station F6: This station will be used to determine fish passage through Unit No. 1 (Kaplan unit). Gate well slots at Unit 1 are not accessible for the insertion of underwater drop antennas. As a result, a single aerial antenna will be installed to monitor the outflow area from Unit 1 (Kaplan unit). Due to the lack of access, it will be necessary to use process of elimination to distinguish radio-tagged juvenile alosines and adult American eels passing via Unit 1 (Kaplan unit) from other passage routes.

Monitoring Station F7: This station will detect radio-tagged juvenile alosines and adult American eels passing the Project via spill over the dam crest and will consist of a single receiver and an aerial antenna mounted overlooking the downstream side of the dam.

Monitoring Station F8: Station F8 will be the first stationary receiver downstream of the Project and will detect radio-tagged juvenile alosines and adult American eels at a point approximately 1.8 miles downstream. This monitoring station will consist of a receiver coupled to an aerial

antenna and will be located on the Brunswick & Topsham Water District property along the eastern bank of the river (pending permission). Detection information from this location is required for evaluation of downstream passage success at Project.

Monitoring Station F9: This station will be the second stationary receiver downstream of Project and will consist of a single receiver coupled to an aerial antenna. Station F9 will be located bankside at a point downstream of Station F8 and upstream of Station F9 located at Brunswick dam (exact location to be determined pending landowner permission). Detection information from this location is required for evaluation of downstream passage success at the Pejepscot Project.

Monitoring Station F10: This station will detect radio-tagged juvenile alosines and adult American eels approaching the Brunswick Project from upriver. F10 will consist of a single receiver coupled to an aerial antenna oriented in an upstream direction and attached to a section of railing adjacent to the powerhouse along the western bank. Detection information from this location will be used to inform on the departure of radio-tagged juvenile alosines and adult American eels from the lower Pejepscot Project study area (i.e., the 4.6-mile reach between the Pejepscot and Brunswick Dams).

4. Tagging and Release Procedures:

Juvenile alosines tagged as part of this evaluation will likely be collected at the outlet of Sabattus Pond. A single, effective collection technique will be selected for sampling at the Sabattus outlet. Potential techniques may include cast nets, beach seine or boat electrofishing. Following capture, juvenile alosines will be transported by truck to a temporary tank facility established at the Project (or an alternative location along the Androscoggin River). Following an overnight holding period, fish will be lightly anesthetized using diluted soda water (10:1 river water: soda water ratio) and each individual measured for total length. Previous experience with radio-tagging of juvenile clupeids has demonstrated that a total length of at least 100 mm is the minimum body length required for a tagged individual to be able to swim upright and maintain position among other untagged fish. NTQ-1 transmitters will be attached to a dry fly hook using bonding cement. The hook will be inserted posterior to the dorsal fin with the majority of the tag and antenna trailing behind the insertion point. Normandeau Associates, Inc. has experience in externally tagging juvenile alosines using radio-transmitters (Figure 7.2.5-2) and has evaluated downstream passage using this approach at hydroelectric facilities elsewhere in New England. After tagging, fish will be held in 32-gallon holding cans and maintained in ambient Androscoggin River water until they are transported to the release site. It is anticipated that releases will likely occur during October to ensure that (1) juvenile alosines are actively outmigrating from the system and (2) individuals have achieved the body size necessary to support the NTQ-1 transmitter.

Pending availability, a total of 100 radio-tagged juvenile alosines will be transported to a release site upstream of the Project. Previous studies on the Connecticut and Merrimack Rivers have relied on upstream release points approximately 0.5 river miles upstream of the dam to minimize loss of study fish to predation (Normandeau 2015a; 2015b). A total of four release events are proposed, each consisting of 25 radio-tagged individuals being transported by boat to the release

location upstream of the Project dam. Releases will occur around sunset and transport containers carrying radio-tagged juvenile alosines will be gently lowered overboard and fish allowed to exit the container volitionally to avoid additional handling or netting. A number of untagged juvenile alosines (2-3 times the number of tagged juvenile alosines) will be released concurrently with each group of test fish to promote natural schooling behavior and help reduce predation on test fish. The date and time of each release will be recorded.

Adult silver-phase American eels will be obtained from commercial trapping operations on the St. Croix River, Maine and transported to a temporary tank facility established at the Project (or an alternative location along the Androscoggin River). Following a 24-hour holding period, individuals will be visually examined and if they appear healthy will be anesthetized in a clove oil and ethanol solution. Eels will be held and visually monitored in the anesthesia bath until sufficiently sedated. Once sedated, eels will be removed from the bath and placed on a clean, wet towel. The total length and eye diameter (horizontal and vertical; nearest 0.1 mm) will be measured. A previously described correlation between eye size, body length and gonad development will be used to confirm whether individuals are mature and can be considered as active outmigrants (Pankhurst 1982). This eye index relationship (I) was described using the formula:

$I = [((A+B)/4)2\pi/L]*100$

where A = horizontal eye diameter, B = vertical eye diameter, and L = total body length. Silver-phase American eels typically have an eye index between 6.0 and 13.5, with a bronze coloration along the lateral line that separates the dark, silver back from the white belly. Eels meeting these characteristics will be selected for surgical tagging. For tagging, an incision will be made off-center on the ventral surface of the individual. A hollow needle will be inserted into the incision and pushed through the body wall just off the ventral mid-line and at a point posterior to the incision. The antenna will be fed through the needle and gently pulled so that the transmitter enters the body cavity. The needle will then be fully pulled through the body wall and removed from the antenna. The transmitter will be positioned by pulling the antenna so that it lies directly under the incision. The incision will then be closed with two or three interrupted sutures. A small amount of an antibacterial ointment will be applied to the incision site to prevent infection. Following tagging, each individual will be transferred to a second holding tank supplied with ambient river water for an additional 24-hour observation/recovery period.

A total of 50 radio-tagged adult American eels will be transported via stocking truck from the tagging location and released at the Pejepscot public boat launch located 2.6 miles upstream of the Project. A minimum of two separate release events will be conducted during early October with both events consisting of approximately 25 radio-tagged individuals. Releases will be conducted during the evening hours and individuals will be lowered into the river in their transport containers and allowed to volitionally exit to avoid additional handling or netting.

5. Project Data Collection:

Active Radio-transmitters: Data will be offloaded from the receivers at each monitoring station using a laptop computer and will be stored on removable memory sticks. Data downloads will

occur at least one time weekly during the period from the initial tag and release date until the last week of November. Backup copies of all telemetry data will be made prior to receiver initialization. Field tests to ensure data integrity and receiver performance will include confirmation of file integrity, confirmation that the last record is consistent with the downloaded data (beacon tags will be critical to this step), and lastly, to confirm that the receiver is operational upon restart and actively collecting data post download. Within a data file, transmitter detections will be stored as a single event (i.e., single data line). Each event will include the date and time of detection, frequency, ID code, and signal strength. Supplemental detection information will be collected during manual tracking events covering the section of the Androscoggin River between Worumbo and Brunswick. These tracking events will be conducted once every other week from the initial tag and release date until the end of November.

River and Project Operational Data: In addition to the manual and stationary radio telemetry data, river and Project operations data will be reported for the duration of the evaluation period. Mainstem river temperature will be recorded via a thermal logger installed at the Project. Project discharge (generation and spill), unit operations (total cfs and percent gate), downstream bypass settings, and extent and location of spill will be obtained from Topsham Hydro at the completion of the study period.

6. Project Data Processing and Analysis:

Data Processing: Tag detections in each downloaded stationary telemetry data file will be validated through a series of site-specific and logical criteria: These criteria will include:

1. Signal strength threshold level of the detection,
2. Frequency of the radio tag signals per unit of time, and
3. Spatial and temporal characteristics of each individual detection with respect to the full series of detections at monitoring stations within the entire detection array.

To determine the signal strength threshold for a valid tag signal, power levels associated with background noise will be recorded at each monitoring station prior to the release of radio-tagged fish. These “false” signals are typically received at relatively low power levels, and they will be removed from the analysis using a series of data filters. The frequency of the signal detections for an individual radio tag will be examined at each monitoring station, such that over a set period of time, there are an adequate number of detections to rule out an isolated false detection (e.g., at least 3 detections within 1 minute). Finally, the spatial and temporal distribution of detections across multiple monitoring stations will be examined to verify that the pattern of detections is not occurring in a manner that is unreasonable (i.e., time for a fish to have relocated within the time between the detections).

Data Analysis: A complete record of all valid detections for each uniquely coded radio-tagged juvenile alosine and adult American eel will be generated. The pattern and timing of detections in these individual records will be reviewed, and a route of passage as well as arrival and passage times will be determined. In instances where a specific passage route is not clearly defined by the available data, the passage route for that individual will be classified as unknown. The stationary telemetry dataset collected using the monitoring stations described above will also permit the

evaluation of upstream residence time for radio-tagged juvenile alosines and adult American eels prior to downstream passage. Upstream residence time will be defined as the duration of time from initial entry into the upper Project area (i.e., detection at Monitoring station F1) until successful downstream passage at the Project. Passage duration through each of the defined reaches will be calculated as the duration from initial detection at the stationary receiver on the upstream end of the reach until initial detection at the stationary receiver on the downstream end of the reach.

Downstream passage survival at the Project will be estimated for adult silver-phase American eels using a standard Cormack-Jolly-Seber model run for the set of individual encounter histories (i.e., the series of detection/no detection through the linear sequence of receivers from upstream to downstream) for each species evaluated. This approach will provide a series of reach-specific survival estimates for:

- Release location to Monitoring station F1 (i.e., upstream approach);
- Monitoring station F1 (i.e., upstream approach) to downstream passage;
- Downstream passage to Monitoring station F8 (i.e., first downstream receiver); and
- Monitoring station F8 (i.e., first downstream receiver) to Monitoring station F9 (i.e., second downstream receiver).

Standard error and confidence bounds for each estimate will be generated. The joint probability of the two Project reach survival estimates (i.e., (StnF1 to Passage)*(Passage to StnF8)) will be used as the estimate of total passage survival for the Project. This approach will result in mortality estimates that include both background mortality (i.e., natural mortality such as predation) and mortality due to Project effects for radio-tagged adult silver eels in the 650-foot section upstream of the dam as well as in the reach downstream of the dam extending to the first downstream receiver. Thus, the results will reflect a minimum estimate of survival attributable to Project effects for adult silver eels.

Dependent on the distribution of downstream passage events among potential passage routes (i.e., Unit No. 1, Unit Nos. 21-23, downstream bypasses, spill, and upstream fishway), route-specific estimates of passage survival may be available. The availability of these estimates will be driven by sample size and will be a function of passage route selection by the radio-tagged eels.

To evaluate passage survival using the CJS model, a suite of candidate models will be developed in Program MARK (White and Burnham 1999) based on whether survival, recapture (i.e., detection), or both vary or are constant among stations. Models will include:

- *Phi*(t)*p*(t): survival and recapture may vary between receiver stations;
- *Phi*(t)*p*(.): survival may vary between stations; recapture is constant between stations;
- *Phi*(.)*p*(t): survival is constant between stations; recapture may vary between stations;
- *Phi*(.)*p*(.): survival and recapture are constant between stations;

Where;

- *Phi* = probability of survival
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- (t) = parameter varies
- (.) = parameter is constant

Prior to comparison among models, goodness of fit testing will be conducted for the "starting model" (i.e., the fully parameterized model) using the function RELEASE within Program MARK. Within RELEASE, outputs from Test 2 and Test 3 combine to provide goodness of fit information for the fully time dependent model. If the χ^2 results from Test 2, Test 3, or the overall result (Test 2 + Test 3) are significant, then the test assumptions are violated and the fully time dependent model does not provide adequate goodness of fit. To accommodate for the lack of fit, a measure of how much extra binomial noise (i.e., variation) exists in the data is needed. This value, the variance inflation factor ($\hat{c}$), can be estimated within MARK and used to correct for any minor over-dispersion.

Akaike's Information Criterion (AIC) will be used to rank the models as to how well they fit the observed mark-recapture data. Lower AIC values denote a more explanatory yet parsimonious fit than higher AIC values. Assuming the assumptions of the model with the lowest AIC value are reasonable with regards to this study, it will be selected for the purposes of generating MARK-derived survival estimates.

Downstream passage success at the Project for juvenile alosines will be defined as the proportion of radio-tagged individuals which approach the Project (i.e., those detected at Monitoring station F1) and are subsequently determined to have utilized one of the available downstream passage routes. An estimate of Project reach survival for externally radio-tagged juvenile alosines will not be generated using the CJS approach described above for eels. It is likely that any such estimate will be negatively biased by uncertainty around the rate of transmitter retention during the act of downstream passage through various routes (e.g., spill, turbines, downstream bypass). During a previous tank evaluation of the external attachment technique for attaching Lotek NTQ-1 transmitters to juvenile alosines, retention was observed to be 97% over a seven-day period (Normandeau 2015d). Although conditions in the tank setting are likely comparable to the relatively low velocity conditions in the section of the Androscoggin River just upstream of the Project, they are likely not representative of conditions through a specific passage route. As a result, the use of externally radio-tagged juvenile alosines is most ideally suited for evaluation of upstream residence duration, downstream passage route selection and proportional use of downstream passage facilities.

Consistency with Generally Accepted Scientific Practice

The proposed approach to evaluate downstream passage effectiveness for fall outmigrating diadromous fish species at the Project is consistent with those employed during the FERC relicensing process for other hydroelectric facilities such as Vernon (FERC No. 1904), Bellows Falls (FERC No. 1855), and Wilder (FERC No. 1892).

Deliverables and Schedule

Installation of telemetry monitoring stations will occur during September 2019 with tagging and releases of juvenile alosines and adult American eels during late September or early October of that year. Field monitoring is proposed to extend through November 2019. A full report of findings will be included in the Updated Study Report which is due for filing in July 2020.

Cost and Level of Effort

Topsham Hydro is proposing to conduct the field study during the course of one passage season. Estimated costs for this study are $108,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information to evaluate the effectiveness of downstream passage for juvenile alosines and adult American eels at the Project.

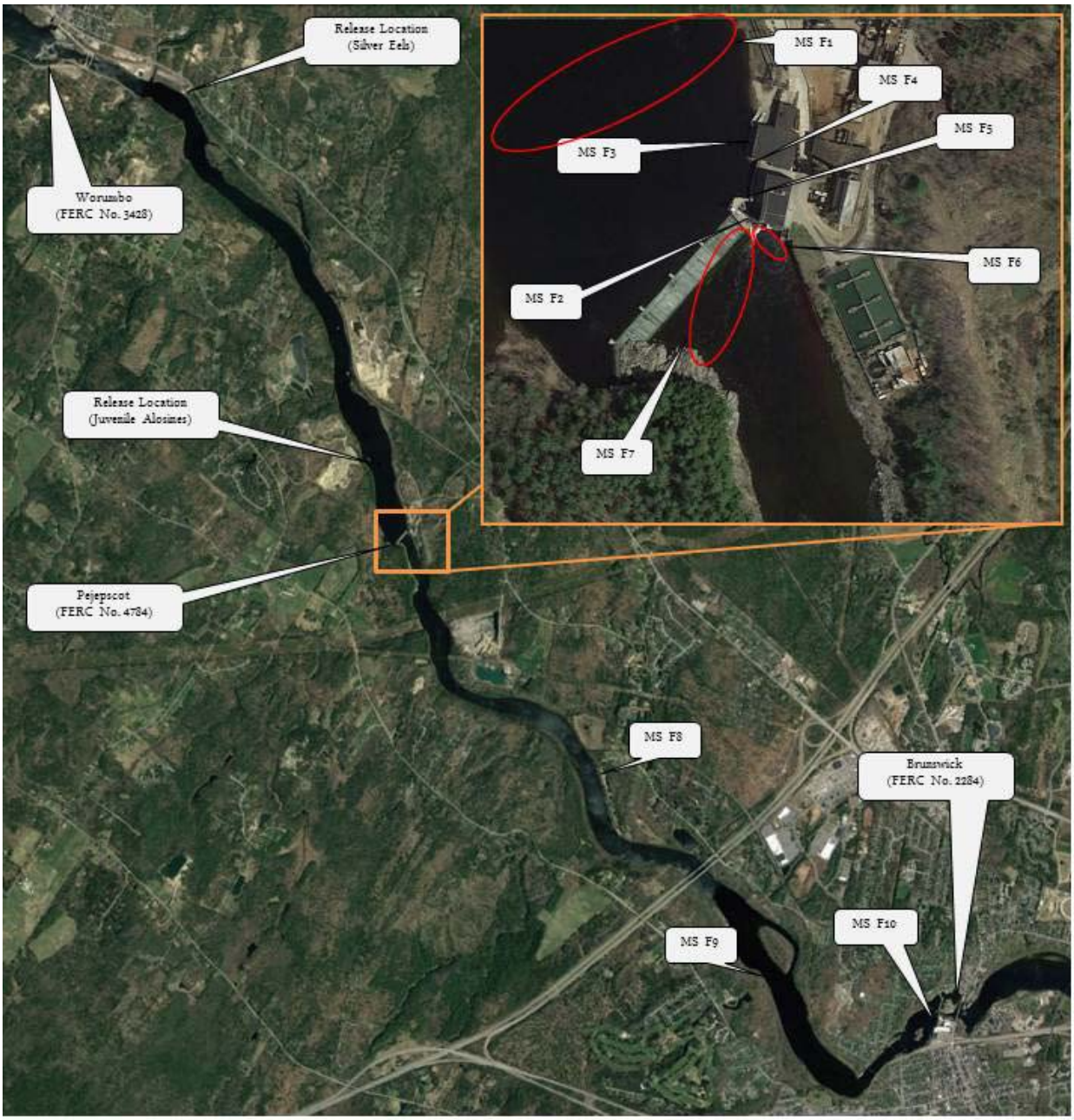


Figure 7.5.2-1: Project Release and Monitoring Station (MS) Locations for Evaluation of Downstream Effectiveness for Passage of Fall Season Diadromous Species.

Red ovals represent intended detection zones for aerial antenna coverage in vicinity of Pejepscot.

Figure 7.2.5-2: Juvenile Alosine Externally Tagged with a Lotek NTQ-1 Radio Transmitter.

References

Normandeau (Normandeau Associates, Inc.). 2012. Downstream bypass effectiveness for the passage of adult American eels at the Weston Project (FERC No. 2325), Kennebec River, Maine. Report Prepared for FPL Energy Maine Hydro LLC. Report Date February 2013.

Normandeau (Normandeau Associates, Inc.). 2015a. Study 22 Downstream Migration of Juvenile American shad at Vernon – Final Study Report. Report Prepared for TransCanada Hydro Northeast, Inc. Report Date January 2017.

Normandeau (Normandeau Associates, Inc.). 2015b. Garvins Falls juvenile clupeids downstream passage telemetry assessment. Letter Report Prepared for Eversource Energy. Report Date January 2016.

Normandeau (Normandeau Associates, Inc.). 2015c. Study 19 American eel downstream passage assessment– Final Study Report. Report Prepared for TransCanada Hydro Northeast, Inc. Report Date February 2017.

Normandeau (Normandeau Associates, Inc.) 2015d. Evaluation of downstream passage for adult and juvenile river herring at the Lockwood Project, Kennebec River, Maine. Report Prepared for Merimil Limited Partnership. Report Date January 2016.

Normandeau (Normandeau Associates, Inc.). 2016. Garvins Falls adult eel downstream passage telemetry assessment. Letter Report Prepared for Eversource Energy. Report Date December 2016.

Pankhurst, N. W. 1982. Relation of visual changes to the onset of sexual maturation in the European eel (*Anguilla anguilla*). Journal of Fish Biology 21: 127-140.

White, G.C., and K.P. Burnham. 1999. Program MARK: survival estimation from populations of marked animals. Bird Study 46: 120-138.

7.2.6 **Stranding Evaluation**

NMFS requested a study to evaluate the potential effect of Project operations on diadromous fish stranding in the ledges along the western shore immediately downstream of the dam. NMFS suggested 1) collecting detailed three-dimensional data in areas identified as sensitive to flow fluctuations; 2) developing hydraulic models to analyze the relationship between flow and water surface elevation, and 3) identifying areas where fish standing could occur.

During a meeting with NMFS on April 27, 2018, Topsham Hydro and NMFS agreed that there are no known, documented instances of stranding in the study area and it is unknown whether there are pools that would allow the potential for stranding in this area. Further, stranding is primarily a concern during times of transition from high flows to low (i.e. no or little flow following spill or operation of the bascule gate providing potential attraction).

Topsham Hydro is proposing to conduct a reconnaissance level evaluation of stranding through a combination of photo-documentation and onsite flow demonstration in consultation with NMFS. As such, in their May 14, 2018 PSP comment letter NMFS stated that they were no longer requesting an evaluation of stranding using surface or hydraulic modeling methods, but would rely on the results of reconnaissance level stranding. The following sections detail the methodology for the proposed reconnaissance level stranding evaluation.

Goals and Objectives

The study will provide information regarding the potential for fish stranding below the Project spillway. The study objective is to determine if potential stranding pools are present in the ledges immediately below the western end of the Project spillway, after spill operations cease.

Known Resource Management Goals

NMFS is a federal resource agency with a mandate to protect and conserve fisheries resources and associated habitat. Resource management goals and plans are codified in their regulatory statues. NMFS relies on the best available data to support conservation recommendations and management decisions.

Background and Existing Information

There is no existing information regarding stranding-prone areas or operational scenarios for the Pejepscot Project. This study is needed to quantify project effects on a potential source of fish mortality and injury.

Project Nexus

As high flows recede and spill over the dam ceases, the area of ledge immediately below the spillway on the western bank may create potential stranding pools for fish.

Methodology

Task 1: Operational Data Review:

Prior to conducting the field investigation, a desktop literature review will be performed to gather information on the typical sequencing of bascule gate operations, as well as the frequency of annual spill operations at the Project. This information will determine the inflow and operational conditions under which the ledges might experience variable flows.

Task 2: Field Surveys:

The field survey will consist of a reconnaissance level evaluation where a field crew will examine potential stranding sites in the study area at an appropriate time interval after spilling operations have ceased. Any accessible pools with fish stranding potential will be identified and visited shortly after the spillage event. On-ground surveys will traverse any pools and visually document fish present as well as looking for fish trapped under rocks. Information on the number and location of fish stranded will be recorded. In addition, the conditions of the study area will be photo-documented.

Consistency with Generally Accepted Scientific Practice

The proposed survey to document potential stranding areas is an accepted means of documenting species use in the Project area.

Deliverables and Schedule

The survey effort will be conducted during the summer/fall of 2018. Data and results will be included in the Initial Study Report to be filed with FERC in July 2019.

Cost and Level of Effort

The estimated cost for the stranding evaluation is approximately $10,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information on stranding potential below the western end of the Project spillway.

7.3 Wildlife Resources Survey

Topsham Hydro proposes to conduct a reconnaissance level survey to document wildlife resources and habitat in the Project area and to search for threatened or endangered (TE) species or unique habitat during this effort.

Goals and Objectives

A reconnaissance level field survey of the Project with respect to wildlife resources will be undertaken. The survey is designed to provide information pertinent to:

- existing wildlife (bird and mammal) habitats in riparian, wetland, and upland areas of the Project impoundment and tailwater shoreline;
- the presence of wildlife species at the Project; and
- the presence of TE species or associated habitats.

Known Resource Management Goals

MDIFW and USFWS have responsibilities for protecting wildlife resources. This study will provide the necessary information to assess wildlife resources (species and habitats) within the Project area including TE species.

Background and Existing Information

The Project is located in the Laurentian Mixed Forest Province and, more specifically, the Central Maine Coastal and Interior Section. The Laurentian Mixed Forest Province lies between the boreal forest and broadleaf deciduous forest zones and, as such, is considered transitional (Bailey, 1995). The Central Maine Coastal and Interior Section is also regionally described as a transitional zone; from both west to east as well as from south to north. From west to east, the forest transitions from mixed hardwoods typical of the southern New England coastal plain to northern coastal spruce-fir and spruce-fir northern hardwood communities. From south to north, coastal communities typically transition to northern hardwood communities (Bailey, 1995).

Wildlife Habitat

The Project boundary generally follows the shoreline of the Pejepscot impoundment at El. 75.0. Downstream of the dam, the Project boundary generally encompasses the Project facilities and river before terminating 260 feet downstream of the dam. Given that the Project boundary lies close to the impoundment, there is limited upland habitat for terrestrial wildlife within the Project boundary.

The dominant terrestrial habitat adjacent to the Pejepscot impoundment is the Laurentian-Acadian Pine-Hemlock-Hardwood Forest. This habitat is described as a coniferous or mixed forest widespread in the glaciated northeast. White pine, hemlock, and red oak are typical canopy

dominants. Red maple is common, and other hardwoods like sugar maple, beech, and birch also occur.

Wetland, riparian, and littoral habitats within the Project boundary are associated with the margin and near shore areas of the impoundment. USFWS National Wetland Inventory (NWI) coverage shows a variety of wetlands in the Project area, including open water wetlands as well as freshwater emergent or freshwater forested/shrub wetlands.

Riparian zone habitat and vegetation adjacent to the Pejepscot impoundment is, in general, comprised of forested areas of varying width. In some developed locations, the riparian zone is limited by the presence of roads, railroads, barren areas, and/or industrial and residential areas. At the dam, there is little to no riparian zone due to the presence of bedrock and riprap on the west side (right side looking downstream) and the powerhouse, railroad bed and industrial area on the east side (left side looking downstream).

The Project impoundment includes approximately three miles of the Androscoggin River. The NWI indicates freshwater emergent and freshwater woody wetlands that may make up littoral habitat in small areas of the Project but little information is present on the specific littoral zone habitat.

Wildlife Species

Based on the available habitat information, a variety of common wildlife species occupy or have the potential to occupy habitat within the Project area and vicinity. Some of the species occurring in the vicinity of the Project area are seasonal migrants that travel substantial distances between breeding and wintering areas or have life history and habitat requirements that result in seasonal shifts of habitat usage within the Project area or region. Wildlife species occurring or potentially occurring within the vicinity of the Project are described in the PAD, Section 5.4.3, and Table 5.4.3-1.

TE Habitat and Species

The USFWS identified the northern long-eared bat, a threatened species, as potentially occurring in the Project area or vicinity (USFWS, 2016). In addition, MDIFW has identified nine mammal species that are classified as TE or Special Concern (Table 5.6.4-1 of the PAD). The majority of this group is comprised of various bat species. Bat species' populations have been declining due to White Nose Syndrome, a fungal disease.

Furthermore, MDIFW has identified 32 bird species that meet Maine's TE or Special Concern requirements (Table 5.6.4-2 of the PAD). Several of these bird species are also considered to be Birds of Conservation Concern by the USFWS and are protected under the Migratory Bird Treaty Act.

Project Nexus

The Project area and surrounding uplands outside of the Project area provide habitat for a variety of wildlife species. The Project operates in a run-of-river mode and therefore has no significant

effect on the overall river flow regime. A survey of the wildlife species in the Project area would provide information on the type and quantity of habitat and wildlife resources that have become established under existing Project operation.

Methodology

The reconnaissance level survey will consist of navigating around and through the Project area by boat, by car or on foot and would be conducted in conjunction with the Botanical Resource Survey (Section 7.4). When possible, observations will be conducted through the use of binoculars and/or a spotting scope to minimize disturbance to wildlife. Biologists will circumnavigate the entire impoundment and tailrace area as part of the survey. The survey will be performed during summer months (June – August). The information collected during the surveys will include observations of wildlife, habitats, and sign.

Investigation of potential TE species in the Project area will include consultation with Maine Natural Areas Program (MNAP), MDIFW, and USFWS to determine if these agencies are aware of any newly identified (since preparation of the PAD) state or federal TE wildlife species in the Project area. During the shoreline survey work, biologists will also attempt to observe and/or identify any TE species that may be present but that may or may not have been previously identified in the impoundment or tailrace. Other studies (i.e., botanical surveys) being performed as part of the Project relicensing will include incidental observations of wildlife, TE species, and habitats.

Consistency with Generally Accepted Scientific Practice

Consultation with MNAP, MDIFW, and USFWS for known occurrences of species and habitats coupled with observation and documentation of wildlife species and habitats and potential TE species and habitats during the reconnaissance survey and other studies being performed is an accepted means of documenting species use of the Project area.

Deliverables and Schedule

The reconnaissance survey will be conducted during the summer of 2018. Data and results will be included in the Initial Study Report to be filed with FERC in July 2019.

Cost and Level of Effort

The estimated cost for the reconnaissance-level wildlife survey is approximately $10,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information on wildlife species and habitat in the Project vicinity.

References

Bailey, Robert G. March 1995. Ecoregions of the United States. United States Department of Agriculture: Forest Service. Rocky Mountain Research Station. https://www.fs.fed.us/land/ecosysmgmt/colorimagemap/images/212.html Accessed. December 2016.

United States Fish & Wildlife Service. 2016. *IPaC Trust Resources Report*. https://ecos.fws.gov/ipac/ Accessed December 2016.

7.4 Botanical Resources Survey

Topsham Hydro proposes to conduct a reconnaissance level survey to document botanical resources and habitat in the Project area and to search for TE species or unique habitat during this effort.

Goals and Objectives

The reconnaissance level survey is designed to provide information pertinent to:

- the nature and extent of riparian and wetland botanical resources; and
- the presence or absence of TE botanical species or associated habitats within the Project area.

Known Resource Management Goals

MDIFW and USFWS have responsibilities for protecting terrestrial resources such as habitat and wildlife. This study will provide the necessary information to assess botanical resources (species and habitats) within the Project boundary.

Background and Existing Information

The Project is located in the Laurentian Mixed Forest Province and, more specifically, the Central Maine Coastal and Interior Section. The Laurentian Mixed Forest Province lies between the boreal forest and broadleaf deciduous forest zones and, as such, is considered transitional (Bailey, 1995). The Central Maine Coastal and Interior Section is also regionally described as a transitional zone; from both west to east as well as from south to north. From west to east, the forest transitions from mixed hardwoods typical of the southern New England coastal plain to northern coastal spruce-fir and spruce-fir northern hardwood communities. From south to north, coastal communities typically transition to northern hardwood communities (Bailey, 1995).

Upland Plant Communities and Species

The dominant terrestrial habitat adjacent to the Pejepscot impoundment is the Laurentian-Acadian Pine-Hemlock-Hardwood Forest. This habitat is described as a coniferous or mixed forest widespread in the glaciated northeast. White pine, hemlock, and red oak are typical canopy dominants. Red maple is common, and other hardwoods like sugar maple, beech, and birch also occur. In Maine, the natural community is referred to as a Hemlock Forest. Associated plant species include barren strawberry, mountain laurel, giant pinedrops, green adder's-mouth, loesel's twayblade, sand violet, scarlet oak, slender mountain-ricegrass, spotted wintergreen, and spreading-pod rockcress (Ferree and Anderson, 2013). Other habitat types found in the vicinity of the Project include Developed; Agriculture; Laurentian-Acadian Large River Floodplain; and Laurentian-Acadian Alkaline Conifer Hardwood Swamp.

Wetland Plant Communities

Freshwater forested/shrub wetlands delineated in the Project impoundment are forested swamp, or wetland, shrub. In Maine, they may be characterized as deciduous or evergreen, and include: red maple, larch, black ash, yellow birch, gray birch, green ash, American elm, white pine, black willow, northern white cedar, hemlock, balsam fir, and black spruce. Associated shrubs include highbush blueberry, sheep laurel, maleberry, black chokeberry, mountain holly, common elderberry, common winterberry, and silky dogwood. Herbs include skunk cabbage, Jack-in-the-pulpit, Canada mayflower, royal fern, cinnamon fern, sensitive fern, and marsh fern (MDEP, 2017).

Freshwater emergent wetlands delineated in the Project impoundment are herbaceous marsh, fen, swale, and wet meadows, and in Maine, may be characterized by tussock sedge, other sedges, bluejoint, reed canary grass, soft rush, green bulrush, wool grass, and various flowering herbs. (MDEP, 2017).

Unique Plant Communities

MNAP has provided a list of potential botanical TE species that may occur in the vicinity of the Project. These are listed in the PAD in Section 5.6, Table 5.6.5-1.

Invasive Plants and Noxious Weeds

Review of the MNAP invasive plant fact sheets found that there are currently nineteen plant species considered invasive in Maine. Of these nineteen species, only 10 have the potential to occur in the Project area including: Mulitflora Rose, Purple Loosestrife, and Asiatic Bittersweet. Aquatic plants such as hydrilla, milfoil and curly pond weed are not likely to occur near the Project since they prefer to grow in still or slow-flowing water, such as in a lake or pond, and have not been documented to date.

Project Nexus

The vicinity of the Project provides habitat for a variety of botanical species. The run-of-river operation of the Project has little potential to affect littoral zone habitat or botanical resources. A survey of the botanical resources in the Project boundary would provide information on the type and quantity of habitat and botanical resources that have become established under existing Project operation.

Methodology

To provide information pertinent to potential Project effects on botanical resources, a field survey of botanical species (including TE species) within the Project area will be conducted in conjunction with the Wildlife Resources Survey (Section 7.3).

The vegetation mapping will involve three phases of work. The first two phases will identify general cover types through photo interpretation and field verification. The third phase will be

the production of a cover type map. Vegetation types and land use classifications will also be assigned. Additional data collected during the field verification will describe the characteristics of each mapped cover type including species composition, stand structure, habitat quality and land use. Information collected during desktop analysis and field surveys will include:

- plant species composition, including the dominate and more prominent associated species in each vegetation layer (tree, shrub and herbaceous layers);
- structure data, including estimates of aerial cover of the dominant cover types;
- predominant land use(s) associated with each cover type;
- rare, unique, and particularly high-quality habitat; and
- occurrence of exotic invasive species.

During the shoreline survey work, biologists will also attempt to observe and/or identify any TE plant species. Field crews will document TE species observed and/or suitable habitats identified with a GPS unit. Significant habitats within 200 feet of the Project shoreline will also be surveyed, quantified and identified via GPS. Other studies being performed as part of the Pejepscot Project relicensing will also be considered, and any applicable information will be incorporated into this assessment.

Consistency with Generally Accepted Scientific Practice

Documentation of plant species and habitats and potential TE plant species and habitats observed during the reconnaissance level survey and other studies is an accepted means of documenting species in the project area.

Deliverables and Schedule

The reconnaissance survey effort will be conducted during the summer of 2018. Data and results will be included in the Initial Study Report to be filed with FERC in July 2019.

Cost and Level of Effort

The estimated cost for the reconnaissance-level wildlife survey is approximately $20,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information on the botanical resources in the Project vicinity.

References

Bailey, Robert G. March 1995. Ecoregions of the United States. United States Department of Agriculture: Forest Service. Rocky Mountain Research Station. https://www.fs.fed.us/land/ecosysmgmt/colorimagemap/images/212.html Accessed. December 2016.

Ferree, C and M. G. Anderson. 2013. A Map of Terrestrial Habitats of the Northeastern United States: Methods and Approach. The Nature Conservancy, Eastern Conservation Science, Eastern Regional Office. Boston, MA. https://www.conservationgateway.org/ConservationByGeography/NorthAmerica/UnitedStates/edc/reportsdata/terrestrial/habitatmap/Pages/default.asp

Maine Department of Environmental Protection. 2017. Wetland types. http://www.maine.gov/dep/water/wetlands/types.html

7.5 Recreation Facilities Inventory and Public Recreation Use Assessment

Topsham Hydro proposes to conduct a recreation facilities inventory and condition assessment and determine activities and use estimates by season.

Goals and Objectives

Topsham Hydro proposes to address the following study objectives related to recreation use at the Project:

- Conduct an inventory of and map existing public recreation sites and access areas within the immediate Project vicinity, including site locations, facilities/amenities, general conditions, ownership, and management responsibility; and

- Conduct an updated public recreation use assessment to provide an overall assessment of recreation use of and activities at the Project's existing recreational facilities.

Known Resource Management Goals

The resource management goals are to identify, and assess use of, Project recreational facilities.

Background and Existing Information

Topsham Hydro is required to report recreational facilities and estimated usage to FERC every six years on a Licensed Hydropower Recreation Report Form 80 (Form 80). According to the most recently filed Form 80 for the Pejepscot Project, 100 percent of the Project shoreline is available for public use (Topsham Hydro, 2015). The Project boundary encompasses three FERC approved Project recreational amenities owned or managed by Topsham Hydro: one boat launch, one portage, and one access point (Topsham Hydro, 2015) and also partially encompasses the Lisbon Falls Fishing Park. They are described below:

- Boat Launch: Pejepscot Boat Ramp (alternately called Lisbon Falls Boat Launch or Topsham Hydro Boat Launch) is located in Topsham off Route 196, on the eastern shore of the river just downstream from Lisbon Falls. The site provides Project impoundment access for trailered and hand-carry boats via a concrete ramp with an asphalt approach. The site accommodates 10 to 15 vehicles on a sloping gravel lot. There are no amenities provided (ARWC, 2016c).

- Access Point: Pejepscot Dam Recreation Area (alternately called Pejepscot Fishing Park) is located off River Road in Brunswick, on the western shore of the river. The site provides access to the river just above the dam, as well as a trail and metal staircase for portaging around the dam. Parking at the site accommodates about 4 vehicles. There are no amenities at the site (ARWC, 2016b).

- Portage: Pejepscot Dam Recreation Area offers a take out, trail, and put in for portaging around the Pejepscot Dam. The put in is comprised of a metal staircase with a boat slide for descending the rocky shoreline below the dam (ARWC, 2016b).

- In addition to the FERC approved recreational amenities described above, the Lisbon Falls Fishing Park is located adjacent to the Route 125 Bridge and approximately 600 feet downstream of Worumbo Dam. The Fishing Park includes a parking area on the north side of Route 125 as well as two paths and one set of stairs leading to the river.

Project Nexus

Topsham Hydro provides recreational opportunities in accordance with the conditions of the existing Pejepscot Project license. In addition, FERC policy requires licensees to provide reasonable public recreation opportunities consistent with the safe and effective operation of the Project. The proposed inventory and assessment will provide information on the available facilities and recreational use at the Project and identify any areas potentially available for future use.

Methodology

Task 1: Recreation Use Assessment

The proposed methodology consists of installing a trail camera or traffic counter(s) at the Pejepscot Boat Ramp and Pejepscot Dam Recreation Area, and a trail camera along the canoe portage route to quantify recreation use. This equipment will be installed for one field season during the primary open water recreation period (Memorial Day through Columbus Day). Any traffic counters used will have data downloaded regularly, and calibration counts will be performed two (2) times per month to record the number of vehicles and duration on site, number of people per vehicle, and observed activities. Trail camera photographs of the canoe portage route will be reviewed and the recreational activity will be identified, to the extent possible.

Task 2: Recreation Facilities Condition Assessment

The condition assessment of the recreation facilities will include photographs of the sites, an estimate of parking capacity provided at each site (to be used as a proxy for site capacity), an assessment of the overall condition of each site, and general observations on site use and accessibility.

Consistency with Generally Accepted Scientific Practice

Estimating use by conducting spot counts at recreation sites and conducting a recreation site inventory and assessment is a standard practice within FERC relicensing.

Deliverables and Schedule

Topsham Hydro will conduct the recreation inventory and assessment between the months of August and September 2019. Topsham Hydro will install the monitoring equipment and collect recreation use spot count data from Memorial Day to Columbus Day 2019. The results of the Recreation Inventory and Public Use Assessment will be included in the Initial Study Report in July 2020.

Cost and Level of Effort

The estimated cost of conducting the study is $25,000. Topsham Hydro believes that the proposed level of effort is adequate to assess the current amount of recreational use and needs within the Project.

References

Androscoggin River Watershed Council (ARWC). 2016a. Androscoggin Greenway-Riverlands. [Online] URL: http://arwc.camp7.org/greenway. Accessed 12/14/2016.

Androscoggin River Watershed Council (ARWC). 2016b. Androscoggin Greenway-Riverlands: Pejepscot Fishing Park. [Online] URL: http://arwc.camp7.org/resources/Pictures/Pejepscot%20Fishing%20Park.pdf. Accessed 12/14/2016.

7.6 Cultural Resources

7.6.1 Historic Architectural Survey

The PAD identified historic architectural resources as a topic for which additional information is necessary to address whether there are architectural structures within the Area of Potential Effects (APE) that have the potential to be listed in the National Register of Historic Places (NRHP) and that may be affected by the FERC relicensing of the Project.

The Project APE is defined as "…the lands enclosed by the Project's boundary and lands or properties outside of the Project's boundary where Project construction and operation or Project-related recreational development or other enhancements may cause changes in the character or use of historic properties, if any historic properties exist."

Goals and Objectives

The historic structure survey is intended to identify, locate, and evaluate any historic architectural resource within the APE. In accordance with Section 106 of the National Historic Preservation Act of 1966 (as amended), any action that takes place within the APE must be assessed in terms of its potential to affect any building, structure, district, object, or site that is listed on or is eligible for the NRHP. In the case of the proposed relicensing, this will be accomplished with literature review and through field survey. The first step will be to conduct background research at the MHPC to review the existing architectural surveys. A reconnaissance-level historic structures survey will identify and map all resources over 50 years old within the Project APE and the results and evaluation of NRHP eligibility will be provided in the MHPC Architectural Survey Report.

Known Resource Management Goals

Section 106 of the National Historic Preservation Act (1966) requires that federal agencies, licensees, and those receiving federal assistance take into account the effects of proposed undertakings on any resource that is listed on or is eligible for the NRHP. If NRHP-eligible properties are present in the APE, consultation on ways to avoid, minimize, or mitigate adverse project effects must take place. As the lead agency, FERC is responsible for fulfilling the requirements of Section 106 in its decision to issue a new license to the Project.

As stipulated by the regulations that implement Section 106 (36 CFR 800), the Maine State Historic Preservation Officer (SHPO) represents the interests of the State of Maine and its citizens, and advises and assists FERC in determining the significance of cultural resources within the APE. The SHPO administers cultural resource management reviews under the National Historic Preservation Act (Section 106), which involves providing technical guidance and professional advice on the potential impact of relicensing a project, such as the Pejepscot Project, on the state's historic, architectural, and archaeological resources.

Background and Existing Information

The Licensee used the Maine Historic Preservation Commission's Cultural and Architectural Resource Management Archive (CARMA) to identify historic properties within a 0.5-mile vicinity of the Project area. There are fourteen historical structures listed in CARMA. Of these fourteen historical structures, seven are listed as not eligible, one is listed as not determined, and the remaining six are currently listed on the NRHP. The nearest property noted in the NRHP is the Pejepscot Village School, located approximately 0.5 miles from the river and outside of the Project APE.

Project Nexus

The Historic Architectural Survey will provide information on historic resources located within the Pejepscot Project boundary. In accordance with Section 106, this information will support a determination of eligibility for NRHP listing and determine potential effects to identified resources created by the relicensing and continued maintenance and operation of the Project.

The information that is developed during the course of the survey will be used as the basis for preparing a Historic Properties Management Plan (HPMP) if appropriate. Guiding the Licensee's actions relating to Section 106 during the term of the new license, any HPMP will discuss how to avoid potential adverse effects or how they will be mitigated.

Methodology

The Licensee will employ a qualified (as defined by the Secretary of the Interior's standards) architectural historian to undertake an assessment of all structures and facilities within the Project's APE to evaluate whether any of them may be eligible for listing on the NRHP. The study methods to achieve the goals of this historic structures identification and assessment will be consistent with standards of the MHPC. The historic structures survey will consist of three steps: (1) background research at the MHPC, (2) the reconnaissance-level field survey to identify all resources 50 years or older within the APE, and (3) the preparation of the architectural survey report.

Task 1: Background Research

Background research will be conducted on the history and development of the Project APE and its surroundings for the preparation of an historic context spanning the colonial period to the present to evaluate each resource for NRHP eligibility. Published histories and previous architectural and historical studies of Cumberland, Sagadahoc, and Androscoggin Counties will be consulted, as well as historic maps and atlases of the three counties. At the MHPC in Augusta, survey forms for all previously surveyed resources will be reviewed as well as cultural resource management reports for any previous surveys conducted in the Project APE.

Task 2: Reconnaissance-level Field Survey

The field survey will be conducted at the reconnaissance level using the relevant MHPC structure survey form (dwelling, barn, farmstead, linear, landscape, and post-WWII). Digital and

black-and-white photography will be used and will include one or more views of the surveyed individual resources, and representative views of building groups. Field numbers will be assigned to resources not previously surveyed, the locations of all surveyed resources will be mapped on sections of the relevant USGS quadrangle maps, and the surveyed resources will be entered into the MHPC database (CARMA).

Task 3: Architectural Survey Report

Following completion of the fieldwork, an Architectural Survey Report and Finding of Effects Report will be completed using the MHPC Architectural Survey Report Form. This report will include evaluations of eligibility, contact sheet(s) from photographs, survey matrix, negative table, USGS map(s) with properties identified, and hard-copy survey forms.

Consistency with Generally Accepted Scientific Practice

All field investigation methods used will follow all applicable Federal and Maine guidelines, including those contained in the *Guidelines for Identification: Architecture and Cultural Landscapes - Federal and State Regulatory Project Review Specific (Maine Historic Preservation Commission: April 2010*).

Deliverables and Schedule

The research and reconnaissance-level field work for this survey will occur in the summer and fall of 2018. A draft report will be prepared for comment by the SHPO, and the final report will be included in the Initial Study Report in July 2019. Per MHPC guidelines, the report will contain a description of the Project, a statement of the methods used in the survey, a historic cultural overview of the resources, the results of the survey (i.e., descriptions of any historic architectural resources that are identified), recommendations regarding eligibility for the NRHP, and finding of effects. The report will be filed with the SHPO and FERC as a Privileged document.

Cost and Level of Effort

The estimated cost for the proposed historic architectural survey is $10,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain information on historic architectural resources within the Project APE.

References

Maine Historic Preservation Commission 2010 “Guidelines for Identification: Guidelines for Identification: Architecture and Cultural Landscapes - Section 106 Specific.”

7.6.2 **Historic Archaeological Resources Phase 1 Survey**

The PAD identified historic archaeological resources as a topic for which additional information is necessary to address whether there are historic archaeological resources within the APE that have the potential to be listed in the NRHP and that may be affected by the FERC relicensing of the Project.

The Project APE is defined as "…the lands enclosed by the Project's boundary and lands or properties outside of the Project's boundary where Project construction and operation or Project-related recreational development or other enhancements may cause changes in the character or use of historic properties, if any historic properties exist."

Goals and Objectives

The objectives of the historic period archaeological work are to evaluate areas in the Project's APE that have not been previously evaluated for historic period archaeological resources and to make recommendations about whether any additional historic period archaeological sites that may be found are eligible or potentially eligible for listing to the NRHP.

Known Resource Management Goals

Section 106 of the National Historic Preservation Act of 1966 requires federal agencies, licensees, and those receiving federal permits to account for the effects of proposed undertakings on historic resources listed on or eligible for the NRHP. Consultation on ways to avoid, minimize, or mitigate adverse project effects, if any, must take place for any NRHP-eligible resources within the Project Boundary.

As stipulated by the regulations that implement Section 106 (36 CFR 800), the MHPC (Maine SHPO) represents the interests of the State and its citizens, and advises and assists FERC in determining the significance of cultural resources within the Project boundary. The SHPO administers cultural resource management reviews under Section 106 of the National Historic Preservation Act, which involves providing technical guidance and professional advice on potential impacts of relicensing a project, such as the Pejepscot Project, on the state's cultural resources.

Background and Existing Information

No post-contact archaeological sites have been previously identified within the Project boundary or within 0.5 miles of the boundary.

Project Nexus

The proposed investigation will provide information on any discovered historic archaeological sites located within the Pejepscot Project APE that are potentially eligible for listing to the NRHP and what potential adverse effects to eligible historic archaeological resources would be created by relicensing the continued operation of the Project. If potential adverse effects are determined, the information that is developed during the survey will be used as the basis for

preparing an HPMP if appropriate. Guiding the Licensee's actions relating to Section 106 during the term of the new license, any HPMP will discuss how to avoid potential adverse effects or how they will be mitigated.

Methodology

The geographic scope of this study is the Project APE which is defined as "the lands enclosed by the project's boundary and lands or properties outside of the project's boundary where project construction and operation or project-related recreational development or other enhancements may cause changes in the character or use of historic properties, if any historic properties exist."

Task 1: Archival Search

The literature search will identify areas within the Project APE with a high likelihood for the presence of historic period archaeological resources. A Phase I assessment survey will be conducted focusing on these areas. The MHPC's primary interest is the area of potential impacts from erosion within the impoundment area.

Task 2: Identification of Potential Sites

The goals for a Phase I assessment include:

- Complete a walkover of select areas within the impoundment area between the Pejepscot Dam and the upstream project limit;
- Assessment surveys usually extend approximately 50 feet back from each bank to include areas potentially affected by erosion;
- Identify and document any historic features or structures;
- Complete selected shovel test pits, 50 x 50 cm in size, as needed to provide data on historic features or structures identified, and collect artifacts useful in dating such features;
- Complete a walkover of portions of the river banks below the dam, to the downstream limit of the project; and
- Provide recommendations for no further survey, or for additional subsurface testing, depending upon the field findings.

Survey Methods for the Phase I archaeological survey will include:

- A visual inspection of the potential impact area
- Use of GPS devices during Phase I survey to provide UTM coordinates for all sites, site features, site boundaries, and testing locations
- Photography of landforms and areas of historic interest.

Consistency with Generally Accepted Scientific Practice

All field investigation methods used will follow all applicable Federal and Maine guidelines, including those contained in the Maine Historic Preservation's website (http://www.maine.gov/mhpc/). In particular, MHPC-approved level II Historic period archaeologists will be employed to undertake field and site evaluations.

Deliverables and Schedule

Following completion of fieldwork, a report conforming to the MHPC standards will be completed and electronically submitted via the CARMA database as required.

The schedule for the Phase I field survey effort as described in the above methods will occur in the summer-fall of 2018. A draft report will be prepared for comment by the SHPO and tribes (if applicable), and the final report will be included in the Initial Study Report, currently scheduled for July 2019. Follow-up Phase II studies to identify whether any of the archaeological sites discovered during Phase I survey are eligible for listing to the NRHP would occur in the summer-fall of 2019, if necessary.

Cost and Level of Effort

The estimated cost for completion of a Phase I Historic period survey of the Pejepscot Project is approximately $10,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain initial information on historic archaeological resources within the Project APE.

References

Doyle, Richard, Jr., Nathan Hamilton, James Petersen, and David Sanger 1985 Late Paleo-Indian Remains from Maine and their Correlations in Northeastern Prehistory. Archaeology of Eastern North America 13:1-34.

7.6.3 **Precontact Period Archaeological Resources Survey**

The PAD identified Precontact archaeological resources as a topic for which additional information is necessary to address whether there are Precontact archaeological resources within the APE that have the potential to be listed in the NRHP and that may be affected by the FERC relicensing of the Project.

The Project APE is defined as "…the lands enclosed by the Project's boundary and lands or properties outside of the Project's boundary where Project construction and operation or Project-related recreational development or other enhancements may cause changes in the character or use of historic properties, if any historic properties exist."

Goals and Objectives

The objectives of the Precontact period Phase I archaeological work are to evaluate areas in the Project's APE that have not been previously evaluated for Precontact period archaeological resources and to make recommendations about whether any additional Precontact period archaeological sites that may be found are eligible or potentially eligible for listing to the NRHP.

Known Resource Management Goals

Section 106 of the National Historic Preservation Act of 1966 requires federal agencies, licensees, and those receiving federal permits to account for the effects of proposed undertakings on historic resources listed on or eligible for the NRHP. Consultation on ways to avoid, minimize, or mitigate adverse project effects, if any, must take place for any NRHP-eligible resources within the Project Boundary.

As stipulated by the regulations that implement Section 106 (36 CFR 800), the MHPC (Maine SHPO) represents the interests of the State and its citizens, and advises and assists FERC in determining the significance of cultural resources within the Project boundary. The SHPO administers cultural resource management reviews under Section 106 of the National Historic Preservation Act, which involves providing technical guidance and professional advice on potential impacts of relicensing a project, such as the Pejepscot Project, on the state's cultural resources.

Background and Existing Information

MHPC archaeological site files indicate very few Precontact archaeological sites have been identified within the region of the Androscoggin River watershed in which the Pejepscot Project area is located. Only three sites have been identified to date within or near the Project area, one of which falls within the Project boundary.

The Pejepscot site (ME 14-108) was identified during a 1985 survey of the Pejepscot Dam impoundment and falls within the current Project area. Phase I and II research was undertaken on the Pejepscot Project by the University of Maine at Farmington Archaeology Research Center (UMF ARC) in 1989 and 1992 (Hamilton et. al. 1985; Hamilton et. al. 1986). This site was

found to be either a small camp site or an ancillary activity area of a larger site. It was identified as relating to a single occupation belonging to the late Ceramic Period.

Site ME 14-138 is located upstream of the Project area and consists of a small scatter of Late Ceramic Period ceramic sherds, possibly buried below the ground surface. Site ME 14-152 is located downstream of the Project area and consists of a small scatter of lithic debitage, from an unknown Precontact cultural period, located at or near the ground surface.

Historical records of the area of Lisbon Falls indicate that there was a Native American village located somewhere close to the present location of the village of Lisbon Falls (Hamilton et. al. 1985). To date, no official record has been made for a possible location of this site, which may span the Precontact to Contact periods.

Only one prior cultural resource investigation has taken place within the Project area, the above-mentioned Phase I investigation of the Pejepscot Dam impoundment by UMF ARC in 1985 (Hamilton et. al. 1985), followed by a Phase II investigation of the only site identified during that previous survey. The Project area for this investigation was slightly smaller than the current Project area, totaling 3 miles on both banks of the Androscoggin River. The Phase I investigation involved an initial walk-over of the Project area, through which the investigators looked for surface evidence of archaeological sites and determined areas to test. A total of 135 shovel test pits were excavated on 16 sampling transects. The Phase I survey identified the Pejepscot site (ME 14-108) that was later investigated for the Phase II.

Project Nexus

The proposed investigation will provide information on Precontact archaeological sites located within the Pejepscot Project APE that are potentially eligible for listing to the NRHP and what potential adverse effects to eligible Precontact archaeological resources would be created by the relicensing the continued operation of the Project. If potential adverse effects are determined, the information that is developed during the survey will be used as the basis for preparing an HPMP if appropriate. Guiding the Licensee's actions relating to Section 106 during the term of the new license, any HPMP would discuss how to avoid potential adverse effects or how they will be mitigated.

Methodology

The geographic scope of this study is the Project APE which is defined as "…the lands enclosed by the project's boundary and lands or properties outside of the project's boundary where project construction and operation or project-related recreational development or other enhancements may cause changes in the character or use of historic properties, if any historic properties exist."

All methods used to conduct either survey for archaeological sites or for the NRHP-eligibility evaluation of sites will conform to MHPC guidelines. Consistent with other recent similar studies conducted at hydropower projects in Maine, the Licensee anticipates utilizing a phased approach.

Task 1: Archival Search

The literature search will identify areas within the Project APE with a high likelihood for the presence of Precontact period archaeological resources. A Phase I assessment survey will be conducted focusing on these areas. The MHPC's primary interest is the area of potential impacts from erosion within the impoundment area.

Task 2: Identification of Potential Sites

The goals for a Phase I assessment include:

- Complete a walkover of select areas within the impoundment area between the Pejepscot Dam and the upstream Project limit;
- Assessment surveys usually extend approximately 50 feet back from each bank to include areas potentially affected by erosion;
- Identify and document any Precontact features;
- Complete selected shovel test pits, 50 x 50 cm in size, as needed to provide data on precontact features identified, and collect artifacts useful in dating such features;
- Complete a walkover of portions of the river banks below the dam, to the downstream limit of the project; and
- Provide recommendations for no further survey, or for additional subsurface testing, depending upon the field findings.

Survey Methods for the Phase I archaeological survey will include:

- A visual inspection of the potential impact area;
- Use of GPS devices during Phase I survey to provide UTM coordinates for all sites, site features, site boundaries, and testing locations; and
- Photography of landforms and areas of Precontact interest.

Task 3: Phase II Survey, if necessary

The Phase I survey will recommend whether there are any potentially eligible Precontact period archaeological sites that should undergo a Phase II investigation. The determination of sites that require Phase II survey work will be made in consultation with the MHPC, following completion and review of Phase I findings.

Consistency with Generally Accepted Scientific Practice

All field investigation methods used will follow all applicable Federal and Maine guidelines, including those contained in the Maine Historic Preservation's website

(http://www.maine.gov/mhpc/). In particular, MHPC-approved level II Precontact period archaeologists will be employed to undertake field and site evaluations.

Deliverables and Schedule

Following completion of fieldwork, a report conforming to the MHPC standards will be completed and electronically submitted via the CARMA database as required.

The schedule for the Phase I field survey effort as described in the above methods will occur in the summer-fall of 2018. A draft report will be prepared for comment by the SHPO and tribes (if applicable), and a final report will be included in the Initial Study Report, currently scheduled for July 2019. Follow-up Phase II studies to identify whether any of the archaeological sites discovered during Phase I survey are eligible for listing to the NRHP would occur in the summer-fall of 2019, if necessary.

Cost and Level of Effort

The estimated cost for completion of a Phase I Precontact period survey of the Pejepscot Project is approximately $10,000. Topsham Hydro believes that the proposed level of effort is adequate to obtain initial information on archaeological resources within the Project APE.

References

Doyle, Richard, Jr., Nathan Hamilton, James Petersen, and David Sanger 1985 Late Paleo-Indian Remains from Maine and their Correlations in Northeastern Prehistory. Archaeology of Eastern North America 13:1-34.

APPENDIX A – MINUTES FROM APRIL 27, 2018 MEETING WITH NMFS

Pejepscot Hydroelectric Project (FERC No. 4784)
Meeting with NMFS to Discuss Outstanding Study Requests
For the Revised Study Plan
April 27, 2018

Attendees:
Matt Buhyoff, National Marine Fisheries Service (NMFS)
Matt LeBlanc, Brookfield Renewable
Kelly Maloney, Brookfield Renewable
Frank Dunlap, Brookfield Renewable (by phone)
Drew Trested, Normandeau Associates, Inc.

The purpose of the meeting was to discuss studies proposed by NMFS that were not adopted, or adopted with modifications, by the Licensee for the Pejepscot Project in the Proposed Study Plan (PSP). The intent was to determine what, if any, modifications to the PSP or to NMFS requests could be made based on further discussion of NMFS specific resource concerns and factors including project operations, the Interim and planned Final Species Protection Plan, etc. Per the ILP schedule, the agencies have an opportunity to file study plan comments with FERC on May 13, 2018, while the Revised Study Plan (RSP) by licensee is due to FERC on June 12, 2018.

Ten (10) studies were proposed by NMFS that were not adopted by Topsham Hydro Partners in the PSP.

- Downstream Passage Alternatives Study
- Project Acoustic Effects Study
- Computational Fluid Dynamics Study
- Stranding Evaluation
- Instream Flow Study
- Headpond Predation Study
- Sediment Storage and Mobility Study
- Large Woody Debris Study
- Unimpaired Hydrology Study
- Downstream Fish Passage Effectiveness Study for Atlantic salmon smolts (2nd Year)

Two (2) studies were proposed by NMFS that were partially adopted by Licensee in the PSP. Listed below are the aspects not adopted.

- Desktop analysis to assess upstream passage effectiveness for Atlantic salmon
- Field based direct turbine survival studies for adult and juvenile clupeids.

Discussions regarding potential modifications to these study requests are discussed in detail below.

a) Downstream Passage Alternatives Study, b) Computational Fluid Dynamics Study, and c) Project Acoustic Effects Study

- Brookfield discussed that the proposed downstream and upstream fish passage studies identified in the PSP would help to identify whether a passage issue exists currently for the existing facilities. To that end, the three above-referenced studies may not be necessary should the proposed effectiveness studies show that the Project provides safe, timely and effective upstream and downstream fish passage.
- NMFS indicated that the requested studies would identify issues in combination with passage studies to narrow down impacts to passage right away but acknowledges Brookfield's position of first identifying whether there is an issue.
- Brookfield proposed to modify the RSP to clarify the position that the studies might be appropriate in the future but are, at this point, premature. Once the other studies have been conducted, the necessary information gathered, and the extent of the problem (if any) understood then Brookfield would discuss conducting these or other follow up studies, in consultation with the agencies. For example, an acoustic effects study may not be appropriate if other potential upstream passage issues and remedies are made obvious during the conduct of the proposed passage studies.

Stranding Evaluation

- Brookfield acknowledged the concern for potential stranding in the ledges along the western shore immediately downstream of the dam. Brookfield and NMFS discussed that it is unknown whether there are pools that allow the potential for stranding in this area and that stranding is of interest particularly in times of transition from high flows to low (i.e. no or little flow following spill or operation of the bascule gate providing potential attraction).
- Brookfield discussed that it proposes to conduct a reconnaissance level stranding evaluation through a combination of photo-documentation and on-site flow demonstration in consultation with NMFS. Brookfield discussed that this evaluation would be targeted to take place before the RSP and the information gathered included in the RSP, if flow conditions allow. If flow conditions do not allow this effort to be completed prior to the RSP, the RSP would include available information and the plan for the reconnaissance evaluation.
- Brookfield will coordinate with NMFS to schedule an appropriate date and time for the on-site evaluations. Brookfield will also gather information on bascule gate operations and annual spill in this reach and provide it in the RSP if available.

Instream Flow Study

- Brookfield and NMFS discussed that NMFS has a better understanding of project operations and NMFS would not be pursuing this study in their comment letter on the PSP.

a) Headpond Predation Study, b) Sediment Storage and Mobility Study, c) Large Woody Debris Study, and d) Unimpaired Hydrology Study

- Brookfield reiterated its position that it does not plan to conduct these studies because the resource concerns have no nexus to Project operations (i.e. run of river operations). NMFS disputed Brookfield's assertion regarding these studies' lack of project nexus and expressed concerns that the river is critical habitat for Atlantic salmon and geomorphic inputs of sediment and the availability of large woody debris in the river are components of that. Brookfield and NMFS discussed differing positions on baseline environmental conditions for the relicensing.

- No agreement on modification of the PSP was reached between NMFS and Brookfield for these studies.

<u>a) Downstream Fish Passage Effectiveness Study for Atlantic Salmon smolts (2nd Year), b) Desktop analysis to assess upstream passage effectiveness for Atlantic salmon</u>

- Brookfield reiterated the position discussed at the PSP meeting regarding the activities undertaken under the existing SPP, which includes downstream Atlantic salmon smolt study and upstream Atlantic salmon adult study. To that end, Brookfield has conducted three years of existing baseline downstream Atlantic salmon smolt studies. The existing SPP (2017 – 2022) includes:

    - A one-year downstream passage effectiveness study, in consultation with the fisheries agencies, in 2018 to evaluate whole station survival under additional spill conditions and verify compliance with incidental take limits.

    - Video camera monitoring of the number of Atlantic salmon using the Project's fish lift starting in 2017 and continuing to 2022.

    - An adult upstream passage effectiveness study when a sufficient number of returning adults are counted at Brunswick to conduct the study.

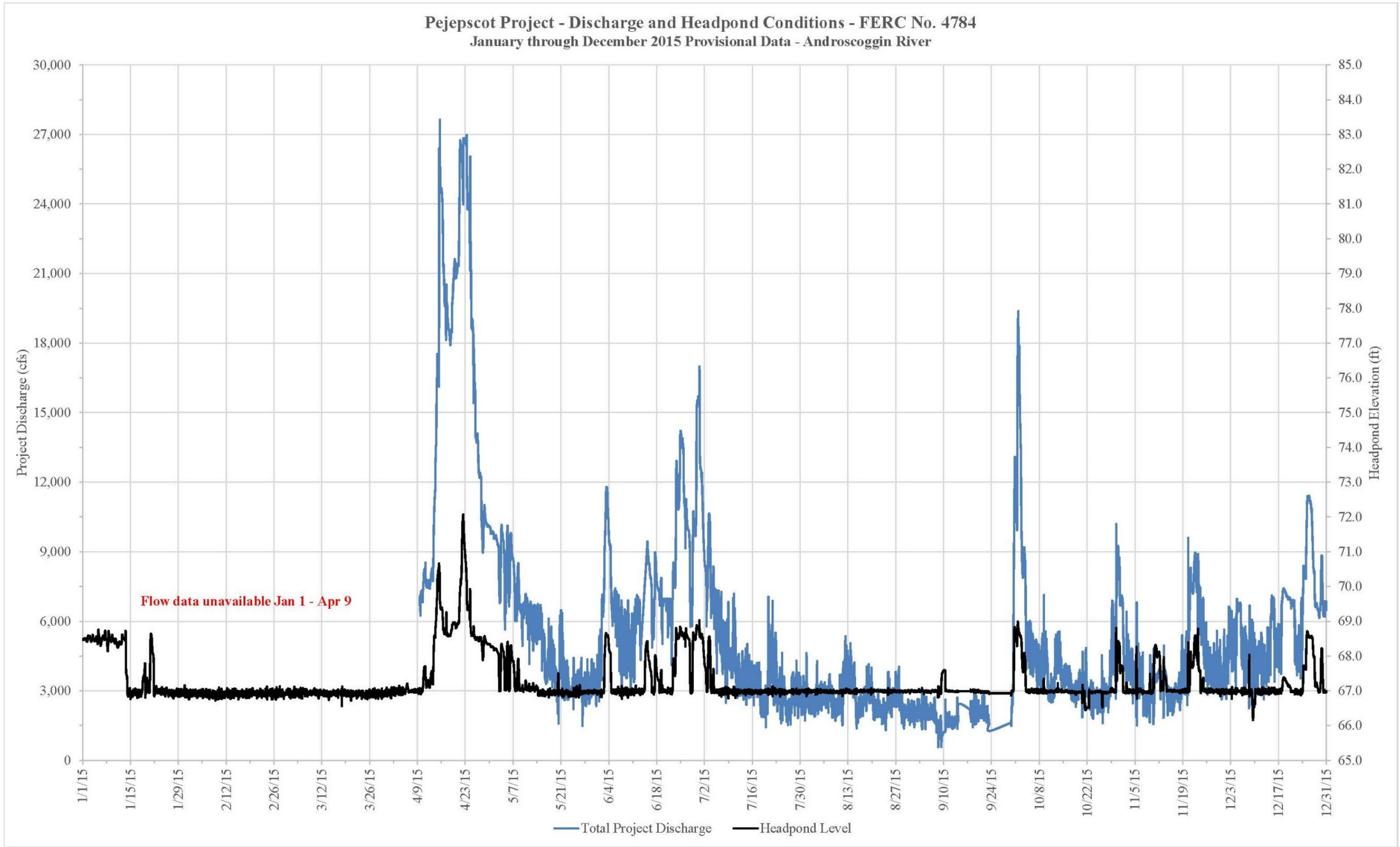
- Brookfield will modify the RSP to include information for clarification of the salmon passage study commitments as part of the SPP.
- Brookfield discussed that a second year Atlantic salmon smolt study may or may not be necessary depending on whether the 2018 study indicates that the Project (even with additional spill measures) results in an exceedance of take. NMFS Biological Opinion (BiOp) for the SPP requires the reinitiation of Section 7 consultation if "the amount or extent of taking specified in the incidental take statement is exceeded". Therefore, Brookfield will modify the RSP to clarify the position that a second year study may be undertaken should an exceedance of take occur.

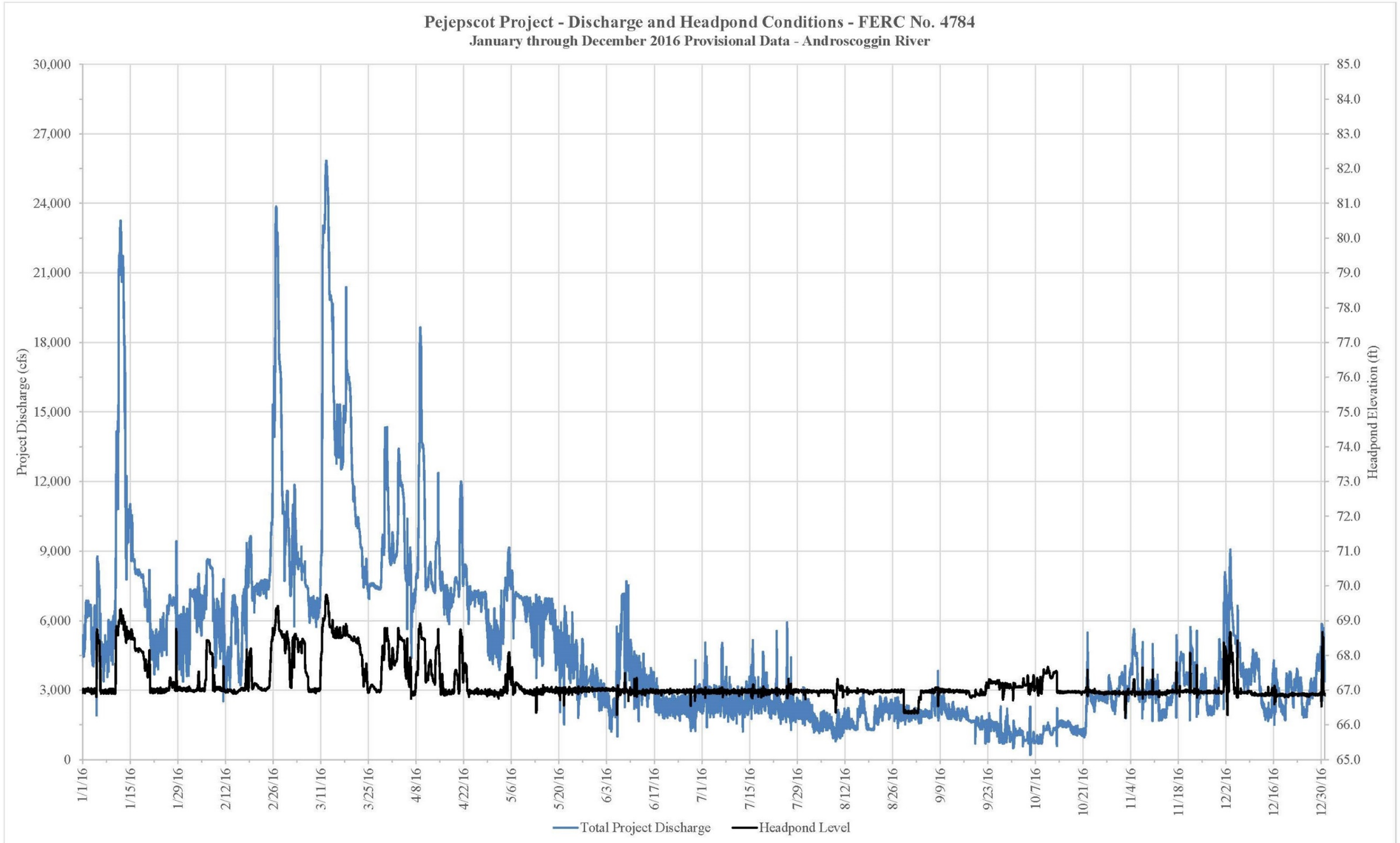
- Brookfield discussed that a desktop evaluation of upstream passage would not likely provide meaningful results in this instance, that the existing upstream passage evaluations for other species will be informative, and the commitment to upstream passage Atlantic salmon specific studies is codified in the existing SPP. NMFS expressed concern that the existing Pre-Application Document (PAD) does not specify a commitment to developing an SPP that would outline Atlantic salmon performance standards and monitoring efforts for upstream and downstream passage for the term of the new license. Brookfield noted that its PAD is not intended to represent Brookfield's final relicensing proposals and commitments. Brookfield will modify the RSP to include information for clarification of the salmon passage commitments as part of the SPP, including the development of a new SPP for the term of the license.

Field based turbine survival study

- Brookfield indicated that the proposed desktop and empirical passage studies for downstream passage will provide good information on the existing downstream passage survival success at Pejepscot. The desktop technique for evaluating downstream passage mortality at hydroelectric projects has been regularly accepted by FERC as a valid approach during numerous ILP relicensing efforts. Brookfield expects that the desktop evaluation proposed for use at Pejepscot will be further strengthened by incorporating a comparison between predicted passage survival (based on desktop models utilizing site-specific turbine unit parameters and fish body lengths) and observed passage survival (based on downstream passage survival estimates obtained from proposed field evaluations of downstream passage for salmon smolts and alosines).
- NMFS expressed concern that variation in unit operations might result in a lack of good information for any one specific unit.
- NMFS also expressed concern that desktop evaluations of passage survival may be inadequate to identify the source of mortality and referenced the Ellsworth Hydroelectric Project (P-2727) as an example.
- No agreement on modification of the PSP was reached between NMFS and Brookfield for these studies.

APPENDIX B - FLOW AND IMPOUNDMENT WATER LEVEL DATA (2015-2017)


Pejepscot Project - Discharge and Headpond Conditions - FERC No. 4784
January through December 2015 Provisional Data - Androscoggin River
Project Discharge (cfs)
Headpond Elevation (ft)
30,000
27,000
24,000
21,000
18,000
15,000
12,000
9,000
6,000
3,000
0
85.0
84.0
83.0
82.0
81.0
80.0
79.0
78.0
77.0
76.0
75.0
74.0
73.0
72.0
71.0
70.0
69.0
68.0
67.0
66.0
65.0
Flow data unavailable Jan 1 - Apr 9
1/1/15
1/15/15
1/29/15
2/12/15
2/26/15
3/12/15
3/26/15
4/9/15
4/23/15
5/7/15
5/21/15
6/4/15
6/18/15
7/2/15
7/16/15
7/30/15
8/13/15
8/27/15
9/10/15
9/24/15
10/8/15
10/22/15
11/5/15
11/19/15
12/3/15
12/17/15
12/31/15
Total Project Discharge
Headpond Level


Pejepscot Project - Discharge and Headpond Conditions - FERC No. 4784
January through December 2016 Provisional Data - Androscoggin River
Project Discharge (cfs)
Headpond Elevation (ft)
30,000
27,000
24,000
21,000
18,000
15,000
12,000
9,000
6,000
3,000
0
85.0
84.0
83.0
82.0
81.0
80.0
79.0
78.0
77.0
76.0
75.0
74.0
73.0
72.0
71.0
70.0
69.0
68.0
67.0
66.0
65.0
1/1/16
1/15/16
1/29/16
2/12/16
2/26/16
3/11/16
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6/3/16
6/17/16
7/1/16
7/15/16
7/29/16
8/12/16
8/26/16
9/9/16
9/23/16
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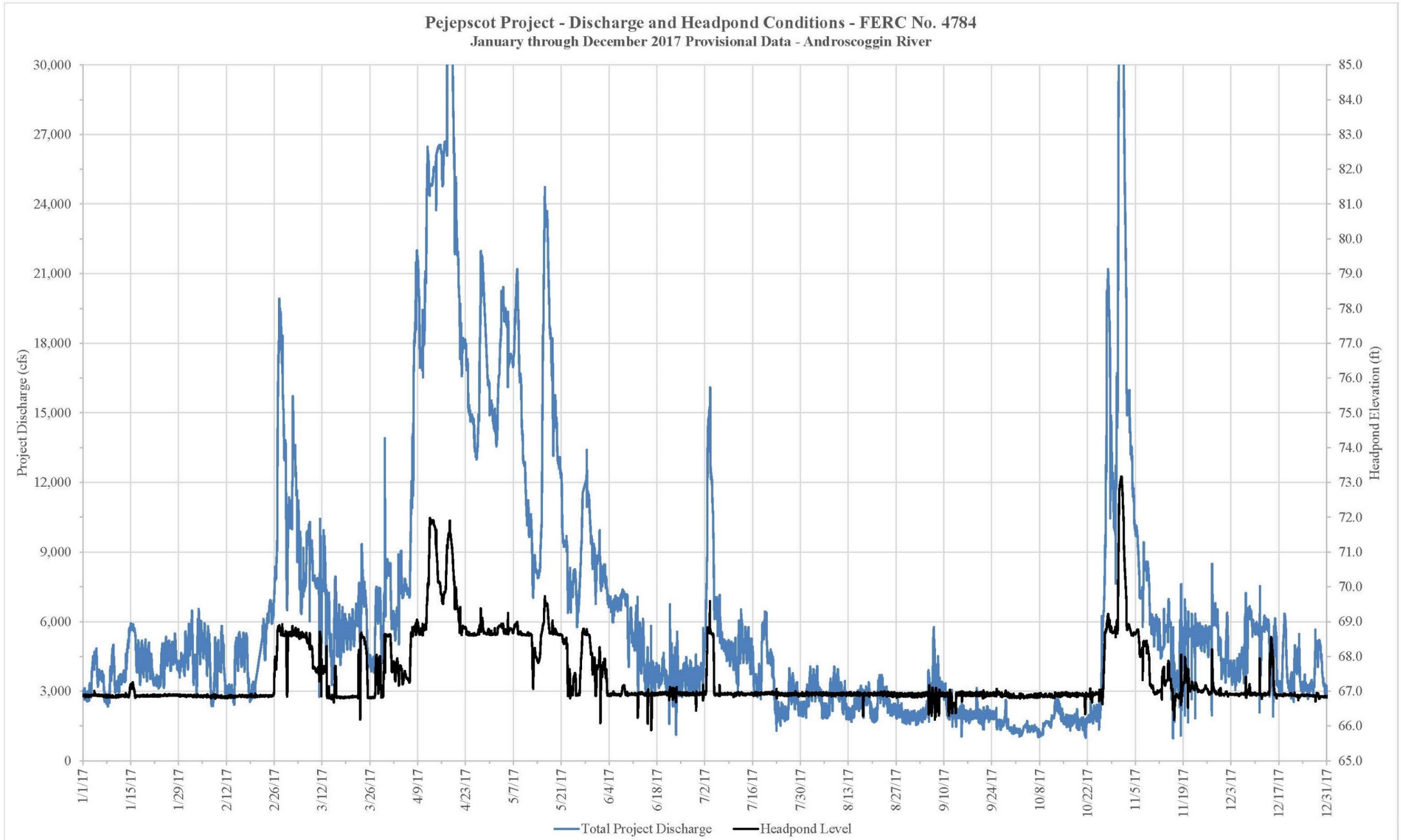
12/16/16
12/30/16
Total Project Discharge
Headpond Level


Pejepscot Project - Discharge and Headpond Conditions - FERC No. 4784
January through December 2017 Provisional Data - Androscoggin River
Project Discharge (cfs)
Headpond Elevation (ft)
30,000
27,000
24,000
21,000
18,000
15,000
12,000
9,000
6,000
3,000
0
85.0
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74.0
73.0
72.0
71.0
70.0
69.0
68.0
67.0
66.0
65.0
1/1/17
1/15/17
1/29/17
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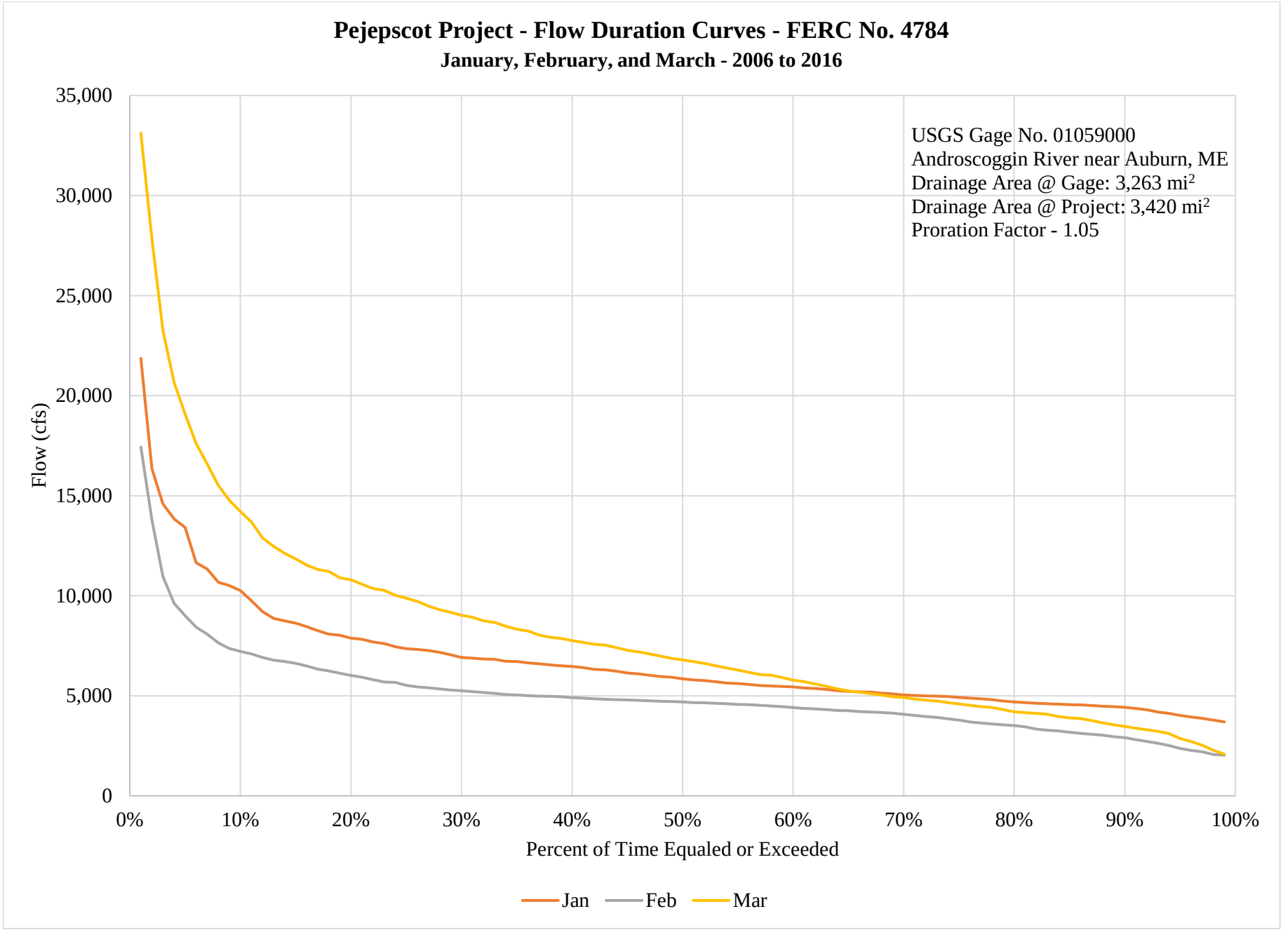
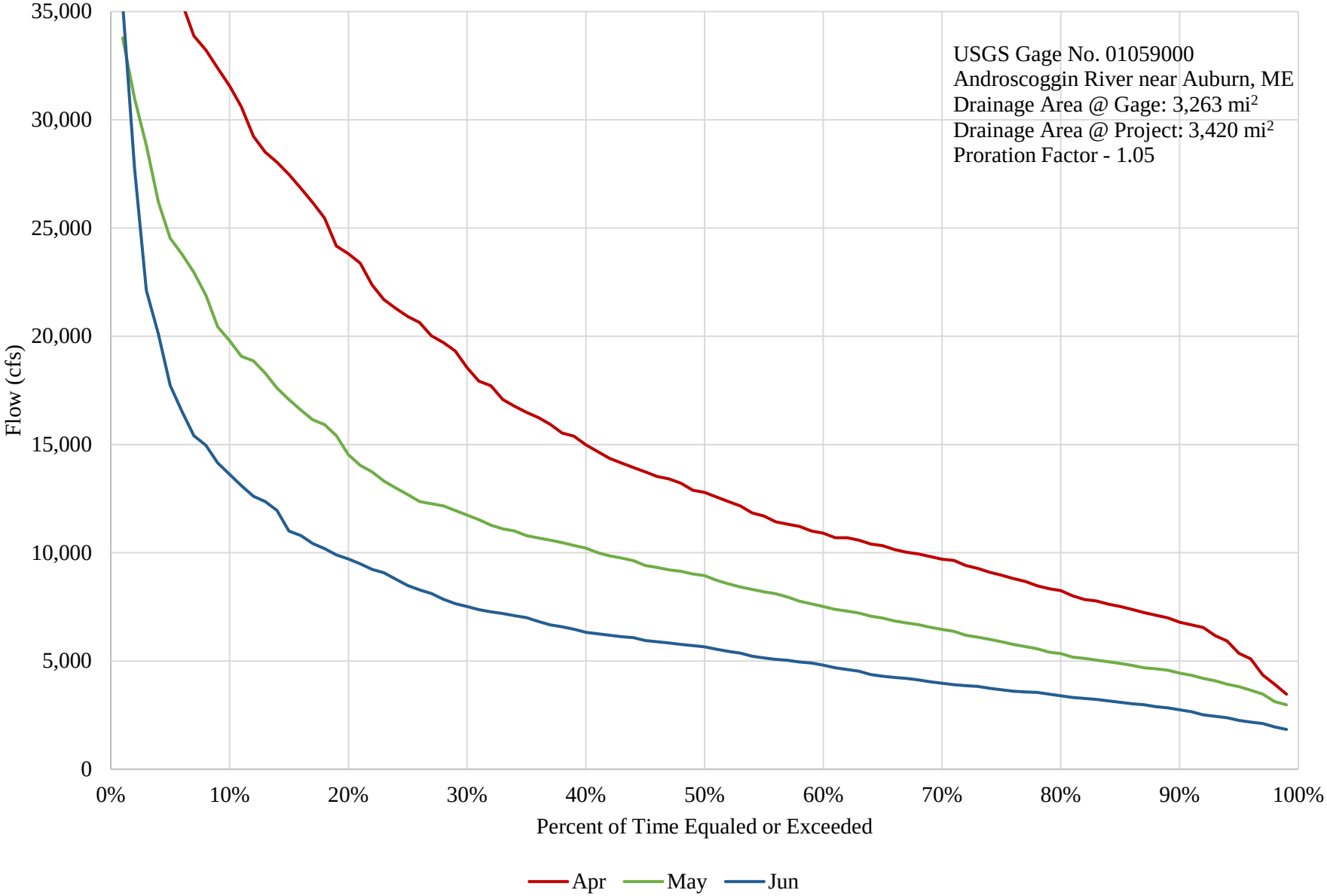
6/4/17
6/18/17
7/2/17
7/16/17
7/30/17
8/13/17
8/27/17
9/10/17
9/24/17
10/8/17
10/22/17
11/5/17
11/19/17
12/3/17
12/17/17
12/31/17
Total Project Discharge
Headpond Level

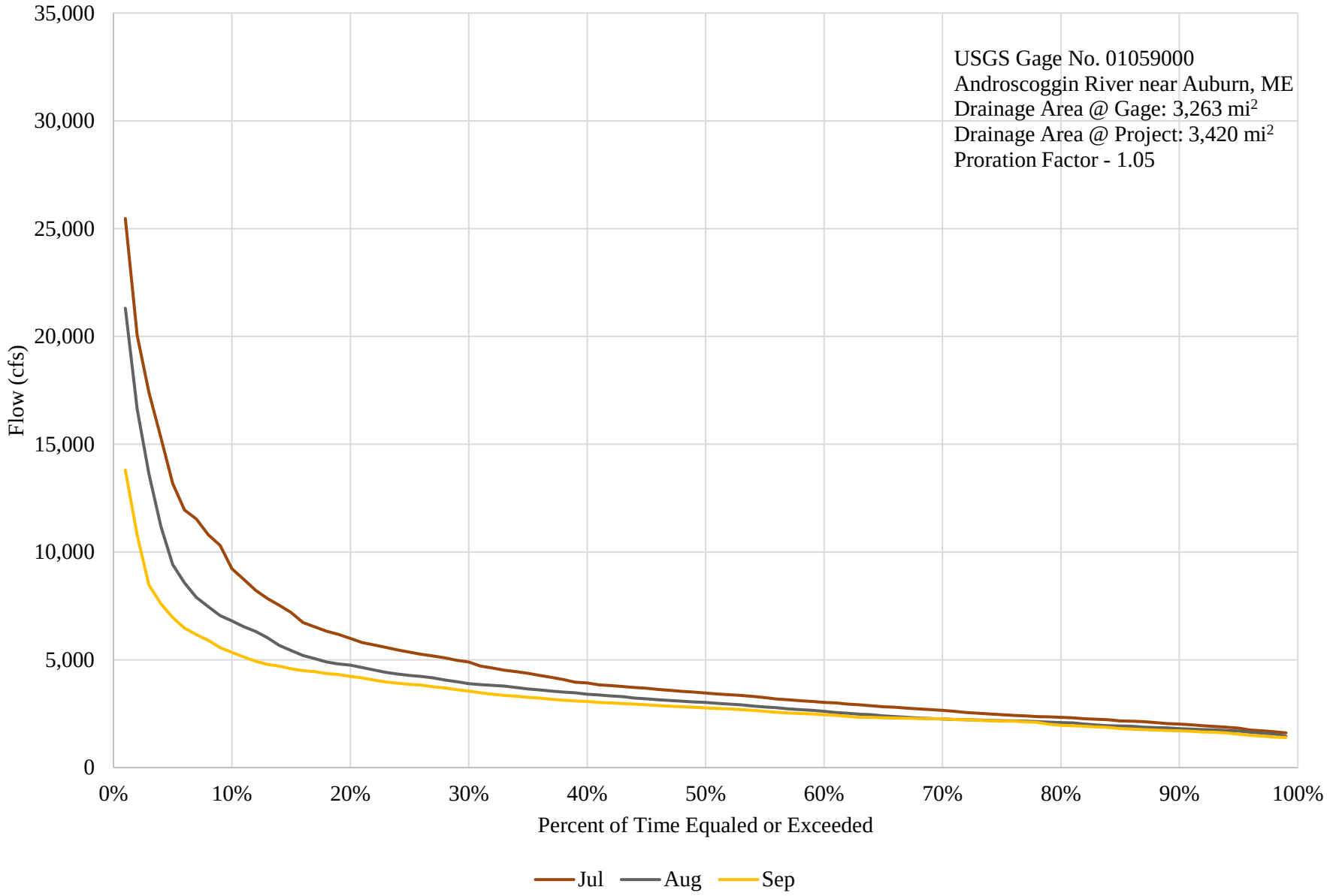
APPENDIX C - MONTHLY AND ANNUAL FLOW DURATION CURVES (2006-2016)

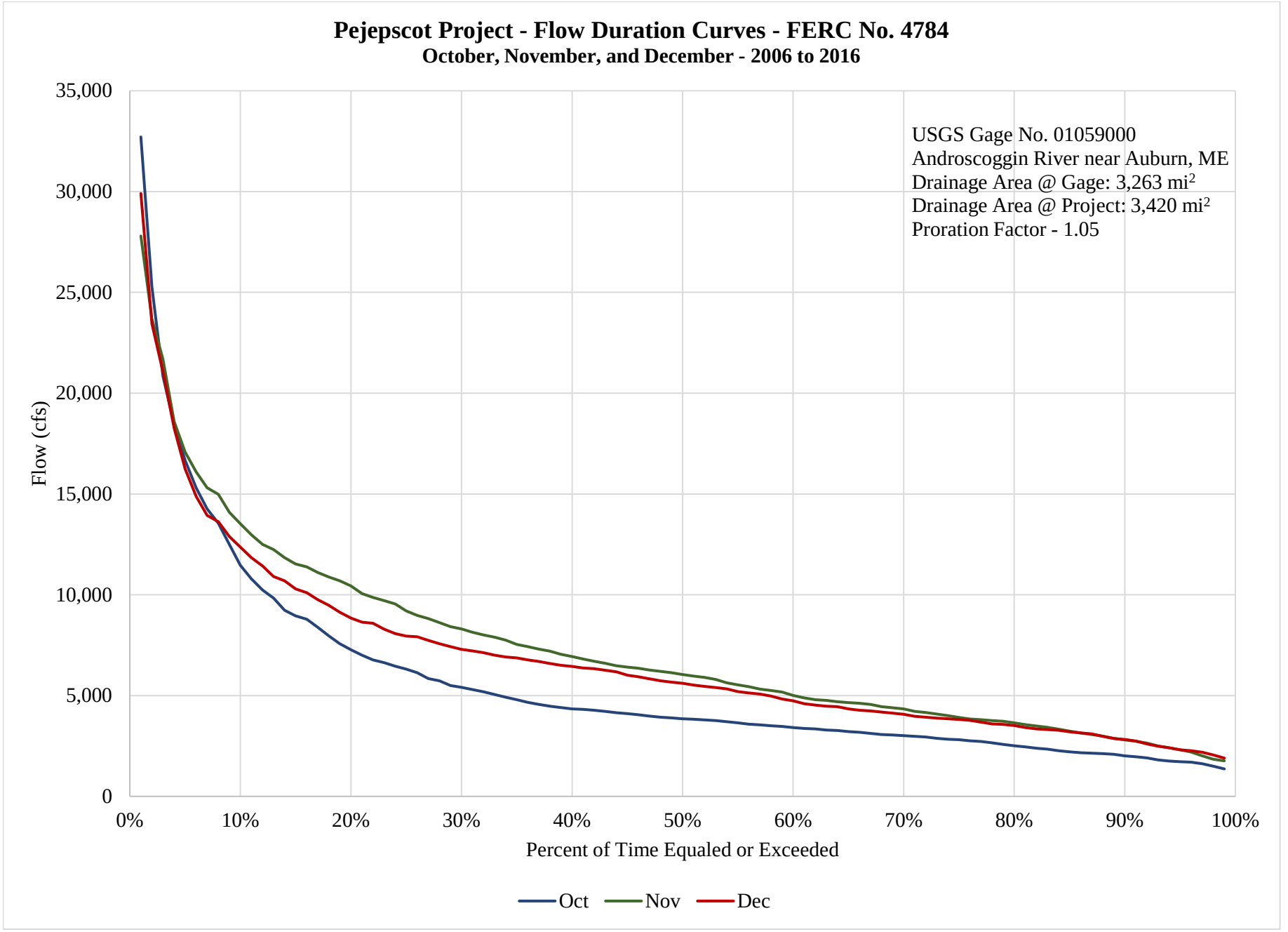

Pejepscot Project - Flow Duration Curves - FERC No. 4784
January, February, and March - 2006 to 2016
USGS Gage No. 01059000
Androscoggin River near Auburn, ME
Drainage Area @ Gage: 3,263 mi²
Drainage Area @ Project: 3,420 mi²
Proration Factor - 1.05
Flow (cfs)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Equaled or Exceeded
Jan
Feb
Mar

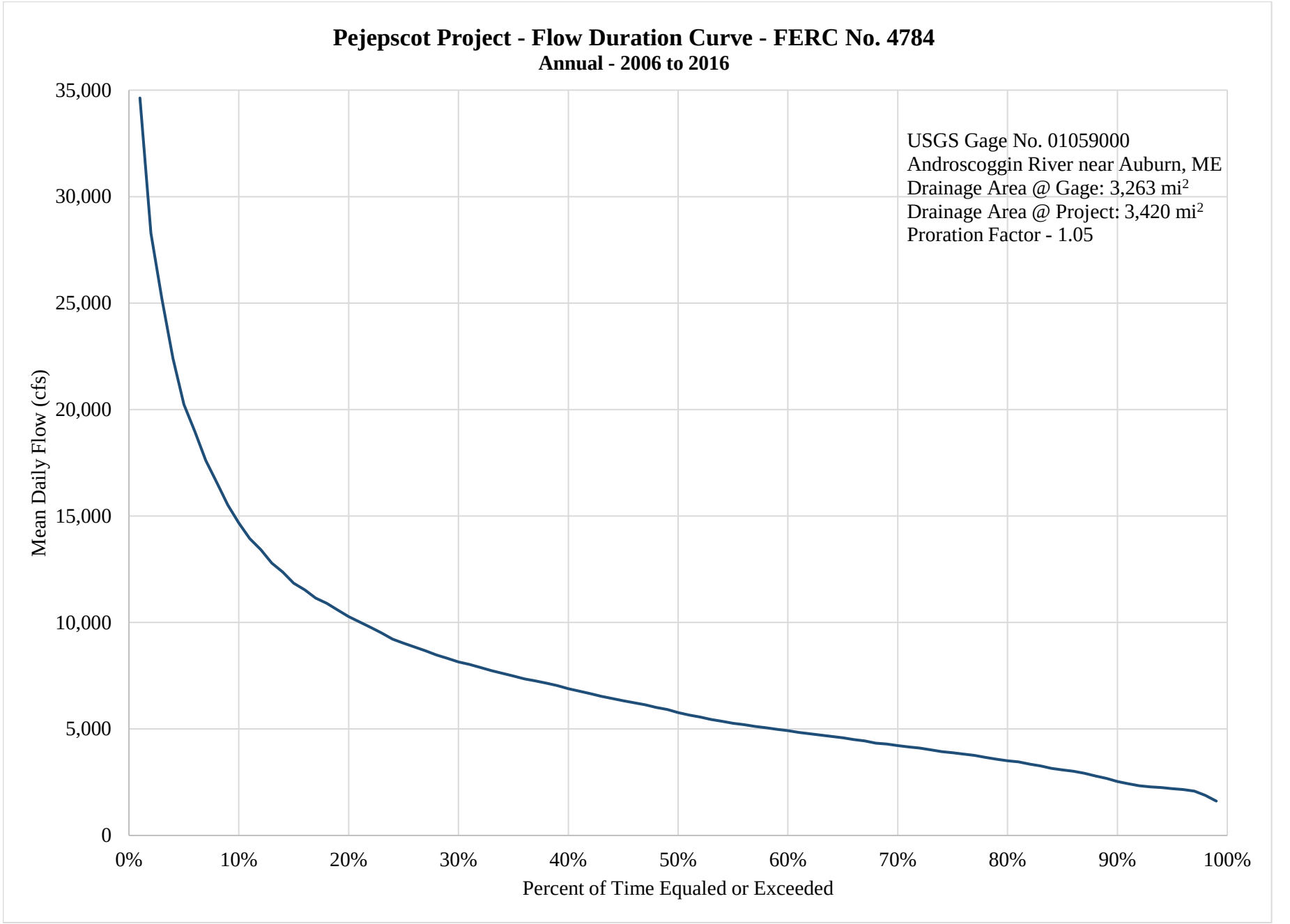
Pejepscot Project - Flow Duration Curves - FERC No. 4784
April, May, and June - 2006 to 2016



Pejepscot Project - Flow Duration Curves - FERC No. 4784
July, August, and September - 2006 to 2016




Pejepscot Project - Flow Duration Curves - FERC No. 4784
October, November, and December - 2006 to 2016
USGS Gage No. 01059000
Androscoggin River near Auburn, ME
Drainage Area @ Gage: 3,263 mi²
Drainage Area @ Project: 3,420 mi²
Proration Factor - 1.05
Flow (cfs)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Equaled or Exceeded
Oct
Nov
Dec


Pejepscot Project - Flow Duration Curve - FERC No. 4784
Annual - 2006 to 2016
USGS Gage No. 01059000
Androscoggin River near Auburn, ME
Drainage Area @ Gage: 3,263 mi2
Drainage Area @ Project: 3,420 mi2
Proration Factor - 1.05
Mean Daily Flow (cfs)
35,000
30,000
25,000
20,000
15,000
10,000
5,000
0
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Percent of Time Equaled or Exceeded