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July 25, 2025

Via Electronic Filing

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

SUBJECT: Lawrence Hydroelectric Project (FERC No. 2800)
Response to Comments on the Initial Study Report

Dear Secretary Reese:

Essex Company, LLC (Essex) is the Licensee, owner, and operator of the Lawrence Hydroelectric Project (FERC No. 2800) (Project or Lawrence Project). The Lawrence Project is located on the Merrimack River in the City of Lawrence in Essex County, Massachusetts. The Project was licensed by the Federal Energy Regulatory Commission (FERC or Commission) in 1978, and the license expires on November 30, 2028. Essex has elected to use the Integrated Licensing Process (ILP), as defined in 18 Code of Federal Regulations (C.F.R.) Part 5 of the Commission's regulations. Essex filed a Pre-Application Document (PAD) and the associated Notice of Intent (NOI) with the Commission on June 16, 2023, to initiate the ILP. On May 10, 2024, the Commission issued a Study Plan Determination (SPD) for the Project. On April 28, 2025, Essex filed the Initial Study Report (ISR) for the Project. In accordance with the Commission's regulations at 18 C.F.R. §5.15(c)(2), the ISR Meeting was held on May 7-8, 2025, and a virtual option was available. The ISR Meeting Summary was filed on May 26, 2025. Stakeholders had 30 days to file comments on the ISR and ISR meeting summary (e.g. June 25, 2025). Essex herein provides a responses to comments on the ISR and ISR meeting summary.

Background

The Commission's SPD directed Essex to perform the following 17 studies in support of relicensing the Project:

- Upstream Anadromous Fish Passage Assessment
- Upstream American Eel Passage Assessment
- American Eel Upstream Passage Siting Study
- Desktop Entrainment, Impingement, and Turbine Passage Survival Study
- Sturgeon Distribution and Project Interaction Study

- Diadromous Fish Behavior, Movement, and Project Interaction Study
- Project Operations and Fish Stranding Study
- Freshwater Mussel Habitat Assessment and Survey
- Water Quality Study
- Three-Dimensional Computational Fluid Dynamics (CFD) Modeling
- Recreation Facilities, Use, and Aesthetics Study
- Historically Significant Waterpower Equipment Study
- Condition Assessment of Historic Properties and Associated Canal System
- Downstream Juvenile Alosine Passage Assessment
- Sturgeon Habitat Mapping and Assessment Study
- Fish Assemblage Assessment
- Invasive Plants Survey

Essex has been conducting studies as required in the Commission's SPD. In accordance with 18 C.F.R. §5.15(c)(2), the ISR described Essex's overall progress in implementing the study plan and schedule, summarized available data, and described any variances from the study plan and schedule approved by the Commission. While fieldwork and data processing are ongoing for several studies, Essex filed six individual study reports with the ISR. These reports include the:

- The Upstream American Eel Passage Assessment Study Report
- American Eel Upstream Passage Siting Study Report
- Phase 1 of the Diadromous Fish Behavior, Movement, and Project Interaction Study Report
- The Freshwater Mussel Habitat Assessment and Survey Study Report
- Historically Significant Waterpower Equipment Study Report
- Condition Assessment of Historic Properties and Associated Canal System Study Report[1]

The Commission's regulations at 18 C.F.R. §5.15(c)(4) provide that any participant or the Commission's staff may file a disagreement concerning the ISR Meeting Summary within 30 days of filing of the ISR Meeting Summary, setting forth the basis for disagreement. Any such filing must also include any requested modifications to ongoing studies or proposed new studies. Seven entities filed comments on the Revised ISR Meeting Summary, as shown below in Table 1.

Table 1
Entities Filing Comments on the Revised ISR Meeting Summary and/or Requests for New or Modified Studies

Filing Entity	Filing Date
FERC	June 24, 2025

[1] This report was filed with the Commission on May 6, 2025.

Filing Entity	Filing Date
Massachusetts Department of Environmental Protection (MassDEP)	June 24, 2025
National Marine Fisheries Service (NMFS)	June 25, 2025
Massachusetts Division of Marine Fisheries (MDMF)	June 25, 2025
New Hampshire Fish and Game Department (NHFGD)	June 25, 2025
Massachusetts Division of Fisheries and Wildlife (MassWildlife)	June 25, 2025
Groundwork Lawrence	June 26, 2025

Pursuant to 18 C.F.R. §5.15(c)(5), Essex is filing this response to comments on the ISR Meeting Summary, requests for modification of approved studies, and requests for new studies. As provided in 18 C.F.R. §5.15(c)(6), the Commission's Director of the Office of Energy Projects (Director) will resolve any disagreements and amend the approved study plan (as appropriate) within 30 days of the date of this filing (August 24, 2025).

Pursuant to 18 C.F.R. §5.15(d) of the Commission's regulations, any request to modify an ongoing study must be accompanied by a showing of good cause why the request should be approved, and must include a demonstration that: (1) the approved studies were not conducted as provided for in the approved study plan; or (2) the study was conducted under anomalous environmental conditions, or that environmental conditions have changed in a material way.

MassWildlife submitted a formal Request to Modify the Downstream Juvenile Alosine Passage Assessment to include American eel; Essex responds to that request below. Essex provides a response to individual comments on the ISR or the Project in Attachment A.

Request to Modify the Downstream Juvenile Alosine Passage Assessment to include American eel

In their comment letter on the ISR, MassWildlife requested a modification to the approved and ongoing Downstream Juvenile Alosine Passage Assessment to evaluate downstream American eel passage at the Project.

MassWildlife previously requested a Downstream American Eel Passage Assessment in their comments on the Proposed Study Plan. However, as determined by FERC in the May 10, 2024 SPD, the requested Downstream American Eel Passage Assessment was not approved and the Commission determined that the results of the 2019 Downstream American Eel Passage Assessment[2] (2019 Normandeau Study) were sufficient to inform on downstream passage efficiency. Specifically, the SPD noted:

[2] Filed with the Commission on April 17, 2024.

"The 2019 Normandeau study provides sufficient information to assess behavior, approach and passage routes, passage success, and survival of adult silver-phase American eels passing through the turbines and over the spillway. Although the 2019 Normandeau study does not evaluate the North and South Canals as a potential route of downstream passage at the project, the gates in the North Canal gatehouse are inoperable, and the operational status of the South Canal and its gatehouse are unknown. Therefore, use of the canals as downstream passage routes for adult silver eels cannot be evaluated at this time. However, Study 13, Condition Assessment of Historic Properties and Associated Canal System, will provide information about the condition of the canals, a schedule for any necessary repairs, and information about whether adult silver eels and other migratory fish can currently access the canals for downstream passage."

Under 18 C.F.R. §5.14, MassWildlife had the opportunity to file a study dispute within 20 days of the issuance of the SPD; MassWildlife did not file a study dispute regarding FERC's decision on the Downstream American Eel Passage Assessment. As described in the RSP, in the 2019 Normandeau Study, Essex proactively collected downstream passage data at the Lawrence Project in accordance with the approved study plan for the FERC relicensing of the upstream Lowell Hydroelectric Project (P-2790). The methodology is provided in the 2019 Normandeau Study that was reviewed by the Commission prior to its issuance of the SPD. Additionally, as referenced in the Commission's SPD decision, Condition Assessment of Historic Properties and Associated Canal System (Study 13) was filed with the Commission on May 6, 2025, and additional information pertaining to that report is filed herein (see Attachment A).

MassWildlife claims that the results of the Upstream American Eel Passage Assessment and the American Eel Upstream Siting Study indicate that there is "substantial species interactions with the project." The objectives of these studies as approved by FERC are to evaluate the effectiveness of existing upstream passage facilities and inform on the spatial distribution and relative abundance of juvenile eels downstream of the Project. Essex does not refute species interaction or presence at the Project, and due to a known presence, has implemented fish passage measures and designed eel passage facilities for safe passage. The abundance of juvenile eel detected in the upstream relicensing studies is not an indicator of downstream passage effectiveness. MassWildlife claims that *"(these) surveys also found low percentages of large individuals (>12 inches), which could indicate size selective processes occurring at fish passage structures."* This statement is speculative and does not provide justification for the requested study modification. In fact, visual estimates from Essex staff indicate passing over 300,000 eels during the 2025 season (as of July 18), a pattern which has been observed in recent years. Observations by Essex' fish lift staff indicate that the size range of lifted eels is consistent with that seen in the eel ramp and eel lift.

MassWildlife's request does not meet criteria for a study modification under 18 C.F.R. §5.15(d). Essex is implementing the Downstream Juvenile Alosine Passage Assessment consistent with the FERC-approved study plan. MassWildlife has not presented sufficient evidence to countermand the Commission's prior determination regarding this same study request. Essex supports FERC's

determination that sufficient information is available from existing 2019 Normandeau Study, and asserts that additional insights will be provided from relicensing studies including the Condition Assessment of Historic Properties and Associated Canal System, Desktop Entrainment, Impingement, and Turbine Passage Survival Study, and Three-Dimensional Computational Fluid Dynamics Modeling Study (which Essex anticipates filing in Q3 of 2025). Additionally, as noted in the RSP, Essex is proposing to develop a narrow-spaced trashrack design to replace the existing trashrack system. Essex believes this proposal for a measure to screen the Project's intake would greatly inform the new Project proposal and mitigate fish entrainment during downstream passage. Essex intends to consult with agencies regarding this measure and to provide further details within the Draft License Application.

The data collected as part of these studies, along with other fisheries surveys conducted in support of this relicensing and proposed measures, will inform on downstream passage and will be sufficient to support FERC's National Environmental Policy Act analysis of continued operation and maintenance of the Lawrence Project.

As always, I welcome the opportunity to further discuss the ongoing relicensing process with the Commission. If you have any question regarding this filing, please feel free to contact me at (978) 935- 6039 or at kwebb@patriothydro.com.

Sincerely,

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Attachment A

Comment/Response Matrix

Study Number	Study	Commenting Party	Comment	Response
1	Upstream Anadromous Fish Passage Assessment	MASSWildlife	Essex and Normandeau has initiated an extensive radio-telemetry monitoring array that will inform on the upstream passage of Sea Lamprey and American Shad. MassWildlife requests that potential weaknesses in the radio telemetry receiver placement be explicitly documented when evaluating 2025 detection data, specifically in detecting individuals approaching the tailrace on the river right opposite the fish passage entrance. Essex and Norandeau [sic] recognize this and stated in the ISR Meeting Summary “Given the parallel orientation of the antenna with the river, they will not be able to derive bank positioning from signal strength. As a result, it will not show the path taken upstream through the bridges. We recommend that this area lacking receiver coverage is highlighted in a radio telemetry array map or described so that agencies and the Commission are aware of potential data gaps and their effect on evaluating passage efficiency.	Comment noted. The array deployed during the 2025 Upstream Anadromous Fish Passage Assessment will be fully described in the USR.
1	Upstream Anadromous Fish Passage Assessment	MASSWildlife	Essex comments from the ISR state “Normandeau indicated that they had not yet observed any lamprey in electrofishing collections but will see if those fish are seen as sampling continues downstream. Normandeau noted that the tagging process for sea lamprey is much different than the quick tag insertion process for alosines and that doing those surgeries on a boat below the dam would be more challenging and that fish would be released without any post-surgery holding time.” While MassWildlife recognizes the challenge of catching Sea Lamprey through electrofishing, we are concerned that individuals tagged directly from the fish lift have the potential to significantly bias the study. These individuals have successfully navigated fish passage structures and do not represent the entirety of the population approaching the project. Behavioral differences among individuals have the potential to influence Sea Lamprey passage efficiency, making it critical to sample individuals prior to any interactions with fish passage structures (Mesinger et al. 2021). American Shad included in this study are captured prior to entering the fish lift and the Project should apply the same methodology to Sea Lamprey.	In the absence of options to collect naïve sea lamprey, individuals selected for tagging as part of the spring 2025 Upstream Anadromous Fish Passage Assessment were collected from the fish lift. All other species tagged during this and the Diadromous Fish Behavior, Movement, and Project Interaction Study were able to be collected downstream by boat electrofish sampling.
1	Upstream Anadromous Fish Passage Assessment	MADMF, NMFS	A 14-station radio telemetry monitoring array has been installed to inform of upstream fish movements. Though briefly mentioned in the ISR filing, the three upstream receivers (i.e., stations 13, 14, and 15) were not in the figures/ information presented at the ISR meeting. Essex should appropriately illustrate and describe the configuration of deployed receiver array.	As requested in the FERC SPD, Stations 13, 14, and 15 were deployed as part of the spring 2025 Upstream Anadromous Fish Passage Assessment, the final methodologies and results of which will be part of the USR.
1	Upstream Anadromous Fish Passage Assessment	MADMF, NMFS	As described in our study request, collection and tagging of study fish should occur downstream of the Project to avoid bias that would result from obtaining study fish from the upstream fishway. During the ISR meeting, Essex noted stated [sic] that electrofishing was unsuccessful in collecting sea lamprey, and the upstream fishway trap will be used to obtain sea	Comment noted. In the absence of options to collect naïve sea lamprey, individuals selected for tagging as part of the spring 2025 Upstream Anadromous Fish Passage Assessment were collected from the fish lift. All other species tagged during this and the

Study Number	Study	Commenting Party	Comment	Response
			lamprey for tagging. We do not support this approach, in order for the study results to be representative of all fish approaching the Project, the test fish should be naïve and not have experience passing the fishway under evaluation. Fish captured in or upstream of the fishways have already successfully navigated fish passage structures and exhibit a significantly higher passage performance than naïve fish (Hershey, 2021).	Diadromous Fish Behavior, Movement, and Project Interaction Study were able to be collected downstream by boat electrofish sampling.
1	Upstream Anadromous Fish Passage Assessment	MADMF	MADMF requests that any signal gaps or potential weaknesses in the radio telemetry receiver placement be explicitly documented when evaluating the 2025 detection data, specifically in detecting individuals approaching the tailrace on river right opposite the fish passage entrance.	Comment noted.
1	Upstream Anadromous Fish Passage Assessment	NHFGD	Objective 1 of the study was to, “determine approach of upstream migrating American shad from the downstream release location towards the project fishway under a range of operational/river conditions.” The position of the radio telemetry receivers in this study will not allow for the determination of approach (i.e. across the spillway vs. up the river right bank). Direction of approach for shad and river herring will be determined in the Diadromous Fish Behavior, Movement, and Project Interaction Study. Objective 1 should be clarified to reflect that approach will be evaluated in terms of timing of arrival from the release site to the tailrace (not in terms of direction).	Comment noted. The objectives section of the Upstream Anadromous Fish Passage Assessment report will be updated to reflect this study adjustment when filed as part of the USR.
2	Upstream American Eel Passage Assessment	MASSWildlife	South Side American Eel Ladder Functionality a) This ladder has a number of issues related to American Eel passage that include false attractions, gaps in the ladder structure, and clogged fish ladder nozzles. While these deficiencies will be tested in this study, MassWildlife notes that these results will only assess internal efficiency only of American Eel passage at the project. Since only internal efficiency was tested, we have no understanding of external efficiency and how many individuals are not successful in their approach or entrance into passage structures. External efficiency will be taken into account as agency stakeholders continue to consider defining more explicit target passage goals for this species. The ISR report indicated that two of the three spray nozzles were clogged, resulting in most of the attraction water coming from the ramp entrance, with little water moving down the ramp surface (ISR, Figure 5-2). Both sources of water are important to stimulate physical and olfactory cues to passage (Williamson et al. 2025). MassWildlife requests that Essex provide explicit documentation of ladder maintenance including nozzle clogging and its severity (i.e. how many clogged, duration, attraction water velocity) and a corrective plan to repair, clean and or replace the clogged nozzles. The large mortality event that occurred on July 25, 2024 in structures adjacent to the eel ladder is very concerning and unacceptable (ISR, Figure 5-5). To avoid future events, Essex should provide aeration in these stagnant areas and or to remove individuals quickly. Further, Essex should provide clean quantification of mortality events (e.g., as total counts) beyond “a high number” as stated in the ISR. All fish kill event, must be reported to the MassWildlife Fish Kill Hotline at 1 (800) 632-8075.	Essex maintains a daily status log for both the south side eel ramp and north side eel lift. The south side eel ramp log notes the date/time of Essex operator check, attachment of cover sections, presence of ramp obstructions, operation of AWS pump, presence of flow, drain status, spray bar functionality, damage from spill flows, presence of spat ropes, and status of substrate material. On the north side, operators note the date/time of check, presence of obstructions on the lower ramp, and status of the AWS. In both locations, Essex operators record the daily number of eels present, presence of mortalities, evidence of predation, and fate of collected eels (i.e., transported up to the headpond). Essex is providing the 2024 fish lift data that was provided to the MRTC as Attachment B.

Study Number	Study	Commenting Party	Comment	Response
2	Upstream American Eel Passage Assessment	MASSWildlife	North Side American Eel Lift Functionality Essex concluded that there was high internal efficiency as individuals were sealed in the lift prior to its operation. While this achieves the objectives of this internal efficiency study, MassWildlife stresses the importance of considering external efficiency of the ramp leading to the lift. False attraction in this area created two primary routes of travel (ISR, Figure 5-8). Since internal efficiency was tested, we have no understanding of external efficiency and how many individuals are not successful in their approach and entrance to the lift. Essex and Normandeau sealed in 46-58 American Eel individuals into the lift at once to test its efficiency. With the lift only being operated for one lift per night and for a limited amount of time, MassWildlife requests that Essex quantify the number of individuals typically using the lift when not sealed in for study purposes. Based on the number of individuals sighted (ISR, Section 2.3), the lift should function to accommodate higher densities than tested in this study. Additional studies are needed to establish (1) whether the eel lift can accommodate densities similar to those during the passage season, (2) and what measures (e.g., aeration) can be taken to optimize survival of eel passage.	As discussed during the development of the PSP and RSP, observations of the size distribution of juvenile eels downstream of Lawrence Dam made previously by USFWS and NHFGD are such that the body sizes present are not suitable to mark using any active tag style which would facilitate a meaningful assessment of external efficiency. The use of VIE tags to assess nearfield effectiveness of upstream eel passage facilities has been tried at other Projects in the Merrimack drainage and did not produce any meaningful results (Amoskeag – FERC No. 1893 [Accession No. 20170223-5040] and Lower Penacook Falls – FERC No. 3342 [Accession No. 20220715-5157]).
2	Upstream American Eel Passage Assessment	MASSWildlife	Overall American Eel Passage Structures a) The ISR (Section 2.3, Table 5-1 & 5-2), provided length frequencies for American Eel located downstream to the “bucket.” These data show that captures are higher for smaller individuals than larger individuals. Therefore, size selection is likely occurring at these passage structures as smaller individuals are captured more frequently and are more successful at navigating passage structures. This size selection is important to evaluate as passage of larger older individuals is critical for supporting population and reproductive success. b) False attraction and potential escapement from structures is unacceptable in these structures and should continue to be the focus of evaluation of American Eel passage. MassWildlife requests that additional data collection be completed to improve understanding of these inefficiencies. Examples of data that could be collected during existing surveys include proportions of individuals using false attraction vs. true attraction flow, estimates of escapement from specific locations in the fish ladder, and mortality estimates related to stranding or entrapment. c) Determination of passage efficiency requires quantification of both those individuals that enter to the passage structure and those that are not successful. This is missing from the studies and thus inferences can only be made about successful individuals and not the efficiency of the structures, nor does it provide information about American Eels that are not successful in their upstream passage attempt.	a) Essex agrees that understanding the length frequencies of eels both downstream of and utilizing the existing passage structures is important. In general, the majority of juvenile eels observed from the upstream end of the existing passage structures to downstream on the nearfield ledges was dominated by small (i.e., less than six inch) eels with a lesser percentage of eels greater than six inches. Essex is not clear how the data provided in Tables 5-1 and 5-2 is being interpreted as evidence of size selective passage. b) Comment noted. Data collection for the Upstream American Eel Passage Assessment was completed in 2024 and reported in the ISR. c) Comment noted. This limitation (due to small eel sizes at this Project) was discussed during study plan development. Currently there is not an active tag technology suitable for eels of the dominant size found downstream of Lawrence to conduct a true overall passage effectiveness study.

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2	Upstream American Eel Passage Assessment	MADMF, NMFS	Based on the methods employed and information collected and reported in the ISR, the internal efficiency during normal operations cannot be determined. Therefore, the internal efficiency component for the eel lift at the north abutment needs to be evaluated again to account for the holding period between lifts. Normal operation involves eels entering the trap throughout the night with lifting the following morning. Therefore, Essex should place tagged eels in the trap at dusk followed by lifting and evaluation the next morning to assess trap efficiency.	Essex concurs with the request made here and will conduct an overnight effectiveness test for passage effectiveness at the north side eel lift during summer 2025. This test will consist of two events. During each event, a set of 100 juvenile eels will be color marked using VIE and put into the north side eel lift hopper during the afternoon of Day 1. During the subsequent morning lift on Day 2, the number of marked eels present in the upper collection tank will be enumerated. This will be repeated (Day 2 to Day3) for a second set of 100 VIE marked eels. Results will be reported in the USR.
2	Upstream American Eel Passage Assessment	MADMF, NMFS	Trap capacity is a function of both the size of the holding area and the associated frequency of checks; escapement and mortality indicate that volume of the holding area, frequency of checks, or both, are insufficient at the south abutment eel way, and are undetermined for the north abutment eel lift pending results of reevaluation of internal efficiency.	Comment noted. See response to comment above.
2	Upstream American Eel Passage Assessment	MADMF, NMFS	In addition to inadequate capacity, the south abutment eel way is demonstrably inefficient and unsafe at the entrance, in the ramp, and at the trap. Problems with false attraction, gaps in the ladder structure, and clogged fish ladder nozzles were all reported in the ISR. A new passage solution for the south abutment will likely be necessary to address these issues.	Comment noted.
2	Upstream American Eel Passage Assessment	MADMF	With lifting only occurring once a night, MA DMF requests that Essex quantify the number of eels typically using the lift when not sealed in for the purpose of the study. Based on the number of individuals sighted (ISR Section 2.3), the lift should function to accommodate higher densities than tested in this study. Additional studies are needed to establish 1) whether the eel lift can accommodate densities like those seen during the passage season, 2) and what measures (e.g., aeration) can be taken to optimize the survival of eels during passage.	Essex records an estimate of daily catch for each operational run of the north side eel lift. During the 2024 passage season, these count estimates ranged from 0 up to 5,000 (mean = 247; median = 75 eels). Essex has observed limited mortality events associated with eel lifts conducted during the 2024 and 2025 passage seasons.
2	Upstream American Eel Passage Assessment	MADMF	In addition to reevaluating internal efficiency MA DMF stresses the importance of considering external efficiency of the ramp leading to the lift. False attraction in this area created two primary routes of travel (ISR Figure 5-8). Given that only internal efficiency was tested, we have no understanding of external efficiency and how many individuals are not successful in their approach to the lift.	As previously noted, Essex will further evaluate the internal efficiency of the north side eel lift during the summer of 2025 and will provide findings in the USR. As discussed during the development of the PSP and RSP, observations of the size distribution of juvenile eels downstream of Lawrence Dam made previously by USFWS and NHFGD are such that the body sizes present are not suitable to mark using any active tag style which would facilitate a meaningful assessment of external efficiency.
2	Upstream American Eel Passage Assessment	MADMF	MA DMF requests that Essex provide detailed documentation of ladder maintenance including nozzle clogging and its severity (i.e. how many nozzles were clogging, duration, attraction water velocity). As reported in the ISR, spray nozzles were clogged with debris and the PVC spray bar on ramp 4 was clogged with debris which resulted in inadequate water moving down the ramp surface (ISR Figure 5-2). Both sources of water are important to stimulate physical and olfactory cues for passage (Williamson et al., 2025).	Essex maintains a daily status log for both the south side eel ramp and north side eel lift. The south side eel ramp log notes the date/time of Essex operator check, attachment of cover sections, presence of ramp obstructions, operation of AWS pump, presence of flow, drain status, spray bar functionality, damage from spill flows, presence of spat ropes, and status of substrate material. On the north side, operators note the date/time of check, presence of obstructions on the lower ramp, and status of the AWS. In both locations, Essex operators record the daily number of eels present, presence of mortalities, evidence of predation, and fate of collected eels (i.e.,

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				transported up to the headpond). Essex is providing the 2024 fish lift data that was provided to the MRTC as Attachment B.
2	Upstream American Eel Passage Assessment	MADMF	The ISR indicated a large mortality event that occurred on July 25th, 2024, in structures adjacent to the eel ladder (ISR Figure 5-5). This is very concerning and unacceptable. MA DMF requests that Essex provide aeration in these stagnant areas to prevent this or if possible, monitor these areas and remove individuals prior to mortality events occurring. MA DMF requests that potential mortality events should be quantified (i.e., as total counts of individuals) beyond "a high number" as stated in the ISR and reported to the MassWildlife fish kill hotline at 1 (800) 632-8075.	Comment noted.
2	Upstream American Eel Passage Assessment	MADMF	The ISR (Section 2.3, Table 5-1 & 5-2), provided length frequencies for American Eel located downstream to the "bucket." These data show that captures are higher for smaller individuals than larger individuals. Therefore, size selection is likely occurring at these passage structures as smaller individuals are captured more frequently and are more successful at navigating passage structures. This size selection is important to evaluate as passage of larger older individuals is critical for supporting population and reproductive success.	Essex agrees that understanding the length frequencies of eels both downstream of and utilizing the existing passage structures is important. In general, the majority of juvenile eels observed from the upstream end of the existing passage structures to downstream on the nearfield ledges was dominated by small (i.e., less than six inch) eels with a lesser percentage of eels greater than six inches. Essex is not clear how the data provided in Tables 5-1 and 5-2 is being interpreted as evidence of size selective passage.
2	Upstream American Eel Passage Assessment	NHFGD	The internal efficiency of the north side eel lift was tested by placing tagged eels in the hopper and lifting the eels to the collection tank. While it is good to know that large numbers of eels are not escaping the hopper during the lifting process, the study does not shed light on eel escapement from the hopper overnight. Under normal operations, the north side eel lift is run once each morning during the migration season. Eels are trapped in the hopper, which acts as a collection tank while it is in the lowered position. It is important to understand the internal efficiency of the hopper while it is fishing overnight. Significant levels of escapement may require modifications to the hopper or a more frequent, possibly automated, lift cycle. The internal efficiency of the hopper in its lowered position should be studied in 2025 by placing tagged eels in the hopper at dusk and assessing escapement in the morning when the hopper would typically be lifted.	Essex concurs with the request made here and will conduct an overnight effectiveness test for eel passage effectiveness at the north side eel lift during summer 2024. This test will consist of two events. During each event, a set of 100 juvenile eels will be color marked using VIE and put into the north side eel lift hopper during the afternoon of Day 1. During the subsequent morning lift on Day 2, the number of marked eels present in the upper collection tank will be enumerated. This will be repeated (Day 2 to Day3) for a second set of 100 VIE marked eels. Results will be reported in the USR.
2	Upstream American Eel Passage Assessment	NHFGD	Nearfield attraction of the south side eel trap and the north side eel lift was done qualitatively. While the qualitative observations show that eels are attracted to both passage structures in large numbers, the study methodology does not fully achieve one of the stated objectives in the study: - Determine the proportion of marked eels entering the south side eel trap or north side eel lift which then successfully ascend upstream (i.e., internal efficiency). The results of the internal efficiency study for the south side eel trap identify a number of issues with the passage efficiency of the structure. Additional study is not warranted at that location. The north side eel lift, however, appears to be a viable passage solution, but some questions remain about its overall efficiency. Given the access to large numbers of eels demonstrated in both upstream eel studies and the relative ease of marking	As discussed during the development of the PSP and RSP, observations of the size distribution of juvenile eels downstream of Lawrence Dam made previously by USFWS and NHFGD are such that the body sizes present are not suitable to mark using any active tag style which would facilitate a meaningful assessment of external efficiency. The use of VIE tags to assess nearfield effectiveness of upstream eel passage facilities has been tried at other Projects in the Merrimack drainage and did not produce any meaningful results (Amoskeag – FERC No. 1893 [Accession No. 20170223-5040] and Lower Penacook Falls – FERC No. 3342 [Accession No. 20220715-5157]).

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			smaller eels with elastomer tags, evaluation of nearfield attraction using elastomer tagged eels released near the entrance of the north side eel lift seems feasible. This should be done in conjunction with the internal efficiency assessment of the hopper in its lowered position mentioned above.	
2	Upstream American Eel Passage Assessment	NHFGD	This study provides an assessment of the internal passage efficiency of the south side eel trap and the north side eel lift. The study does not provide information on the overall efficiency of upstream eel passage at the project. It is difficult to fully evaluate upstream eel passage efficiency without some estimate of the total number of eels that encounter the project compared to the number of eels captured in the south side eel trap and the north side eel lift. Providing that context would require a large-scale mark/recapture study. That said, the large number of eels observed downstream of the dam in nighttime observations, eel pots, and electrofishing surveys, suggests that the overall upstream passage efficiency for American eels at the project is very low.	Comment noted.
3	American Eel Upstream Passage Siting Study	MassWildlife	This study is in the second year and appears to be successful in visually spotting American Eels approaching the project. Based on the ISR results, MassWildlife requests that Essex and Normandeau consider how survey conditions influence these results. Specifically, Welsh et al. 2016 found that high observations of American Eel's occurred almost exclusively following rain events consistent with increases in river flow are known movement cues. Half of the ten sightings in the ISR (Table 5-1) surveys were conducted during dry conditions and had very low observations of individuals (ISR Table 5-1). a) It is likely that the study is underestimating the number of individuals in the project area because sampling occurred during conditions that do not stimulate American Eel movements. Mensinger et al. 2020 found that individuals can often be delayed at dams for greater than 24-hour periods, indicating that American Eel could be present during dry periods when little to no individuals were observed. Consequently, additional studies are needed that better disentangle the effect of survey conditions on sighting efficiency. b) ISR Table 5-1 has varying survey length times for the different locations, does this contribute to the "approximately ninety minutes" as described in the ISR methods? MassWildlife requests that siting surveys are standardized to the exact duration of the survey (eels sighted per minute) to compare surveys of different sampling efforts.	Comment noted. The March 2023 USGS Protocol for Observational Surveys for Upstream Migrant Eels presents criteria for the selection of sampling nights to offer conditions most likely to induce eels to climb, including warmer nights, cloudy nights, light rain, minimal wind. Combinations of these various criteria were met across the length of the 2024 survey window. Survey results presented in the ISR provide insight into the presence and relative abundance of juvenile eels among survey locations. The American Eel Upstream Passage Siting Study is not currently being continued for a second year. a) It should be noted here that the goal of the American Eel Upstream Passage Siting Study was not to develop a population level estimate of juvenile eels in the Project area or to tease out environmental factors which might influence higher or lower relative rates of upstream movement. The intent here was simply to provide a series of consistent survey efforts from which relative abundance estimates for various survey points could be compared to provide insight into where supplemental upstream eel passage facilities beyond those currently in operation may benefit passage of that species at the Project. b) The durations presented in ISR Table 5-1 provide the more specific durations when survey staff were searching a specific area. In general, the total survey time from start to end of time on site, was around 90 minutes.
3	American Eel Upstream Passage Siting Study	MADMF	Based on the ISR results, MA DMF requests that Essex and Normandeau consider how survey conditions influence the results of this study. High observations of American Eels occurred almost exclusively following rain events as increases in the river flow are known movement cues (Welsh et al., 2016). Half of the ten sighting surveys were conducted during dry low flow conditions and had very low observations of individuals (ISR Table 5-	Comment noted. The March 2023 USGS Protocol for Observational Surveys for Upstream Migrant Eels presents criteria for the selection of sampling nights to offer conditions most likely to induce eels to climb, including warmer nights, cloudy nights, light rain, minimal wind. Combinations of these various criteria were met across the length of the survey window. Survey results presented in the ISR provide

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			1). Mesinger et al. (2020) found that individuals can often be delayed at dams for greater than 24-hour periods, indicating that American Eel could be present during dry periods when little to no individuals were observed. Subsequently, additional studies are needed that better disentangle the effect of survey conditions on sitting efficiency.	insight into the presence and relative abundance of juvenile eels among survey locations.
3	American Eel Upstream Passage Siting Study	MADMF	ISR Table 5-1 has varying survey length times for different locations, does this contribute to the "approximately ninety minutes" as described in the ISR methods? MA DMF requests that siting surveys are standardized to the exact duration of the survey, as large congregations of American Eels observed could easily be counted during a rapid time period (minutes).	The durations presented in ISR Table 5-1 provide the more specific durations when survey staff were searching a specific area. In general, the total survey time from start to end of time on site, was around 90 minutes.
3	American Eel Upstream Passage Siting Study	MADMF, NMFS	The observed size distribution of eels in this study differs from the upstream passage assessment study, with a higher proportion of larger size classes observed. This suggests that eel are utilizing canal habitat within the Project boundary for purposes other than migration, particularly in the North Canal.	Comment noted.
3	American Eel Upstream Passage Siting Study	MADMF, NMFS	We note the observed high concentrations of eel around the North Canal Gatehouse. It is unclear if those eels originated from downstream of the canal, or if they represent fallbacks from the north side lift. The provided data suggests the latter as the high gatehouse trap counts followed high north abutment eel lifts counts.	Comment noted.
3	American Eel Upstream Passage Siting Study	NHFGD	The study documented a large number of juvenile eels observed in the fish lift entrance canal on July 16. Fish lift operations ended on July 12. Additional information on the conditions in the fish lift entrance canal at the time of observation would be useful, including status of attraction flow or other leakage flows, position of the entrance gate, location of eels within the entrance canal, water depth in the tailrace, and the status of turbine output/spill at the time of observation. Photos similar to those provided in Figures 5-1 to 5-9 of the Upstream American Eel Passage Assessment report would be helpful if available.	Observations of juvenile eels at the fish lift during the July 16, 2024 survey were right around the river side entrance gate. At the time of the survey (~23:00 on July 16), Merrimack River flow (~1,300 cfs) was passing primarily via spill as both Units 1 and 2 were offline. The tailrace elevation at the time of survey was 13.74 ft. The fish lift was not online on this survey date. Eels were primarily on the wetted rock immediately adjacent to the entrance.
4	Desktop Entrainment, Impingement, and Turbine Passage Survival Study	MADMF, NMFS	We recommend that that Essex perform this study in accordance with the best practices included in Estimating Downstream Survival of Diadromous Fishes at Hydroelectric Facilities (Lake et al. 2024). This Technical Memo facilitates consistency of evaluation methods and a more representative quantification of downstream passage project effects leading to better outcomes for NMFS trust resources.	Comment noted.
4	Desktop Entrainment, Impingement, and Turbine Passage Survival Study	MADMF	We note that there are data available for other Projects upstream within the Merrimack watershed that provide additional context and inform the study process at the Lawrence Project. In particular, the Lowell Project (P-2790) conducted similar studies during that licensing proceeding. Additionally, there are recent licensing studies available for the Contoocook (P-3240, P-3342, & P-6689) and Mine Falls (P-3442) Projects which share the same type of turbine runner—horizontal Kaplan—with the Lawrence Project.	Comment noted.

Study Number	Study	Commenting Party	Comment	Response
5	Sturgeon Distribution and Project Interaction Study	FERC	At the ISR meeting, Essex stated that: (1) it had installed acoustic telemetry receivers near the project in late March; (2) it would tag 45 sturgeon (15 adult shortnose sturgeon, 15 juvenile shortnose sturgeon, and 15 subadult Atlantic sturgeon) to determine if tagged sturgeon approach the project dam; and (3) it had tagged approximately 22 out of 45 sturgeon as of the time of the meeting. As stated in the SPD, sturgeon are most likely to interact with the project during the spring spawning period (i.e., late April through early May). So that staff understands how many tagged sturgeon were present in the river during the 2025 spawning period, please provide the dates tagging occurred and the number of adult shortnose sturgeon, juvenile shortnose sturgeon, and subadult Atlantic sturgeon tagged on each date.	Preliminary tagging information was provided by USGS to Essex on June 4, 2025 and is provided as Attachment C to this comment response. The final tagging list and summary of any subsequent detections will be included as a part of the USR.
5	Sturgeon Distribution and Project Interaction Study	FERC	Commission staff revised the objectives of the Sturgeon Distribution and Project Interaction Study (sturgeon distribution study) to include the following: "(1) determine if Atlantic and shortnose sturgeon are present between the project dam and the I-495 Lawrence Bridge; (2) if present, quantify the duration and seasonality of sturgeon presence in the study reach; (3) identify any project-related effects; and (4) evaluate the need for upstream sturgeon passage at the project." The ISR did not include the SPD required goal for the mussel study or the SPD-required objectives for the sturgeon distribution study. Explicitly stating these goals and objectives is important for providing an overall context for what the studies are attempting to accomplish and the specific information to be gathered to achieve each study's goals. It also assists Commission staff in evaluating a study when an applicant and stakeholders disagree about how the study was conducted or the quality of the study results. Therefore, please include the SPD required goals and objectives in the Updated Study Report (USR).	Understood, the report will identify the goals and objectives verbatim from the SPD, as appropriate, in the study report. Objective 1 to "determine if Atlantic and shortnose sturgeon are present between the project dam and the I-495 Lawrence Bridge" was re-stated differently in the section 1.2 of the study plan as "determine if Atlantic (*Acipenser oxyrinchus oxyrinchus*) or shortnose sturgeon (*A. brevirostrum*) are interacting with the Lawrence Project" and again beginning with line 1 of Section 1.6.1.1. and reads as "The primary objective of these repeated mobile surveys is to determine the presence or absence of sturgeon along a 1.5-mile river reach between the Project and the Lawrence I-495 Bridge." Objective 2 that states "if present, quantify the duration and seasonality of sturgeon presence in the study reach" will not be readily addressed by the mobile SSS survey besides a course-level of temporal resolution of seasonality if sturgeon are present and detected. Fixed sonar monitoring could potentially characterize timing of detection for seasonality, but the history of tagged sturgeon detected by a receiver network would provide direct measurement of duration within this river reach and inform seasonality. Objective 3 to "identify any project-related effects" will be addressed by data collected by the mobile and fixed sonar surveys by descriptive statistics of operational flows when sturgeon were detected versus not detected, but any statistical comparison will be subject to sufficient sample size. Detections, location of detections, and duration of detections of tagged sturgeon may be used to characterize any patterns as a function of generation and spill flow. An experimental design to manipulate operations for the purpose of studying operational effects on sturgeon abundance or behavior was not requested or prescribed in the SPD. Based on the results from the data collected by multiple

Study Number	Study	Commenting Party	Comment	Response
				methodologies will lead to a qualitative assessment whether upstream sturgeon passage is needed.
5	Sturgeon Distribution and Project Interaction Study	MassWildlife	The ISR failed to identify the changes to the project goals as required by FERC in their Study Plan Determination (May 10, 2025). These goals should be included and addressed in the Updated Study Report.	Understood. See response to FERC's comment.
5	Sturgeon Distribution and Project Interaction Study	MassWildlife	As of June 3, 2025, both Atlantic (n=14) and Shortnose Sturgeon (n=37) have been tagged to evaluate potential Sturgeon interactions with the project. MassWildlife recognizes the effort to tag these individuals. We note, however, that a lack of observed interaction may not exclude such activities by untagged individuals since Sturgeon have been observed at the base of the dam in recent decades (Hartel et al. 2002).	Hartel et al. 2002 (page 69-70) describes a single 8-foot long Atlantic Sturgeon observed visually on two occasions during late June in the mid- to late 1970s. Without a specific collection date or description of the capture and identification, this sighting is consistent with an unverified report from 55 years ago or more. The fundamental assumption of the telemetry of sturgeon and other fishes in the FERC re-licensing studies for Lawrence Hydroelectric Project is that the group of tagged individuals are representative of the population.
5	Sturgeon Distribution and Project Interaction Study	MassWildlife	The study needs to consider all abiotic conditions relevant to Sturgeon habitat selection when documenting their distribution in relation to habitat type. For example, Kynard et al. 2000 used substrate type, water depth, bottom water velocity, and channel geomorphology to describe habitat use of Shortnose Sturgeon in the Merrimack and Connecticut Rivers. The existing study only documents depth and substrate. Additional studies are needed that collect all relevant abiotic data necessary to inform discussion of Sturgeon distribution and project interactions.	Surveying habitat factors (e.g., substrate type, water velocity, depth, other abiotic factors) for relating sturgeon distribution to habitat selection was neither identified as an objective or described in methodologies by the SPD. As such, the Sturgeon Distribution and Project Interaction Study will not be modified to address this comment.
5	Sturgeon Distribution and Project Interaction Study	MassWildlife	MassWildlife also requests that this study accounts for detecting the same individual multiple times within a survey. The existing study does not document strategies to determine multiple detections of the same individual vs. documenting a new individual. This data could be an important metric for repeated habitat use and help in estimating the number of individuals interacting with the project. Further, such data will provide some understating if repeated interactions differ by sex, time of year, or life-stage. Further, MassWildlife requests that surface and bottom water velocity be taken into account when estimating detection probability since both turbulence and water velocity will likely influence the results.	Turbulence and water velocity measurements were not requested in the SPD for this study, which was largely based on agency comments to date. The telemetry of tagged sturgeon used uniquely coded transmitter tags to identify specific individuals. SSS will not be able to identify multiple detections from the same fish or not and will not be able to identify sex of individuals detected by sonar. Sonar detections of sturgeon targets separated by space and time or different size increase the likelihood of unique individual detections. The objectives for this study in FERC's SPD requests presence/absence data and no estimates of absolute abundance.
5	Sturgeon Distribution and Project Interaction Study	MassWildlife	We request that Essex maintain a subset of the Juvenile Salmon Acoustic Telemetry System (JSATS) receivers deployed for the Diadromous Fish Behavior, Movement, and Project Interaction Study until September 15th to detect sturgeon tagged with JSATS. There are approximately 36 individual shortnose sturgeon tagged with JSATS from Essex and MassWildlife, with 23 tagged only with JSATS. Maintaining 2 receivers in the tailrace as well at the established gates downstream of the project provides a complementary array to help assess sturgeon approach and interaction with the project by almost doubling the number of detectable individuals and increasing array coverage to the extent of the JSATS tag life, maximizing information generated through this tagging effort. The additional timing of receiver deployment is also better aligned with sturgeon habitat use in large rivers into the fall (Hartel et al. 2002) and so is more likely to capture potential	Essex concurs with the comment provided here and understands the potential value of additional detections which may result from the continued deployment of a set of the JSAT receivers. At the conclusion of the monitoring specific to the Diadromous Fish Behavior, Movement, and Project Interaction Study (expected mid-July), Essex will need to remove and download all JSAT receivers. Following cleaning and installation of a new battery pack, a subset of receivers (i.e., at the established gates downstream of the Project) will be reinstalled and allowed to run to September 15, 2025. Results from this effort will be reported in the USR.

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			sturgeon interactions with the project throughout their residency in the Merrimack River.	
5	Sturgeon Distribution and Project Interaction Study	NMFS	In the ISR, Essex states that, "Essex collaborated with the Merrimack River Technical Committee (MRTC) on a variance from the Commission's SPD to develop a more effective approach for fixed-location side scan sonar (SSS) survey component of the study." The MRTC agencies participated in a call with Essex on November 26, 2024; however, the parties did not reach consensus on a new approach regarding the study variance.	Correct.
5	Sturgeon Distribution and Project Interaction Study	NMFS	Essex cites the need to develop a 'fabricated metal mounting or rail system affixed to the concrete structure of the dam.' In NMFS's study request, we recommended deploying the SSS array in the tailrace. NMFS recommends deployment near the downstream end of the tailrace channel with the array mounted to either the wall of the capped former fishway or the bedrock ledge adjacent to the Route 28 Bridge. This would allow for a SSS gate to cover movement in and out of the tailrace while also securing the array downstream from the turbulence in the immediate vicinity of the powerhouse and turbine draft tubes.	Essex will evaluate the feasibility of implementing this suggested deployment. The Project Team will explore options to deploy and test imaging sonars near the tip of the old fishway and aiming coverage perpendicular to flow. However, the opposite bank is approximately 30 meters from this location and a high-resolution imaging sonar may only provide useful data across 50% to 75% of this distance. The other suggestion made by NMFS to secure and operate the sonars from the bedrock ledge adjacent to the Route 28 bridge (Broadway) will not be considered because it is impractical given difficult logistics (mounting, power, etc.), safety hazards, and high risk of vandalism.
5	Sturgeon Distribution and Project Interaction Study	NMFS	NMFS supports Essex's approach to testing the SSS array in Phase I prior to a 2026 Phase II full-season deployment. If during phase I Essex finds that deployment of a fixed array SSS is not effective, we strongly recommend they propose an alternative study in a variance request to collect necessary information on sturgeon interactions with the Project. This could include but is not limited to: a second year for the acoustic telemetry component of this study and/or mobile sidescan sonar surveys, open-stream passive integrated transponder (PIT) tag array, environmental deoxyribonucleic acid (eDNA) water sampling, or a combination of methods.	We are pleased that NMFS supports the two-phase approach to sonar monitoring in the tailrace. If the feasibility study in Year 1 determines fixed-location sonar monitoring within the tailrace is ineffective or problematic, the Project Team will consider extending deployment of the tailrace receivers to detect previously tagged sturgeon within the tailrace and approach, as discussed elsewhere in this response to comments.
5	Sturgeon Distribution and Project Interaction Study	NMFS	Essex's collaboration with USGS researchers to complete tagging for the acoustic telemetry portion of the Sturgeon Distribution and Project Interaction Study has been well-executed to date. NMFS provided coordination and technical assistance to help Essex and USGS prepare ahead of the study season and establish a formal technical assistance agreement and scope of work. Due to the collaborative nature of this study, there are aspects of the scope of work and associated field methodologies that may be absent from the study plan, and therefore not currently captured in the administrative record. We encourage Essex to file on the Project docket any documents germane to this study (e.g., scope of work) developed in collaboration with USGS.	Essex has been pleased with the communication and coordination with both NMFS and the USGS as it relates to the acoustic telemetry portion of the Sturgeon Distribution and Project Interaction Study. Information related to the execution of this study component has been included with these responses to comments as Attachment D.
5	Sturgeon Distribution and Project Interaction Study	NMFS	We recommend that Essex maintain a subset of the JSATS receivers deployed for the Diadromous Fish Behavior, Movement, and Project Interaction Study until September 15, 2025 to detect sturgeon tagged with JSATS. There are approximately 36 individual shortnose sturgeon tagged with JSATS, with 23 of those only tagged with JSATS. Maintaining two receivers in the tailrace as well as the established gates downstream of the Project is an opportunity to collect more data informing the interaction study.	Essex concurs with the comment provided here and understands the potential value of additional detections which may result from the continued deployment of a set of the JSAT receivers. At the conclusion of the monitoring specific to the Diadromous Fish Behavior, Movement, and Project Interaction Study (expected mid-July), Essex will need to remove and download all JSAT receivers. Following cleaning and installation of a new battery pack, a subset of

Study Number	Study	Commenting Party	Comment	Response
				receivers (i.e., at the established gates downstream of the Project) will be reinstalled and allowed to run to September 15, 2025. Results from this effort will be reported in the USR.
6	Diadromous Fish Behavior, Movement, and Project Interaction Study	FERC	The study required a two-phased approach: Phase I is a feasibility evaluation of the Juvenile Salmon Acoustic Telemetry System (JSATS), and Phase 2 is a fish behavior assessment that relies on results of Phase 1. Section 4.2 of the study report presents the results of the Phase 1 feasibility evaluation and includes a footnote stating "[t]he RSP included a comparison between JSATS receivers manufactured by Lotek and ATS." The study report then states that Phase 2 will incorporate ATS receivers due to the higher detection rates observed. However, while the study report provides results that support the use of the ATS receivers for Phase 2 of the study, the comparison of the receivers provided in the RSP cites to a Profish Technology report (2022) that is not available. To help staff evaluate the technical basis and assumptions of the information collected during Phase 1 of the study, please provide a copy of the cited report (Profish Technology, 2022).	Comment noted and the requested report has been included with this filing as Attachment E.
6	Diadromous Fish Behavior, Movement, and Project Interaction Study	FERC	Section 4.2 of the study report presents the results of Phase 1 positional test data analyzed using a YAPS (Yet Another Positioning Solver)1 package that estimates 2-dimensional positions of tags based on time-of-arrival data collected by synchronized hydrophone arrays. The study report, however, does not explain how the telemetry data will be analyzed to inform the Phase 2 study goal, which is to assess project-related effects on the behavior of diadromous fish species (e.g., holding, transiting, milling nearthe dam, or moving in response to predators). At the ISR meeting, Essex stated that it would develop methods to evaluate fish behavior after the collection of telemetry data.However, the methods used to evaluate fish behavior could affect, or be affected by, the methods used to collect the telemetry data. To help staff evaluate project-related effects on the behavior of diadromous fish species (e.g., what percentage of tagged alosine were 'holding' in an area versus moving to a different area in response to potential predation from striped bass), please describe how fish behavior will be analyzed in Phase 2.	Essex is in the process of recovering JSAT receivers deployed during April 2025. The resulting data will be processed through YAPS to provide a data set of 2-dimensional positions for tags within the tailrace array (where possible, the third dimensional information pulled from the subset of fish carrying pressure transducers will be added). This positional information will provide Essex with a better understanding of what data are available (by species and individual) to then address questions on movement and behavior. The methods associated with this analysis will be included in the USR.
6	Diadromous Fish Behavior, Movement, and Project Interaction Study	MassWildlife	Essex, Normandeau, and the Merrimack River Technical Committee (MRTC) collaborated to develop this hydroacoustic study using multiple design considerations, rigorous detection testing, and a large field-based tagging effort. Reports from the ISR indicate high confidence from all parties about this array and achieving stated study objectives. MassWildlife is concerned with the studies ability to detect individuals during the high river flows observed during the 2025 passage season. If detection probability is significantly diminished, MassWildlife requests that Essex incorporate water velocity into these detection estimates as a covariate of importance. This will allow a better understanding of array performance during varying seasonal passage conditions	Comment noted. Flow data for the 2025 season will need to be considered during all aspects of the Diadromous Fish Behavior, Movement, and Project Interaction Study as it has the potential to influence fish movement as well as effectiveness of the acoustic receiver equipment.
6	Diadromous Fish Behavior, Movement, and Project Interaction Study	MassWildlife	MassWildlife requests that Essex explicitly document analytical strategies that it proposed to use to identify Striped Bass behavioral avoidance. Based on the methodology (ISR, Section), Essex and Normandeau indicated that	The final methodologies and associated assumptions used during data analysis for the Diadromous Fish Behavior, Movement, and Project Interaction Study will be included in the USR.

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			they were tagging River Herring prior to and after Striped Bass were observed at the project. While this could provide a point of comparison for the study, caution should be taken when comparing these two time periods as abiotic conditions and density of diadromous fish at the project differed between the two time periods.	
6	Diadromous Fish Behavior, Movement, and Project Interaction Study	MADMF, NMFS	In the ISR, Essex noted the lack of two-dimensional coverage in the bypass reach, and suggests that one-dimensional coverage may be possible with careful placement of receivers in the bypass. Although it is not ideal, MA DMF considers the lack of receiver coverage in the bypass acceptable if the detection efficiency at nearby receivers is high. High detection efficiencies, particularly at the gates in the array, allow us to deduce the location of fish in the bypass reach with confidence. However, if detections efficiencies are low, then we have little confidence in such deductions.	Comment noted. Results from the bypass reach coverage will be provided as part of the USR.
6	Diadromous Fish Behavior, Movement, and Project Interaction Study	MADMF	Essex, Normandeau, and the MRTC collaborated to develop this hydroacoustic study using multiple design considerations, rigorous detection testing, and a large field-based tagging effort. Reports from the ISR indicate high confidence from all parties regarding this array and achieving the stated study objectives. MA DMF has concern with the studies ability to detect individuals with the high flows observed during the 2025 passage season. If detection probability is significantly diminished, MA DMF requests that Essex incorporate water velocity into these detection estimates as a covariate of importance. This will allow for better understanding of the array performance during varying flow scenarios and passage conditions.	Comment noted. Flow data for the 2025 season will need to be considered during all aspects of the Diadromous Fish Behavior, Movement, and Project Interaction Study as it has the potential to influence fish movement as well as effectiveness of the acoustic receiver equipment.
6	Diadromous Fish Behavior, Movement, and Project Interaction Study	MADMF	MA DMF requests that Essex explicitly document analytical strategies that will be used to identify Striped Bass behavioral avoidance. During the ISR meeting Essex and Normandeau indicated that they were tagging River Herring prior to Striped Bass being observed at the project and after the Striped Bass were observed. Caution should be taken when comparing these two time periods as environmental conditions and density of diadromous fish at the project site differed between the two periods.	The final methodologies and associated assumptions used during data analysis for the Diadromous Fish Behavior, Movement, and Project Interaction Study will be included in the USR.
6	Diadromous Fish Behavior, Movement, and Project Interaction Study	NHFDG	Understanding the relative success of fish approaching the tailrace from different directions will help inform upstream passage recommendations. The proposed layout of 2D and 1D receivers should allow for the interpretation of approach direction. It was understood that actual receiver locations may vary based on river conditions during deployment. The study results should include a map of final receiver locations in addition to the map of proposed receiver locations provided in the ISP. The map should document any movement of receivers from initial deployment locations following the multiple high flow events during the passage season. The exact locations of the furthest downstream 2d receivers in the tailrace are of particular importance, as the pilot study showed a decrease in location accuracy as test tags moved farther from the 2d array.	Comment noted. All receivers were geo-referenced at the time of installation and those final positions (relative to the RSP proposed) positions will be included in the final report filed as part of the USR. Commentary will be included on any receivers where are determined to have shifted or moved due to the spring flow pattern observed during the 2025 study.

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7	Project Operations and Fish Stranding Study	MassWildlife	Camera traps were installed to capture potential stranding occurring from project operations. Based on the images provided in the ISR, MassWildlife requests that cameras should be angled at a steeper downward angle to capture stranding occurring by the corners of dam. Current camera configuration (ISR, Photographs 1-54) is directed to the center of the tailrace and is potentially missing locations where previous stranding was observed by Matt Carpenter on 5/16/2023 and 6/11/2019 (New Hampshire Fish and Game). These stranding locations included river left among the rip rap under the bridge and on ledges on the river right below the spillway.	Essex will adjust the trail cameras according to the recommendations provided by the fishery agencies. Essex will consider the feedback provided by the agencies during the ISR meeting along with the information provided in their comment letters.
7	Project Operations and Fish Stranding Study	MassWildlife	MassWildlife requests that Essex provide information to document their response protocol to stranding events. Specifically, the stranding protocol should require documentation of the date and time, number of individuals stranded, river flows, and project operations during any stranding events. All fish kills are required to be reported to the MassWildlife Fish Kill Hotline at 1 (800) 632-8075 to properly document these events.	Essex is conducting the study in accordance with the methods outlined in the approved study plan. As appropriate, Essex will report any fish kills to MassWildlife. The technical study report will include detailed analysis of the study findings.
7	Project Operations and Fish Stranding Study	MassWildlife	Stranding and mortality were observed by MassWildlife in the upstream impoundment on October 21, 2024, and documented in a letter to the Commission dated February 15, 2025. This event included the discovery of twelve (12) dead fish and ninety (90) freshwater mussels within just a few short sections of shoreline. When extrapolated across the full length and width of the exposed shoreline, these findings suggest impacts to hundreds of fish and mussels. Essex should implement additional monitoring in the upstream impoundment if project operations are modified. The Commission reviewed this letter and responded by requiring Essex to directly consult with and obtain agreement from MassWildlife prior to any future drawdowns. As of the submission of this document, neither MassWildlife nor the MRTC has been consulted regarding any upcoming drawdowns, and both remain under the assumption that no crest gate repair-related drawdowns will occur in 2025. MassWildlife requires advance notice of such events to adequately prepare for fish stranding documentation and response.	Essex is performing the study in conformance with the Commission's SPD, which requires Essex to monitor fish stranding at two locations below the dam. As described in Essex's March 21, 2025 response letter [Accession Number: 20250321-5205] and in accordance with the Commission's May 16, 2025 directives [Accession Number: 20250516-3056], Essex will consult with the MRTC to develop a plan prior to any planned drawdowns.
7	Project Operations and Fish Stranding Study	MassWildlife	MassWildlife is still waiting on detailed streamflow (in, through and out of the Project Area) and water level data requested on February 22, 2024. This data was also required by FERC as part of their May 10, 2024 comments in the Study Plan Determination (see Project Operations and Fish Stranding Study4). These data are critical to understanding ongoing effects and the development of mitigating measures.	As discussed in Section 2.7.3 of the ISR, Essex is in the process of reviewing and analyzing the Phase 1 Project data for the full five-year period of record. Essex intends to file the results on or before the USR.
7	Project Operations and Fish Stranding Study	MADMF, NMFS	There is no context (i.e., amount of spill, river flow, operations, etc.) for the photos provided in the ISR limiting their usefulness and our ability to draw conclusions.	The photos provided as Appendix F of the ISR are representative of potential fish stranding sites. Essex filed operational data from April 2024 through April 2025 with the ISR. A comprehensive analysis of the project operations on water elevations in potential stranding areas will be provided in the study report.
7	Project Operations and Fish Stranding Study	MADMF, NMFS	Stranding is a function of short-term changes in operation not captured by still images. In order to provide actionable information, we request that video or rapid time-series still images that illustrate the changing conditions in order to understand the risks. In particular, Essex should focus on the	The study is being conducted according to the Commission's SPD. An analysis of the project operations on water elevations in potential stranding areas will be provided in the study report.

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			closing of the crest gate on the north and south sections of the spillway. In addition, whether the middle crest gate raises the water level enough to provide access to the north and south side habitats should be evaluated/determined. If that is the case, then the closing of the middle section will need evaluation as well.	
7	Project Operations and Fish Stranding Study	MADMF	Based on photos provided in the ISR, MA DMF suggests that cameras be angled at a slightly more downward angle to capture strandings occurring in the corner of the dam. Current camera configuration (ISR photograph 1-54) is directed to the center of the tailrace and is potentially missing locations where previous strandings were previously observed. Imagery collection should focus on periods leading up to, during and following changes in operations (e.g., crest gate operation, tripping of the turbine, and shifts between turbine and crest gate operation).	Essex will adjust the trail cameras according to the recommendations provided by the fishery agencies. Essex will consider the feedback provided by the agencies during the ISR meeting along with the information provided in their comment letters.
7	Project Operations and Fish Stranding Study	NMFS	We recommend changing the aspect ratio, or orientation of imagery collected to capture both the crest gates/spill condition, and receiving waters/ledge. Imagery collection should focus on periods leading up to, during, and following changes in operations (e.g., crest gate operation, tripping of the turbine, and shifts between turbine and crest gate operation).	The study is being conducted according to the Commission's SPD. An analysis of the project operations on water elevations in potential stranding areas will be provided in the study report.
7	Project Operations and Fish Stranding Study	NHFGD	Water level fluctuations of between one and two feet have been observed regularly below the dam. Most recently, sudden drops in water level have been observed on the following dates: 5/1/25, 5/21/25, 5/30/25, and 6/18/25. These fluctuations sometimes occur over a period of less than an hour. The project operations data provided by Essex as part of this study should be at a level of detail necessary for interpreting these observed water level fluctuations	The study is being conducted in accordance with the Commission's SPD which requires Essex to provide operation data recorded in hourly intervals. The technical study report will include Phase 1 and Phase 2 data, which combined will provide enough detail to inform on observed water level fluctuations.
7	Project Operations and Fish Stranding Study	NHFGD	Some water level fluctuations appear to be related to operational maintenance (turbine inspection, rack cleaning, etc.). In other cases, the reasons for fluctuations are not clear, but they may have to do with the way changes in turbine output are calibrated with water level sensors in the impoundment. These fluctuations in flow below the dam have the potential to cause stranding under certain operational conditions as well as issues with fishway attraction flow. It is difficult for fishway operators to stay within recommended fishway entrance flow conditions when the tailwater elevation is fluctuating hourly. Essex should identify the various potential causes of water level fluctuations at the dam along with potential strategies for reducing their magnitude and frequency or minimizing their impact.	This study is being conducted as approved by FERC in its SPD. Analysis of project operations and results of the CFD Study as they relate to flow conditions, hydraulic processes, and potential fish stranding sites below the dam and powerhouse will be analyzed as a part of Phase 2 of the study.
7	Project Operations and Fish Stranding Study	NHFGD	One photo per day is not enough to capture hourly water level fluctuations.	Comment noted. Photos are captured hourly.
7	Project Operations and Fish Stranding Study	NHFGD	The camera on river left may not be positioned in a way that would document fish trapped among the boulders below the bridge.	Essex will adjust the trail cameras according to the recommendations provided by the fishery agencies. Essex will consider the feedback provided by the agencies during the ISR meeting along with the information provided in their comment letters.
7	Project Operations and Fish Stranding Study	NHFGD	The camera on river right should be angled to capture any potential stranding among the ledges near the south side eel trap.	Essex will adjust the trail cameras according to the recommendations provided by the fishery agencies. Essex will consider the feedback provided by the agencies during the ISR meeting along with the information provided in their comment letters.

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8	Freshwater Mussel Habitat Assessment Study	MassWildlife	The ISR failed to include FERC's added objective of "determine the effects of the project operation on mussels" as required in the May 10, 2025 Study Plan Determination.	It is Essex's intent to evaluate the potential effects of project operations on freshwater mussels and other natural resources as part of their Draft License Application due to be filed with FERC on July 2026.
8	Freshwater Mussel Habitat Assessment Study	MassWildlife	One Creeper was noted to be found downstream of the Essex Dam (P.14), however the data in Appendix B Table 3 of the ISR stated that the one creeper was found in the upper section of the impoundment (spot dive Q2). MassWildlife requests that Essex clarify if this is a mistake or if Creeper was observed in both sections.	The creeper was observed in spot dive Q2 that is located upper portion of the impoundment and not observed downstream of the dam.
8	Freshwater Mussel Habitat Assessment Study	MassWildlife	Individual mussel lengths are not provided in the report. Rather, the report provided minimum and maximum ranges are given for each species. MassWildlife requests Essex provide all lengths and a summary via a histogram or similar graphic. It's also unclear if 50 individuals per species were measured per transect/site (if abundances were available) or a total of 50 individuals per species were measured in aggregate across all sites. If the latter is true, then potential size-classes are underrepresented in various sections of impoundment (i.e., downstream of dam, lower, upper impoundment). MassWildlife requests clarification on measurement efforts.	Due to the substantially large number of mussels observed, individual lengths for each of over 12,000 mussels were not collected. The process of measuring and recording all of these individuals for the most dominant species in the assemblage encumbers a substantial amount of unproductive time for each catch. In the interest of allocating additional time to identify locations and increasing potential detections of rarer species (e.g., triangle floater, creeper, yellow lampmussel) a range of size classes was recorded. Size ranges and representative photos illustrate relative age classes present. However, the specific goals of the approved study plan were to: • Determine the species composition, relative distribution, and abundance of freshwater mussel species in the Project area, • Assess the available habitat within the nearshore areas; and • Document the presence/absence of Corbicula (a non-native, invasive species) in the designated survey areas. The established goals were not focused on recruitment studies. Therefore, lengths for each individual and species were not recorded and a histogram cannot be developed. Both adult and juvenile cohorts were well represented and photo documented to further support these observations in the report.
8	Freshwater Mussel Habitat Assessment Study	MassWildlife	MassWildlife requests data be summarized more succinctly in compact tables and graphs, noting which transects and spot dives are downstream of the dam and within the impoundment.	Comment noted. Data tables will be modified into a more condensed format and provided as part of the USR.
8	Freshwater Mussel Habitat Assessment Study	MassWildlife	A measure of shell condition (i.e., level of shell erosion/loss) was not reported, which is a standard measure during mussel surveys. We recommend implementation of a shell condition metric for measured mussels in future surveys.	Comment noted. Little benefit is gathered from shell erosion data since periostracum quality can be affected by a number of reasons (e.g., hardness, injury, abrasion, or geriatric/non-reproductive communities). Similar to the cost benefit comment response for shell lengths, a substantial amount of time would be diverted to documenting periostracum quality in an assemblage of this size. In general, zero to moderate shell erosion was observed across the assemblage as observed during the 2024 field study, typical of a river of this size and substrate quality.
8	Freshwater Mussel Habitat Assessment Study	MassWildlife	P.17, Section 6.3 Impoundment Water Levels - "Normal operations do not appear to have a substantial effect on the existing mussel community. In fact, this community appears to be thriving at this location." Mussel data	Comment noted. Mussel communities do vary by location and habitat type and are described throughout the report. The initial study targeted and surveyed a variety of depths within the operating range

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			collected suggests unequal distribution of species and densities throughout the impoundment and does not support the report's conclusion. Although the transects were not systematically stratified by depth to measure the potential effect of annual fall drawdowns (conducted for dam maintenance) on the mussel assemblage and habitat, the report states that "Surveyors searched along the margins on the impoundment and observed no live mussels from the shoreline to approximately 2.5-3 ft in depth." These depths are exposed during the annual fall drawdown (~5ft in magnitude) which suggests that drawdown limits mussel establishment at these shallower depths. Notably, very few mussels (<5) were found at Transects 11 and 12 (west side of Pine Island), which are areas largely dewatered during the annual drawdown. Mussel stranding and mortality observations from MassWildlife staff during the 2024 fall impoundment drawdown supports the report's general observation (FERC Accession Number: 20250212-5008).	through two visits (August and September) and two different water levels. The second visit was conducted after a lengthy seasonal dry period, allowing survey teams to access greater areas within the representative operating ranges through spot dives. Water depth at the time of survey is a relative measure to the water surface elevation of the project operation. Seasonal dry periods such as the one observed during the September visit were much lower than the August visit.
8	Freshwater Mussel Habitat Assessment Study	MassWildlife	MassWildlife requests Essex avoid making conclusions on population health and conservation as surveys conducted do not support these statements and Essex does not have the authority nor expertise to do so.	Comment noted. This study was conducted by a qualified malacologist with experience across New England and Massachusetts watersheds, including the Merrimack River. The conclusions presented in the report are based in comparison to the expert observations of many mussel assemblages, available habitats and assessments throughout Massachusetts, New England and the Mid-Atlantic, including existing hydropower operations.
8	Freshwater Mussel Habitat Assessment Study	MassWildlife	In addition to the zero to low mussel abundance in the observed drawdown depth zone, species composition and Catch Per Unit Effort (CPUE) varied throughout the impoundment. In comparison to the upper impoundment (Transect 16-21) and downstream of the dam (Transects 1-5, 29-31), transects in the lower (Transect 6-9, 25-28) and middle sections (Transects 10-15, 22-24) of the impoundment tended to possess lower mussel CPUE, richness, and Shannon diversity. Specifically, most transects were dominated by Eastern Elliptio including 12 of 17 transects with >56% compared to 11 of 14 transects with <51% Eastern Elliptio in the upper impoundment and downstream sections. Further, three additional species were observed in the upper impoundment and downstream of the dam including the Massachusetts Endangered Species Act (MESA) Special Concern Creeper, albeit at low abundances. Although not statistically tested, the apparent differences in species composition, richness, and diversity may be driven by differences in substrate and regulated water level fluctuations. As the report indicates, the lower and middle impoundment sections are dominated by finer substrates including silt and sand and undergo the annual water level drawdown. In contrast, the upper impoundment and downstream of the dam are composed of more heterogenous and coarser substrate and are not exposed to or exposed to a lesser extent during the drawdown. Eastern Elliptio is relatively tolerant to water emersion likely because of its thicker shell making it resistant to desiccation compared to thinner shelled species including Alewife and Eastern Floater. Other species including Creeper, Triangle Floater, and species of Lampmussel are also likely sensitive to fast water level changes and desiccation (Galbraith et al. 2015, Mitchell et al.	Comment noted. Mussel assemblages, catch per unit effort, and diversity vary widely by habitat and location during most mussel studies. These variations are expected to occur as habitat changes. The ISR documents and discusses these changes throughout the project area.

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			2018) and may in part explain their negative detections in the lower and middle impoundment compared to the upper impoundment and segment downstream of the dam. Furthermore, Eastern Elliptio and Eastern Floater, the most frequently encountered species in lower and middle impoundment, are generally known to thrive in more lentic and fine substrate habitat conditions. However, the extent to which water levels or substrate conditions induced by the impoundment are driving these potential mussel assemblage patterns are uncertain without additional study.	
8	Freshwater Mussel Habitat Assessment Study	MassWildlife	MassWildlife requests semi-quantitative and quantitative assessment (e.g., quadrats) to estimate mussel densities within the impoundment stratified by exposed and unexposed depths during the drawdown. This will provide density and population size estimates to determine the proportion of the population vulnerable to water level regulation. Furthermore, additional semi-quantitative survey should target low abundance MESA-listed species and Species of Greatest Conservation Need in the upper impoundment and reach downstream of the dam to further understand distributions and abundance relative to water level impacts and habitat conditions of the impoundment. In particular, the discovery of an intact Yellow Lampmussel shell (MESA Endangered) downstream of the dam warrants additional survey and habitat assessment at reaches and depths downstream and upstream of the dam. This can aid in determining if a live Yellow Lampmussel population exists and if the dam is a barrier to movement upstream via viable host fish (e.g., Striped Bass, Largemouth Bass). MassWildlife requests modification and expansion of the freshwater mussel study as stated above because the study to date is insufficient to determine the extent of project impacts on these taxa. We make these recommendations based on the lack of surveys in habitats where mussels are most likely to dwell, the small amount of suitable habitat sampled (estimated at less than 1%), and evidence of presence of two MESA-listed species which are likely found at low densities and warrant further investigation.	Comment noted. Essex conducted the Freshwater Mussel Habitat Assessment and Survey as approved with modifications by FERC in their SPD.
8	Freshwater Mussel Habitat Assessment Study	FERC	In the May 10, 2025 study plan determination (SPD), Commission staff required Essex to include the following goal for the Freshwater Mussel Habitat Assessment Study (mussel study): “determine the effects of project operation on mussels.” The ISR did not include the SPD required goal for the mussel study. Explicitly stating these goals and objectives is important for providing an overall context for what the studies are attempting to accomplish and the specific information to be gathered to achieve each study’s goals. It also assists Commission staff in evaluating a study when an applicant and stakeholders disagree about how the study was conducted or the quality of the study results. Therefore, please include the SPD required goals and objectives in the Updated Study Report (USR).	Comment noted. Essex conducted the Freshwater Mussel Habitat Assessment and Survey as approved with modifications by FERC in their SPD.
8	Freshwater Mussel Habitat Assessment Study	NMFS	The results of the riverbed substrate and composition components of the Mussel Habitat Assessment Study may be useful for the sturgeon habitat	Comment noted.

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			mapping study. As appropriate, Essex should incorporate this information into the Sturgeon Habitat Mapping and Assessment Study.	
9	Water Quality Study	FERC	The SPD required Essex to continuously monitor water quality in the bypassed reach (i.e., station LH-06 “River reach below dam”). At the ISR meeting, Essex presented a list of study locations for the 2025 water quality study that did not include a monitoring location in the bypassed reach. Staff notes that the study should be conducted as provided in the approved study plan, in accordance with section 5.15 of the Commission’s regulations, and should include a monitoring station in the bypassed reach.	Following receipt of FERC’s June 24, 2025 ISR Comments, Essex added an additional water quality station (LH-06). However it should be clarified that the Lawrence Project does not have a true “bypass reach”. The location LH-06 (originally identified in the PSP) represents a generally still area located immediately downstream of the southernmost spill gate and upstream of the filled in fish ladder.
9	Water Quality Study	MassWildlife	This study will use Onset U26 continuous data loggers to record water temperature and dissolved oxygen at predetermined intervals. MassWildlife provides several recommendations for operating these loggers to ensure accurate data collection. a) The optic sensor on these loggers is extremely susceptible to biofouling, so the loggers need to be cleaned weekly. If this is not accomplished, data quality is at risk. b) Continuous data loggers should collect hourly measurements to document diel changes to water temperature and dissolved oxygen. c) Water depth of the data loggers will be critical as both water temperature and dissolved oxygen likely differ throughout the water column. For example, hypoxia and anoxia often occurs near the benthos and may not be recorded if loggers are positioned near the surface. MassWildlife requests that logger depth in the water column be consistent among monitoring stations and be located close to the benthos. d) MassWildlife requests that data loggers be calibrated to both 0% and 100% oxygen saturation prior to deployment. The 0% calibration is required is DO is expected to be <3.0 mg/l (Onset Computer Company 2025), as is the case in this study. Following the study, loggers should be tested with the same calibration in the lab to make sure they were collecting accurate measurements.Normandeau confirmed to agency representatives on at The Water Quality Study site visit on 5/30/25 that loggers are calibrated 100% oxygen saturation prior to deployment. They also confirmed that they do not calibrate to 0% oxygen saturation. MassWildlife staff brought this up at the meeting and Normandeau confirmed that it would calibrate to 0% oxygen saturation but provided no timetable to accomplish this and as of the date of this letter, Normandeau has not confirmed that they have completed the 0% calibration. A record of calibration to both 0 and 100%, and any other standards, should be included in any future reports to validate data collected using continuous data loggers.	a) Deployed units are being maintained weekly including cleaning of the optic sensor as specified in the FERC approved RSP. Results will be provided in the USR. b) As stated in the FERC approved RSP, water temperature and dissolved oxygen readings are being collected at a 15-minute interval. c) The loggers will be deployed in the epilimnion under stratified conditions and mid-depth under unstratified conditions, this is standard procedure for DO monitoring in impoundments. Additionally, weekly water quality profiles will be collected at the deep spot of the impoundment to characterize stratification and hypoxic/anoxic conditions. Results will be provided in the USR. d) DO calibration procedures for this ongoing study have been updated to include 0% DO calibration if low DO conditions are documented (below 4 mg/L). Results will be provided in the USR.
9	Water Quality Study	MassWildlife	MassWildlife also concurs with the Massachusetts Department of Environmental Protection’s (DEP) request to modify the water quality study, including the addition of macroinvertebrate sampling in the North Canal,	Essex intends to execute the benthic macroinvertebrate components of the water quality study as described in the FERC approved RSP. Results will be provided in the USR.

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			expanded mussel collection closer to midstream within survey reaches, and the inclusion of an additional macroinvertebrate and water quality sampling reach near the dam and upstream of the mouth of the Spicket River.	
9	Water Quality	MASSDEP	MassDEP and MassWildlife met with Essex's contractor team from Normandeau on May 30, 2025, following the May 7-8, 2025, Lawrence ISR meetings, to discuss the FERC-approved Water Quality Study. MassDEP and MassWildlife provided the following feedback and requests to Essex, which we are now providing to you: The addition of another water quality, macroinvertebrate sampling reach immediately downstream of the dam, but upstream of the Spicket River (for an overall main river total of 3 sampling areas, with 6 transects each).	Essex intends to execute the benthic macroinvertebrate components of the water quality study as described in the FERC approved RSP. This includes two sample locations – one downstream of Essex Dam near the confluence of the Spicket River and one upstream of the outfall of the Duck Island Waste Water Treatment Plant near to the upper extent of the impoundment. These locations were identified in the field along with staff from MassDEP and MassWildlife. Results will be provided in the USR.
9	Water Quality	MASSDEP	Recommend collection of macroinvertebrate samples in the part of the river channel that does not dewater. Ten (10) macroinvertebrate samples should be collected in each transect to calculate metrics per EPA protocols. In addition, two (2) macroinvertebrate samples should be collected at the deepest point feasible per transect to be aggregated by reach to look for similarities/differences between locations.	Essex intends to execute the benthic macroinvertebrate components of the water quality study as described in the FERC approved RSP. Sampling will be conducted using the Large River Bioassessment Protocol for Benthic Macroinvertebrate Sampling (LR-BP) as described in the USEPA guidance document Concepts and Approaches for the Bioassessment of Non-wadeable Streams and Rivers (Flotemersch et al. 2006), consisting of sweep samples collected from the 5-meter zone on each bank side of the transect set placed within the upstream and downstream sample locations. Results will be provided in the USR.
9	Water Quality	MASSDEP	When possible, dragonfly nymphs and mussels should both be identified to the species level.	As recommended by FERC in their SPD, Essex will identify dragonfly nymphs found in the laboratory samples to the lowest possible taxonomic level (ideally to species).
9	Water Quality	MASSDEP	Recommend the addition of macroinvertebrate sampling in the north canal using an appropriate technique for the water type (enough to generate 300 organism subsamples). To determine the appropriate technique, the following is an excerpt from MassDEP's draft Macroinvertebrate SOP: Prior to sample collection, consideration must be given to determine the type of collection method that is most appropriate for the site. In wadable, higher gradient streams that have steeper slopes, faster flows, and abundant riffle habitat, the single habitat (riffle only) sampling method is generally most appropriate. Conversely, lower gradient streams with more gradual slopes, slower flows, an abundance of vegetation and/or woody debris, and an overall lack of riffle habitat should be sampled using the multihabitat method. It is advisable to select the collection method that is most representative of the stream reach. When riffle habitat comprises ≥ 30% of the stream reach, the single habitat (riffle only) sampling method should be employed, whereas in rivers where riffle habitat comprises < 30% of the stream reach, the multihabitat method should be employed. In streams with < 30% riffle habitat in the stream reach but with some riffles present, it is acceptable to sample riffles in proportion to the stream reach (e.g., 10% of stream reach is riffle habitat therefore 1 kick sample is collected from the riffle and 3 are collected from woody debris, and 6 are collected from	Essex intends to execute the benthic macroinvertebrate components of the water quality study as described in the FERC approved RSP. This includes two sample locations – one downstream of Essex Dam near the confluence of the Spicket River and one upstream of the outfall of the Duck Island Waste Water Treatment Plant near to the upper extent of the impoundment.

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			vegetation, etc.). In large, non-wadable rivers, other collection methods may be utilized (e.g., rock baskets or multiplates).	
9	Water Quality	MASSDEP	Request sampling for sea lamprey ammocoetes in the canals if the canals are retaining sediment. MassWildlife has confirmed presence of ammocoetes along the shore of the impoundment.	Backpack electrofish sampling was conducted in the North Canal during field sampling executed as part of the American Eel Upstream Siting Study and was reported as part of the ISR. A full list of species and counts observed during North Canal sampling was provided. There were no observations of sea lamprey ammocoetes from the North Canal. Electrofish sampling in the South Canal was determined to be unsafe due to issues associated with egress of project staff from the canal structure in the event of an emergency. As a result, no electrofish sampling of that reach was conducted as part of the American Eel Upstream Siting Study and Essex does not intend to electrofish sample in that reach in the future.
9	Water Quality	MASSDEP	Recommend measurements of cyanobacteria consisting of cell counts and identification in the impoundment upstream of the dam since certain levels of cyanobacteria could affect recreational use. A surface grab sample would be appropriate to estimate potential cyanotoxin presence at a depth that swimmers are likely to ingest. This sampling effort should occur more than 3 times during the recreational season, with each sampling event more than 10 days apart.	Essex intends to execute the Water Quality Study as described in the RSP, with modifications provided by FERC in their SPD. Results will be provided in the USR.
9	Water Quality	MASSDEP	For sampling to investigate nutrient impacts upstream of the dam, MassDEP would expect use of a lakes protocol with depth-integrated sampling (within either 2 times Secchi depth or top 1 meter (m) or top 2 m). This integrated sample would be used to obtain any phytoplankton, chlorophyll-a, and nutrients (e.g., TP) samples for analysis.	The approved study plan includes sampling for nutrients at 25% of the water depth and chlorophyll-a sampling as a column composite from the upper 2m of the water column; This methodology was proposed based on other lakes sampling protocols used on previous FERC studies. Modifying this protocol to include collection of nutrients and chlorophyll-a from the column composite sample (upper 2m of water column) is reasonable and this protocol will be used going forward. Phytoplankton analysis was not requested and was not proposed.
9	Water Quality	MASSDEP	Onset U26 continuous data loggers will be used in this study for collection of both water temperature and dissolved oxygen measurements at set rates. Below are several recommendations regarding the operation of these loggers and their performance: a. The optic sensor on these loggers is extremely susceptible to biofouling and must be cleaned weekly or at least biweekly as planned. If this is not accomplished data quality is at risk. b. Depth of the data loggers will be critical as both water temperature and dissolved oxygen likely differ in the water column. How will this be addressed? For example, hypoxia and anoxia often occur near the bottom and may not be captured if loggers are positioned near the surface. We understand that a vertical profile is planned in the deepest area of the impoundment, but other deep areas of the river should be screened for stratification and potential vertical profiling or adjustment in the depth of the data logger.	a. Deployed units are being maintained weekly including cleaning of the optic sensor as specified in the FERC approved RSP. Results will be provided in the USR. b. The loggers will be deployed in the epilimnion under stratified conditions and mid-depth under unstratified conditions, this is standard procedure for DO monitoring in impoundments. Additionally, weekly water quality profiles will be collected at the deep spot of the impoundment to characterize stratification and hypoxic/anoxic conditions. Results will be provided in the USR. c. DO calibration procedures for this ongoing study have been updated to include 0% DO calibration if low DO conditions are documented (below 4 mg/L). Results will be provided in the USR. d. Post-field calibration checks will be included and results will be provided in the USR.

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			c. Data loggers must be calibrated to 100% oxygen saturation prior to deployment; additionally, if low DO measurements are expected (e.g., <4 mg/L) it is recommended to calibrate loggers to 0% oxygen saturation. A record of calibration should be included in the water quality appendix to confirm loggers are functioning and collecting accurate data. d. Post-field calibration checks should also be included within the study scope.	
10	Three-Dimensional Computational Fluid Dynamics (CFD) Modeling	FERC	The SPD required Essex to develop a 2-dimensional (2D) flow model for the bypassed reach and a 3-dimensional computational fluid dynamics (CFD) model of the tailrace. However, Essex did not provide any information about the status of the 2D flow model in the ISR or at the study report meeting. Please provide an update on the status of the 2D flow model for the bypassed reach.	Essex anticipates filing the 3D CFD model report in Q3 2025, the results of which inform the 2D model study plan. Essex intends to consult with the relevant fisheries agencies on the 2D model study plan.
10	Three-Dimensional Computational Fluid Dynamics (CFD) Modeling	MADMF	We do not have any technical comments at this time. However, we recommend Essex engage with the MRTC agencies as progress on this study continues to ensure input parameters and simulations align with our information needs.	Comment noted.
11	Recreation Facilities, Use, and Aesthetics Study	FERC	In the ISR and at the ISR meeting, Essex stated that it established a focus group of representatives from community organizations and government agencies to assist in the selection of recreation facilities to be included in the study. However, Essex did not provide any information about the focus groups' opinions and views toward the project's recreation facility, as required by section 16.6.2 of the approved study. Please provide a summary of the focus group's views and opinions of the project's recreation facility, as required by the SPD.	Essex requested data from the focus group pertaining to recreation in the Project area on July 15, 2024. Essex also requested input on the identification and selection of recreation sites and facilities by a letter dated September 3, 2024 and invited the study group to participate in a virtual meeting held on September 19, 2024. Essex requested opinions from the focus group in regard to conditions of the facilities as well as for participants to identify informal recreational facilities. The focus group did not share opinions in regard to the condition of the project's recreation facility, and primarily focused on a discussion on planned development. As stated in the study plan, Essex anticipates holding a final focus group meeting to discuss the study results prior to filing the final recreation report with the Commission. Essex will include the results of that discussion in the final study report.
11	Recreation Facilities, Use, and Aesthetics Study	FERC	The SPD required that Essex include additional topics, including the "condition of the project's recreation facility" on the survey form Essex is using to conduct its 2025 Field Reconnaissance and Visitor Intercept Surveys that began on May 1, 2025, and will continue through October 1, 2025. However, Essex did not include a copy of the updated survey form in the ISR. Please provide a copy of the final survey form being used for the intercept surveys.	The hardcopy visitor intercept survey forms are provided as Attachment F. The survey is administered by JotForm, so there are slight variations in formatting and layout. Please see Question No. 24 and No. 26 of the survey form that asks participants to describe the North Canal Carriage House condition, as well as to rate and describe the conditions of the recreation facility being surveyed.
11	Recreation Facilities, Use, and Aesthetics Study	FERC	In the approved study, Essex stated that it would seek input from the focus group participants to identify a maximum of 16 existing formal/developed recreation facilities (e.g., established facilities such as Abe Bashara Boathouse, Merrimack River Trail, and Lawrence Riverfront State Park) and	Essex consulted with a variety of interested parties to develop and implement study plans for identifying, analyzing, and addressing

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			informal/undeveloped recreation sites (e.g., river access areas, informal trails) that should be included in the Field Inventory portion of the study. The approved study also required Essex to conduct the 2025 Field Reconnaissance and Visitor Intercept Survey at 10 of those recreation sites: seven formal/developed sites and three informal/undeveloped sites. In the ISR and at the ISR meeting, Essex stated that it had completed the Field Inventory of the 16 sites selected with assistance from representatives of the focus group. In addition, Essex indicated that it had identified the three informal/undeveloped sites to be included in the Field Reconnaissance and Visitor Intercept Surveys as Oxford Park, Campagnone Commons, and the Lawrence Boys and Girls Club. However, it appears that these three sites are formal/developed sites. Please explain why Oxford Park, Campagnone Commons, and the Lawrence Boys and Girls Club were selected and why no informal/undeveloped recreation sites were included in the Field Inventory or as locations for the Field Reconnaissance and Visitor Intercept Surveys. In addition, please confirm if the Oxford Park to be surveyed is also known as Julia Silverio Park, located at 57 Canal Street in Lawrence, as opposed to the Oxford Street Park located at 329 Lowell Street in Lawrence.	recreational resources that may be affected by Project operation and maintenance activities from relicensing of the Project. On July 15, 2024, Essex requested data pertaining to recreation in the Project area. Essex also requested input from the study group on the identification and selection of recreation sites and facilities by letters dated September 3, 2024 and invited the focus group to participate in a virtual meeting held on September 19, 2024. Essex also invited Focus Group Participants to attend the October 2024 field inventory assessment. On April 3, 2025, Essex sent Focus group participants a letter and map of the ten recreation sites selected for the visitor intercept surveys and asked to provide comments. Essex did not receive comments from any focus group participants and used the focus group's recommendations, requests and descriptions to select the sites included in the visitor intercept surveys. Essex selected recreation sites that focus group participants specifically requested with the exception to certain sites documented during the 2024 field inventory that posed health and safety concerns. To clarify, Oxford Park and the Boys and Girls Club are informal sites. Oxford Park located at 57 Canal Street was formally named Julia Silverio Park and signage was installed at the park entrance in November 2024. At the time that the site was selected (September 2024), it was unnamed without signage and not listed on major web mapping services (Google maps, Bing maps, etc.). Oxford Park was selected as informal based on the description provided by the focus group on the September 2024 planning call. Oxford Park/Julia Silverio Park was intended to represent an area described by participants as informal access to the north canal located at the terminus of the north canal and adjacent to the Ferrous Park. The Lawrence Boys and Girls Club was selected as an informal site per the requests of the Focus Group participants. The Focus Group clarified that their interest in the Boys and Girls Club is actually the informal riverfront area (not necessarily activities at the club itself, at least for purposes of this study). The survey is being conducted on the exterior of the facility on the undeveloped riverfront with informal dirt paths that individuals use to recreate. Focus group participants supported their request for this site selection with claims that the City of Lawrence is pursuing a grant for a new trail starting at the Lawrence Boys and Girls Club that would expand indoor and outdoor recreation at the site in the future. Focus group participants also described the Campagnone (North) Common as an essential recreation resource and one of the most frequented parks within the city and described the site as offering a variety of recreation opportunities and amenities. Essex selected this site based on the focus group's recommendations and descriptions of the high volume of visitors and variety of opportunities available at the park.

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				As stated in the study plan, Essex anticipates holding a final focus group meeting to discuss the study results prior to filing the final recreation report with the Commission. Essex will include the results of that discussion in the final study report.
11	Recreation Facilities, Use, and Aesthetics Study	MassWildlife	While this report considers various recreational facilities, their uses, and aesthetic values, it overlooks recreational fishing stakeholders. Pemberton Park (east and south of North Canal Street, Lawrence) and the areas immediately downstream of the project experience significant angling activity during the spring season and likely represent an unrecognized stakeholder group. Angling below the dam for Striped Bass and both in the impoundment and below the dam for shad is well known in the angling community and discussed on recreational fishing social media sites and blogs5. Furthermore, anglers in these areas often lack safe shoreline access and would benefit from improvements that enhance accessibility	As a component of the study, survey technicians are recording recreation activities (including angling) observed at each of the surveyed sites, including Pemberton Park. Survey technicians are also conducting interviews with recreational users (which may include anglers) at each of the ten recreation sites. To date, technicians have surveyed anglers/fisherpersons at Pemberton Park, Nunzio Di Marca Park, Lawrence Riverfront Park, as well as at Abe Bashara Boathouse and the Merrimack River Trail. Essex appreciates the information and links provided by MassWildlife and will include any relevant information into the literature review section of the technical study report.
11	Recreation Facilities, Use, and Aesthetics Study	GWL	The report's consideration of the recreational amenities near the Project overlooks the usage of project lands to access the Merrimack riverfront for fishing. Most anglers are drawn to the Project area by striped bass. The high season for striped bass fishing on the Merrimack is generally considered to be from June to August. This user group accesses the shoreline to fish from the sewer interceptor lines on the north and south shorelines. The City of Lawrence has secured easements from property owners to formalize access to the waterfront via the 'Riverwalk Property. Engagement with this user group through social media (Facebook/ Merrimack River Fishing) would improve the study.	As a component of the study, survey technicians are recording recreation activities (including angling) observed at each of the surveyed sites, including Pemberton Park. Survey technicians are also conducting interviews with recreational users (which may include anglers) at each of the ten recreation sites. To date, technicians have surveyed anglers/fisherpersons at Pemberton Park, Nunzio Di Marca Park, Lawrence Riverfront Park, as well as at Abe Bashara Boathouse and the Merrimack River Trail.
11	Recreation Facilities, Use, and Aesthetics Study	GWL	To advance the long-held goal of accessing Project lands along the Merrimack riverfront below the Great Stone Dam, GWL requests the Recreation Facilities, Use, and Aesthetics Study include an update of the 2008 dam breach analysis completed by GWL and reviewed/accepted by FERC and Essex.	Essex is not proposing to update the 2008 dam breach analysis completed by GWL and reviewed/accepted by FERC and Essex.
12	Historically Significant Waterpower Equipment Study	FERC	At the ISR meeting, Essex stated that there were no variances from the approved study plan. However, one of the study objectives is to document current ownership of historically significant waterpower equipment but, in the study report, Essex does not include any specific ownership information. Instead, Essex states only that it does not own or operate the equipment, and the equipment is not a licensed project structure. At the ISR meeting, Essex noted that information regarding ownership is limited. As required by the approved study plan, please provide current ownership information of the historically significant waterpower equipment identified in the study report. If current ownership cannot be determined, please document the lack of information and update the study report to reflect the variance from the approved study plan.	As described in Section 6.2 of the study report, Essex owns the North Gatehouse, the North Canal Wasteway, the South Canal Gatehouse, the South Canal Wasteway, and the equipment contained within them. The penstock headgate systems and equipment built into the walls of the canals are owned by their respective related mill owners and are not licensed Project structures. Essex has provided known ownership information with this filing as Attachment G. Essex will update the study report with known ownership information and will file it on or before filing the USR.

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13	Condition Assessment of Historic Properties and Associated Canal System	FERC	The SPD requires Essex to assess the current operational status of the gates in the North and South Canal gatehouses and, if necessary, propose a repair schedule. In the ISR, Essex states that most of the gates in both gatehouses were not operational. However, the ISR does not include a repair schedule for the gates in the North and South Canal gatehouses, and Essex did not present a schedule for any gate repairs at the ISR meeting. To the extent possible, please provide planned timeframes for that repair work. Also, please include a plan and schedule for any necessary repairs identified as a result of the May 6, 2025 Condition Assessment of Historic Properties and Associated Canal System.	A prospective schedule for repairing the North and South Canal headgates and all Priority 1 and 2 canal wall sections owned by Essex is provided in Attachment H. This schedule is subject to future modification based on change of priorities, contractor availability and other factors.
14	Downstream Juvenile Alosine Passage Assessment	MassWildlife	Relative to downstream passage of alosines and classification of injuries on recaptured fish, documentation of injuries to recaptures individuals, including loss of equilibrium (LOE), is critical information. Normandeau states that LOE “This condition has been noted in most past HI-Z tag direct survival/injury studies and often disappears within 10 to 15 min after recapture if the fish is not injured” (Normandeau 2008). Algera et. al (2020) noted delayed mortality of fishes in 210 out of 369 studies in a downstream passage metanalysis. Additionally, LOE can make fish susceptible to predation and biophysical effects of a fluvial system (McLaughlin et al. 2013), potentially introducing additional mortality pressures or displacing individuals to unsuitable downstream habitats. Delayed mortality appears to be ignored in this study as mortality after 1 hour post passage will be considered equivalent to 48-hour mortality rates. Overestimates of survival of alosines following downstream passage will likely occur as a function of these noted study weaknesses. Therefore, MassWildlife believes that documentation and quantification of injury and LOE is necessary for this study to inform estimates of downstream mortality.	The text within the RSP that states that loss of equilibrium (LOE) has been observed in previous HI-Z Tag studies and often disappears within 10 to 15 minutes if the fish is uninjured. This is simply meant to explain that the HI-Z Tag recapture technique itself can cause LOE because the processes of attaching, releasing, recapturing, and removing the tags causes stress to test specimens. All fish that are recaptured during this study that are observed to have LOE will be documented and quantified for both treatment and control groups. LOE is considered a passage-related malady, and calculations of malady-free estimates include an adjustment for tagging-related LOE by the control group of fish.
14	Downstream Juvenile Alosine Passage Assessment	MassWildlife	MassWildlife notes the following justification to modify the approved study plan (1) extensive upstream migrations of American eel and their negative interactions with the project (2) the distance from the Project to the point where survival was assumed was only 2.1 miles downstream and appears to be an underestimate of potential downstream transport, and (3) the 2019 Study conducted by Normandeau (2019 Study) did not examine the eels for injury or immediate and latent mortality after they passed the Project. Therefore, the survival rate reported in the 2019 Study and adopted by the SPD is likely a gross overestimate. As a result, the 2019 Study’s methodology, relied upon by the Commission in its SPD, cannot provide information on passage mortality or injury rates for out-migrating eels passing Project. In contrast to the 2019 Study methods, telemetry and balloon tag studies have been conducted together to quantify injury and mortality rates for specific passage routes at hydroelectric projects (Normandeau 2010, 2011, 2022, Heisey et al 2019). MassWildlife recommends a study that would assess American eel passage route selection and evaluate injury and mortality for each route utilized. Specifically, the study should incorporate balloon tags and necropsy, similar to the methodology the Licensee and Normandeau have planned for	The FERC SPD only requires empirical testing of direct survival and injury for juvenile alosines.

Study Number	Study	Commenting Party	Comment	Response
			alosines. This requested methodology will inform the need for enhancements specific to each passage route to improve downstream passage at the Project. Determining route of passage using telemetry to understand how eels pass the Project in combination with balloon tag studies is a comprehensive way to evaluate eel survival and injury at hydroelectric projects and is consistent with generally accepted practice in the scientific community, whereas the 2019 Study methods are not. Without accurate information on survival and injury, it is not possible to conduct an environmental analysis of the Project's effects on American eel despite consist documented interactions with the Project.	
14	Downstream Juvenile Alosine Passage Assessment	MADMF, NMFS	The ISR indicated that HI-Z-tagged juveniles will pass downstream via the spillway and existing fish bypass. Understanding turbine survival is equally important, and tagged juveniles should pass through the turbines to assess this passage route as well.	Comment noted. Essex has proposed to develop a narrow-spaced trashrack design in consultation with MRTC to replace the existing trashrack system at Lawrence, which is a PM&E measure that will mitigate potential fish entrainment at the Project. In response to the RSP, MA DMF supported Essex's approach to implement PM&E measures in lieu of evaluating the turbines, and in the SPD FERC concluded that "FWS, NMFS, and Massachusetts DMF agree that Essex's proposed narrow-spaced trashrack should eliminate the need to evaluate turbine entrainment and passage survival through the project intake…". This study will focus on testing the non turbine passage routes that juvenile alosines will be able to use to pass downstream of the Project (i.e., the spillway and downstream bypass).
14	Downstream Juvenile Alosine Passage Assessment	MADMF, NMFS	The ISR assumes 95% survival for control species without providing citations or justification. This estimate is highly optimistic, and in practice, may be significantly lower. For example Heisey et al. (1992)5 found that 24- and 48-hour control survival for juvenile American shad were 72% and 54% respectively.	The Heisey et al. 1992 study used the original HI-Z Tags and techniques that have since been significantly improved by Normandeau Associates. Recent HI-Z Tag studies of juvenile alosines on the Connecticut and Susquehanna Rivers have had an overall average control survival rate of 94.4% with a range of 89.5–96.7% (Normandeau Associates, Inc. 2001, 2016, and 2017, and Normandeau Associates, Inc. and Gomez and Sullivan Engineers, P.C. 2012). However, if the assumed control survival rate of 95% is not achieved during the study at Lawrence, then the control sample sizes can be increased in the field to meet desired precision goals for survival estimates.
14	Downstream Juvenile Alosine Passage Assessment	MADMF, NMFS	The MRTC agencies were expecting to consult with Essex regarding the methodology of the spillway portion of the study. To date, no such consultation has occurred. With this study set to commence soon, we encourage Essex to initiate this consultation promptly.	Essex will consult with the MRTC prior to the execution of the Downstream Juvenile Alosine Passage Assessment.
14	Downstream Juvenile Alosine Passage Assessment	MADMF, NMFS	We note that one hypothesis contributing to downstream mortality is predation of stunned/disoriented fish exiting the downstream bypass. Essex should document any observed predation behavior during the study. We further note that the presence of field crew(s) conducting the study may alter natural predator behavior, which may confound the assessment of this variable.	It is standard procedure to quantify predation during HI-Z Tag studies, and this is included as a category in the RSP in Section 1.6.4 of Appendix J. If predation is observed during this evaluation, then it will be documented and quantified in the report. However, it is important to understand that the attachment of HI-Z tags on juvenile fish has a significant tag burden which can increase the likelihood for predation compared to untagged fish that would pass downstream naturally. This is especially true for juvenile alosines as they are more fragile

Study Number	Study	Commenting Party	Comment	Response
				and have less mass compared to other juvenile diadromous fish species.
14	Downstream Juvenile Alosine Passage Assessment	MADMF	MA DMF questions the validity of Normandeau's claim that loss of equilibrium (LOE) is abated after "10 to 15 minutes after recapture" and believes this statement may cause an underestimate of downstream mortality. Alegra et al., (2020) noted delayed mortality of fishes in 210 of the 369 downstream passage studies in a meta-analysis. Additionally, LOE can make fish more susceptible to predation and biophysical effects of a fluvial system (McLaughlin et al., 2013), potentially introducing additional mortality pressures or displacing individuals to unsuitable downstream habitats. Delayed mortality appears to be ignored in this study as mortality after 1 hour post passage will be considered equivalent to 48-hour mortality rates. Overestimates of survival of Alosines following downstream passage will likely occur as a function of these faulty assumptions.	The text within the RSP that states that loss of equilibrium (LOE) has been observed in previous HI-Z Tag studies and often disappears within 10 to 15 minutes if the fish is uninjured. This is simply meant to explain that the HI-Z Tag recapture technique itself can cause LOE because the processes of attaching, releasing, recapturing, and removing the tags causes stress to test specimens. All fish that are recaptured during this study that are observed to have LOE will be documented and quantified for both treatment and control groups. LOE is considered a passage-related malady, and calculations of malady-free estimates include an adjustment for tagging-related LOE by the control group of fish.
14	Downstream Juvenile Alosine Passage Assessment	NHFGD	Blade strike models tend to underestimate the effects of other sources of injury and mortality on juvenile alosines (barotrauma, loss of equilibrium/increased vulnerability to predation). In addition to the assessment of passage over the spillway and the downstream bypass, Essex should pass balloon tagged juvenile alosines through the turbines in an appropriate sample size needed to validate the results of the Desktop Entrainment, Impingement, and Turbine Passage Survival Study.	Essex has proposed to develop a narrow-spaced trashrack design in consultation with MRTC to replace the existing trashrack system at Lawrence, which is a PM&E measure that will mitigate potential fish entrainment at the Project. Therefore, juvenile alosine passage through the turbines will not be tested empirically. However, in the SPD FERC determined that a desktop study of turbine passage survival is expected to provide sufficient information about juvenile alosine passage through the project's turbines.
14	Downstream Juvenile Alosine Passage Assessment	NHFGD	Downstream passage survival of adult American eels and adult alosines has not been adequately studied at the Essex project. Even if Essex plans to mitigate for downstream passage by excluding adult eels and alosines from the turbines, the survival of other routes over the dam is necessary to understand the overall downstream passage survival at the project. Pictures from the initial study report of the Project Operations and Fish Stranding Study suggest that fish passing over the spillway on river left or river right may impact shallow ledges depending on flow conditions. Adult alosines have been observed being preyed on by striped bass in large numbers as they pass through the downstream bypass. An assessment of survival for fish passing downstream by way of the spillway or the bypass is incomplete without including adult eels and alosines, which may be even more susceptible to injury and mortality by these routes than the juvenile alosines.	The FERC SPD only requires empirical testing of direct survival and injury for juvenile alosines.
15	Sturgeon Habitat Mapping and Assessment Study	NMFS	Mobile SSS surveys to map habitat should occur during average to high flows to assess the habitat within the fully-inundated river channel. SSS is less effective at shallow depths and surveys at low flows will collect less information and potentially provide lower quality data.	The timing of the SSS surveys to map habitat was not specified or required by the SPD. Conducting this survey during high flows is not advisable because of the difficulty under such currents to successfully deploy grab or drop camera down to sampling stations from a vessel. Grab sampling and underwater video sampling was recently completed at 22 stations. Large sections of shallow water (1-2 feet or less) with numerous hazards (gravel/cobble bars and random boulders) prevented passage up or down the river, excluded areas of sampling, reduced speed, and increased effort. While SSS can be effective at collecting a swath of 300-350 feet width in shallow water of 3-4 feet, the SSS and bathymetry survey components of this study will be rescheduled to a period with a higher water elevation. Higher

Study Number	Study	Commenting Party	Comment	Response
				water elevations will improve data quality, increase survey coverage area, reduce navigational hazards, and alleviate survey limitations. The rest of the survey will be conducted during mid-July to late October. Georeferenced depth data and gauge data for stage will be recorded during the survey and the riverbed elevation will be used to estimate depth at average flow conditions for spawning or other seasonal periods.
15	Sturgeon Habitat Mapping and Assessment Study	NMFS	In addition to mapping the substrate features in the downstream reach, Essex should map the riverbed elevations as this allows for the evaluation of sturgeon habitat at multiple flow conditions using hydraulic modeling tools. Depth measurements alone are insufficient to assess persistent habitat suitability for sturgeon because river stage (i.e., depth) varies with flow. Essex should conduct velocity transects during the field surveys for use as model validation and calibrate the model with data from the existing U.S. Geological Survey gage (USGS No. 01100500). The Federal Emergency Management Agency has an existing HEC-RAS model used for floodplain mapping available upon request that is appropriate for evaluating habitat suitability at multiple relevant flow conditions (i.e., spawning, foraging, and rearing flows).	While the SPD did request habitat to be identified based on substrate type and depth, there were no specific requests, standards or specifications for a bathymetric survey or hydraulic modeling. Given the lack of public bathymetry, the Project team elected to collect single-beam soundings georeferenced by network RTK-GPS which will allow riverbed evaluations to be estimated from three new bathymetric sources: during the SSS survey (provided no acoustic interference), at and between sampling stations, and a dedicated day of bathymetry using a back-and-forth zig-zag transect design.
15	Sturgeon Habitat Mapping and Assessment Study	NMFS	Prior to collecting survey data, Essex should evaluate surveying direction, i.e., motoring upstream versus downstream, and speeds, to determine what will provide the best data. Real-time observation of the sonar display provides a check at the start of a survey and opportunities for correction during surveys if river conditions change. General recommendations for collecting quality data are: o Maintain a straight line while motoring o Optimize SSS unit stability through boat operations o Depending on field conditions, this may be supported by beginning at the upstream extent of the survey reach and motoring downstream with the current instead of motoring against the current o Record operations at the Project throughout the survey	During the mobile SSS survey of sturgeon for Study 5, a transect segment was sampled in an upstream and downstream direction to test the effect of survey direction. Based on real-time SSS imagery, no appreciable difference was observed in the image quality, so the survey efficiently sampled the transects in opposing directions. In practice, especially during high flows, the speed and bow direction was more difficult to maintain while traveling downstream with higher water velocities and turbulence closer to the Project. Direction and speed were well controlled at 3-4 knots motoring against the current.
15	Sturgeon Habitat Mapping and Assessment Study	NMFS	A petite PONAR (6” gape) will not be able to sample medium to coarse cobble, so where Essex assumes ‘hard bottom’ because the PONAR grab is empty, they should use a video-capable camera (assuming water clarity permits visualization) to confirm substrate type, size, and embeddedness. If these methods prove unsuitable, then other methods are necessary to ground-truth riverbed substrate.	The SPD recommended grab samples, underwater camera or SCUBA diving for verification of substrate type. The Study Plan uses two of these three methods (grab samples and underwater video). A standard Ponar and other types of grabs (e.g., van Veen) are too large (12 inches or more opening, not including a frame) and too heavy when full (50-100 pounds) for vessels suitable for navigating this river reach. Larger grabs require vessels with more deck space, a davit and a winch to safely operate these grabs. The proposed petite Ponar grab will be suitable for collected muddy, sandy, silty, gravel and complex substrate types for sediment grain size analysis. The SSS imagery should identify the areas of hard substrate (medium cobble to boulders/bedrock) but three valid empty Ponar grabs will support such classification, and the underwater video will be available to further verify hard substrate type. The underwater video will be equipped with a calibrated dual green laser pointer for measuring size of substrate.

Study Number	Study	Commenting Party	Comment	Response
15	Sturgeon Habitat Mapping and Assessment Study	NMFS	Although the habitat reach between the Project and Haverhill, MA, could support sturgeon throughout, NMFS encourages Essex to pay particular attention to specific features, ensuring high-quality results for areas that are likely to be most suitable for sturgeon. These features include things like tributary inflows, point bars, eddies, and other geomorphic elements within the river corridor.	Comment noted.
16	Fish Assemblages	MassWildlife	MassWildlife requests that standardized fish surveys be completed in all habitats potentially affected by Project operations, including the impoundment and habitats downstream of the dam to the Merrimack River mouth. These surveys are necessary to ensure that data is accurate, informative, and is in a format that will lead to more information on fisheries assemblages interacting with the project. •Data should be provided to relevant stakeholders in both excel raw data formats and clearly visualized in future reports. • Data should include the sampling method, total effort (e.g., shocking time seconds, net set duration), habitat type and GPS locations for each survey and any potential sampling biases associated with specific project goals at the time of sampling. • Data should include individuals identified to species, total lengths, weight, and any other observations such as condition or reproductive status.	It is Essex's intent to follow the recommendation provided by FERC in their SPD. FERC notes that the PAD contains information describing existing migratory fish species found in the vicinity of the project and other fish species found within the greater Merrimack River watershed. To meet the FERC recommendation, Essex will (1) compile information from existing fish assembly study data; (2) summarize the fishery data from all required fishery studies in this determination, and (3) assess the information for any data gaps in the fisheries information.
17	Invasive Plant Survey	MassWildlife	Essex did not collect invasive plant data during the mussel study and is requesting a variance from the approved Study Plan. MassWildlife does not support the omission of this data, as proposed by Essex. However, MassWildlife would support a variance in timing, allowing Essex to collect the required data during the 2025 season, provided the scope and locations remain consistent with those outlined in the approved Study Plan.	As indicated at the ISR meeting, Essex will be making anecdotal invasive plant observations during the 2025 Water Quality Study. These observations will take place at each of the transect or spot dive locations identified and reported as part of the Freshwater Mussel Habitat Assessment and Survey in the ISR. Plant observations will be reported as part of the USR.

Attachment B

2024 Lawrence Fish Passage Log

(Filed Separately as an Excel File)

Attachment C

Preliminary Sturgeon Tag Log

(Filed Separately as an Excel File)

Attachment D

Essex and USGS Scope of Work

Attachment A: Statement of Work

Tagging and Tracking Merrimack River Sturgeons Relative Licensing the Lawrence Hydroelectric Project

March 15, 2025 – November 30, 2028

Research Team:

- Micah Kieffer and Aaron Heisey: USGS Eastern Ecological Science Center, S.O. Conte Anadromous Fish Research
- Drew Trested: Normandeau Associates
- Kevin Webb and Richard Malloy: Patriot Hydro, LLC

I. Background:

Essex Company, LLC (Essex), a subsidiary of Patriot Hydro, LLC, is the Licensee, owner, and operator of the Lawrence Hydroelectric Project, which is Federal Energy Regulatory Commission (FERC or Commission) Project No. 2800 (Project or Lawrence Project). The Project was licensed by the FERC on December 4, 1978 (with an effective date of December 1, 1978), and the license expires on November 30, 2028. The Lawrence Project is located on the Merrimack River in the City of Lawrence in Essex County, Massachusetts (Figure 1). Essex is in the process of renewing its license under the Federal Power Act. As part of the licensing process, Essex is conducting studies to determine project impacts to inform the conditions of the new license. Normandeau Associates (Normandeau) is the lead consultant for licensing studies required to assess project impacts to sea-run migratory fish that pass the dam via a fish lift (upstream) and fish bypass (downstream).

In accordance with 18 C.F.R. § 5.15 requirements, Essex has initiated studies and information gathering activities as provided in the study plan and schedule approved by the Commission. Among the studies initiated during 2024 was the **Sturgeon Distribution and Project Interaction Study** (Essex Study), the general methodologies of which were outlined and approved by FERC in their May 10, 2024, Study Plan Determination (SPD)[1]. The Merrimack River is within the range of ESA listed Atlantic sturgeon (threatened and endangered DPSs) and shortnose sturgeon (endangered). The Lawrence Hydroelectric Project is a barrier to the upstream migration of sturgeon, and restricts freshwater spawning, rearing, foraging, and overwintering habitat within the 29-mile reach below the Project.

USGS researchers working out of the Conte Research Laboratory (Conte Lab), Turners Falls, Massachusetts, a satellite laboratory under the Eastern Ecological Science Center, Leetown, West Virginia, have been conducting sturgeon

[1] FERC Study Plan Determination for the Lawrence Hydroelectric Project (Accession #: 20240806-3048)

investigations in this portion of the watershed for 20 years referenced as the **Merrimack River Sturgeon Life History Study** (USGS Study). This multi-year, multi-objective effort spanning the entire Merrimack River reach below the Dam in Lawrence (Lower Merrimack River; Figure 1) requires protected species permitting support from the National Marine Fisheries Service, the Massachusetts Natural Heritage Endangered Species Program, and the Massachusetts Division of Marine Fisheries. Conte Lab researchers possess state-of-knowledge and expertise in sturgeon life histories within the Merrimack River and adjoining Gulf of Maine waters as well as fish capture, tagging, and telemetry methods consistent with current protected species research handling protocols. Although these efforts have achieved understandings of sturgeon life history in the Merrimack River suitable to provide guidance for some management actions, yet to be investigated are precise details about shortnose sturgeon spawning sites, movements upstream of the Haverhill spawning area identified by Kieffer and Kynard (1993)[2] to the Lawrence Dam, any movement/habitat use of shortnose sturgeon juveniles and riverine movements of Atlantic sturgeon sub-adults. Sturgeon tagging planned for this cooperative effort will contribute to greater USGS investigations of sturgeon life history, reproduction, habitat use and coastal/inter-basin migrations.

The combined efforts of the Essex, Normandeau and USGS investigators aim to increase the likelihood of obtaining sufficient information to allow a robust evaluation regarding the effects of project operations on federally listed Atlantic and shortnose sturgeons and if a need for protective, mitigation, or enhancement actions exists. These proposed investigations would also contribute to increasing the understanding of broad and discrete annual movement and habitat use behaviors of both sturgeon species in the Merrimack River and surrounding. Essex is seeking USGS staff expertise to aid in tagging Atlantic and shortnose sturgeon for their FERC-required study as permitted under the National Marine Fisheries Service (NMFS) Gulf of Maine Sturgeons Section 10 Permit (20347-03), such that institutionally supported goals of the cooperating groups can be achieved to the highest level possible.

II. Purpose:

The purpose of this technical assistance agreement is to allow cooperation among USGS, Essex and Normandeau to meet professional goals at a higher level than if acting independently. USGS benefits resulting from Essex and Normandeau cooperation include: tag purchasing and deployment/management of a 20-unit 2-D acoustic data-logging array positioned in close proximity to the Lawrence Dam and fishway entrance that is specifically designed to detect tag transmissions in turbulent, high energy environments, and the deployment and management of a four-unit Innovasea VR2Tx acoustic data-logging array along

[2] KIEFFER, MICAH & Kynard, B.. (1993). Annual Movements of Shortnose and Atlantic Sturgeons in the Merrimack River, Massachusetts. Transactions of The American Fisheries Society - TRANS AMER FISH SOC. 122. 1088-1103.

the 1.5 mile river reach immediately downstream of the Lawrence Dam that is less suitable for turbulent conditions but allows for longer duration (multi-year) detections. The cooperators' study objectives will also benefit from sharing tag detection results and study plan ideas. Essex and Normandeau benefits resulting from USGS cooperation includes state- and federal-permitted fish capture, sturgeon handling and tagging expertise, and deployment/management of a lesser-capability five-unit Innovasea acoustic data-logging array, all supporting Essex's adherence to required Project relicensing requirements.

III. Objectives or Specific Aims:

Within this cooperation, specific Study objectives for Essex are to determine if and how Atlantic or shortnose sturgeon are interacting with the Lawrence Project. Main study objectives according to the FERC Study Plan Determination are to:

- determine if Atlantic and shortnose sturgeon are present between the Project dam and the I-495 Bridge that crosses the Merrimack River approximately 1.5 miles downstream of the dam in Lawrence, Massachusetts;
- if present, quantify the duration and seasonality of sturgeon presence in the study reach as well as quantify movement patterns and habitat selections;
- identify any project-related effects, such as unnatural water flows/temperatures;
- evaluate the need for upstream sturgeon passage at the Lawrence Dam project.

Within this cooperation, specific study objectives for USGS are to expand ongoing annual movement and habitat use of sturgeons in the Merrimack River and associated Gulf of Maine waters. Main study objectives according to NMFS Section 10 Protected Species Research Permit 20347-03 are to:

- determine the status of Merrimack River sturgeons' use of the reach between the Haverhill spawning site and the Lawrence Dam;
- determine if there is any evidence shortnose sturgeon are motivated to move upstream beyond the Dam in Lawrence;
- determine general Atlantic sturgeon sub-adult and shortnose sturgeon juvenile annual movements and habitat use, including if either are present within the Lawrence Dam study area;
- monitor movements of shortnose sturgeon adults and Atlantic sturgeons along the Gulf of Maine coastal zone.

IV. Term / Project Schedule:

Regarding the immediate need for these study activities, all is to occur in 2025 according to the study task details for both cooperators described below. In the event that the study cannot be conducted in 2025, study execution will be delayed one year and start in spring of 2026. Because a portion the Innovasea acoustic tags will transmit for several years, there is the option for a 2nd year of Innovasea receiver array deployments if additional information is needed from these tagged fish and could occur in either 2026 or 2027 based on when the 1st

study year occurs. However, to allow adequate time for all data to be gathered and all analyses to be performed, the project scope is set at March 1, 2025 to November 30, 2028. As funding or information needs evolve, this agreement may be modified and expanded to incorporate additional licensing and conservation research activities.

V. Collaborator's (Essex) Role and Expertise:

The Collaborator's role, supported by Normandeau, is the procurement of study materials, installation and maintenance of four acoustic receivers at locations identified by FERC in their May 10, 2024 SPD, and review and synthesis of receiver data to inform the Sturgeon Distribution and Project Interaction Study report to be filed by Essex with FERC as part of the Updated Study Report during April 2026.

Specific Collaborator (Essex) Tasks:

Fish tagging:

Essex, supported by Normandeau, will purchase 45 Innovasea acoustic transmitters and 15 ATS transmitters for the purposes of deploying these tags on targeted groups of Merrimack sturgeons. Essex and USGS staff will discuss appropriate tag sizes and configurations towards maximizing the probability of collecting the target sturgeon movement behavior data. These tags will be sent to USGS PI for final preparations and ultimate deployment into selected fish groups shown in Table 1.

Fish tracking:

Passive Innovasea VR2Tx acoustic telemetry monitoring receivers will be deployed in the Lawrence tailrace, and at the Route 28 Bridge, the Duck Bridge, and the I-495 Bridge in Lawrence. The receiver arrays will be deployed as soon as safely possible before the spawning season begins and removed during November 2025. The receiver arrays will be checked regularly for functionality and provide complete coverage of the Merrimack River at the station transect.

A passive array of up to 30 ATS acoustic telemetry receivers will be maintained by Essex within the Merrimack River from just upstream of the Essex Dam downstream to the I-495 Bridge in Lawrence. The array is intended to provide 1-D presence/absence information in the river downstream of Essex Dam and 2D positional information within the immediate powerhouse tailrace area. The receiver array will be installed in the latter half of April and removed upon closure of the upstream fish lift during early July 2025.

Project Management and Reporting:
Results from this work will be included in the Collaborator's final report to the FERC as described in section 7 of the Technical Assistance Agreement.

Project communication will occur with periodic team meetings and email updates to coordinate research activities. An email update of the work activities completed will be provided on an as-needed basis. Basic summary information will be provided in a form of an email, presentation slides, or team meeting. Project management also includes permitting reports for endangered species reporting, data entry and basic data analyses.

Study Budget Subtotal:
The budget proposed to come to USGS for the study as reimbursable funding in FY 2025 is $55,612.12. It includes salary for field work as well as project management and reporting.

VI. USGS Role and Expertise:

The USGS brings high-level qualifications to the table for these actions. The PI brings 34 years of field sturgeon investigation, 18 of which are specific to the Merrimack River. USGS PI is one of the few researchers in the Northeast authorized to conduct invasive internal tagging procedures and is currently engaged in studies looking at annual movements of sturgeons in the Merrimack River and waters within the Gulf of Maine. USGS co-investigator brings expertise and experience in analyzing/managing complex fish movement data sets.

Specific USGS Tasks:
USGS biologists will conduct all sturgeon capture and telemetry-tagging tasks required by the NMFS Sec 10(a) permit. The fish captures (three targeted groups) will be conducted by USGS biologists, occurring as follows, according to sites indicated in Figure 2.

Fish tagging
Atlantic and shortnose sturgeon are listed as threatened and endangered, respectively, under the Endangered Species Act. USGS staff are members of the Sturgeon of the Gulf of Maine project (Permit #20347-03) permitted to conduct these activities under Section 10(a)[3] of the ESA by the National Marine Fisheries Service (NMFS).

Shortnose sturgeon adults (15):

[3] ESA Section 10(a)(1)(A) permit issued for the Sturgeon of the Gulf of Maine project (Permit #: 20347-03)

Gill-net sampling at the spawning area in Haverhill will occur in mid-April–early-May, targeting mature pre-spawning males that have already demonstrated an upstream post-winter movement and known for widely wandering pre-spawning movement behaviors. Each fish will receive a surgically implanted dual-tag combination consisting of an Innovasea V16; 69 kHz (six-year duration – characterized by a 60 second ping rate for the first two years of operation before changing to a 180 second ping rate) tag combined with an ATS (Advanced Telemetry Systems) SS379; 416.7 kHz (247-d duration) tag inserted through a single ventral incision (Table 1). In addition to these tags, the Massachusetts Division of Fisheries and Wildlife has made available up to 19 of the smaller ATS SS410 416.7 kHz tags (111-d endurance) to be injected externally into the dorsal musculature of additional mature male or female adults captured at Haverhill during this same sampling period more than doubling the number of tagged fish that may display the target behavior of moving to Lawrence. In addition to these tags, there exist roughly 25 shortnose sturgeon adults retaining active Innovasea tags deployed earlier that will be included in study analyses if fish enter the Essex study area.

Atlantic sturgeon sub adults (15):
The primary gill-netting sampling site for this group will be in the Joppa Flats foraging area (Figure 1; a known post-wintering foraging area for both shortnose sturgeon adults and Atlantic sturgeon sub-adults) during the months of May–September. Alternate netting sites will include Plum Island Cove between the river mouth jetties and the cluster of four Islands between Newburyport and Amesbury, Massachusetts. Each fish will receive only one Innovasea V16; 69 kHz (six-year duration – characterized by a 60 second ping rate for the first two years of operation before changing to a 180 second ping rate) acoustic tag (Table 1) mounted surgically through a ventral incision.

Juvenile shortnose sturgeon (15):
Capture techniques approved for this effort include smaller-mesh gill-nets, bottom trawls and beach seines deployed in the known adult foraging areas (Haverhill–Newburyport) between June–October, but initially begin in the wide sandy reach in Amesbury, MA (Figure 1). Captured juvenile shortnose sturgeon large enough to receive an internal transmitter will receive an Innovasea V13; 69 kHz (one-year duration – characterized by a 60 second ping rate; Table 1) tag mounted internally. Juvenile shortnose sturgeon habitat occupation is an emerging field of study, so at this time, these locations are based on the best available science and professional judgment of USGS biologists.

General gill-netting and tag detection statement:
All netting activities will occur within NMFS's Section 10 permit as well as NMFS peripheral sturgeon handling protocols. USGS researchers, as required by state permit, will maintain communications with local Environmental Police, the Massachusetts Division of Marine Fisheries and the Massachusetts Division of

Fisheries and Wildlife regarding net sampling as stated on their respective sturgeon collection permits.

Nets will set in areas that are safe for the fish as well as the seasonal boating traffic and be tended throughout the deployment. All fish tagged as a part of this effort will receive routine NMFS-required processing steps including but not limited to the recording of length, weight, the removal of a genetics tissue sample, the scanning for or deploying a PIT (Passive Integrated Transponder) identification tag and the determination of sex/maturity using a variety of techniques.

Finally, as stated earlier, if any pre-existing USGS-tagged Merrimack River shortnose or Atlantic sturgeons are detected within the study areas during this investigation, they are to be included in the shared analyses and routine reporting. However, any non-Merrimack River tagged sturgeons or tagged non-sturgeon species detected during this investigation will require tag-owner permission for use in analyses and reports. All fish capture, handling and tagging data that is part of this cooperative investigation will be shared with cooperating Essex staff in a timely manner.

VII. Joint Tasks and Activities (optional section):

USGS biologists will participate with Essex staff in identifying orphan tags and to communicate with orphan tag owners as appropriate. Field work will largely be conducted independently by both groups, but occasions where the overall effort may benefit from direct cooperative assistance will be considered.

Data sharing shall consist of all fish capture and detection data to be shared openly between the two groups. It is appropriate during the period where sturgeons are most likely to move into the three receiver arrays in April and May that communications are shared weekly regarding (fish captures, fish capture efforts and receiver downloads). However, arrays are scheduled for deployment in difficult to reach areas and this information sharing frequency may be decreased during this demanding period as needed, provided both parties agree data sharing communications are frequent enough to provide opportunities to make sampling/monitoring adjustments based on real-time occurrences. Later in the year, routine reporting may be further decreased as conditions permit, with the agreement that all fish tagging and tag detection data will be available to both groups to generate required intellectual products such as progress and final reports, technical memoranda, oral presentations, and peer-review journal articles. Essex has also requested an opportunity to review drafts of peer review products created by USGS.

VIII. Anticipated Outcomes and Deliverables

- Telemetry data

- USGS biologists request raw data from both Innovasea and JSATs acoustic receivers at Lawrence dam site for construction of time – to – event statistical models. The only instance were pre-processed data is appropriate is with the 2-dimensional positioning array in the dam's tailrace section, where proprietary positioning algorithms (YAPS) are used, therefore resolved positions for fish entering and exiting is requested.
- Data provided should be provided in machine readable format (.csv, .txt) but depending on size database structures (SQLite, HDF5) is also acceptable.
- Time – to – event models (Cox Proportional Hazards, Multi – state models) allow researchers to model state transitions or rates of transition in relation to environmental covariates such as river discharge and temperature that vary over time.

- Results reported in the Updated Study Report (USR) – 4/26/2026

Table 1. Acoustic tags scheduled for deployment on three target sturgeon groups in the Merrimack River as part of the cooperative investigation between Essex and USGS researchers. Table shows each of the three target species/maturity groups, the number and type of acoustic transmitter selected for deployment and the institution providing the acoustic tag resources. The 25 tags listed in the Innovasea column are tags that were already released in the past 10 years. The dual tag combination column does not indicate additional tag purchases but a specific combined tag deployment method.

Sturgeon study groups	Innovasea 69 kHz tags	ATS 416.7 kHz tags	Tag provider	Dual tag combination
SNS adult	15	15	Essex	15
SNS adult		19	MADFW	
SNS adult	25		USGS	
SNS juvenile	15		Essex	
ATS adult/sub-adult	15		Essex	

Figure 1. Lower Merrimack River reach between the Essex Dam and river mouth, Essex County, Massachusetts. Blue circles show primary gill-net sampling sites for targeted sturgeon capture groups.

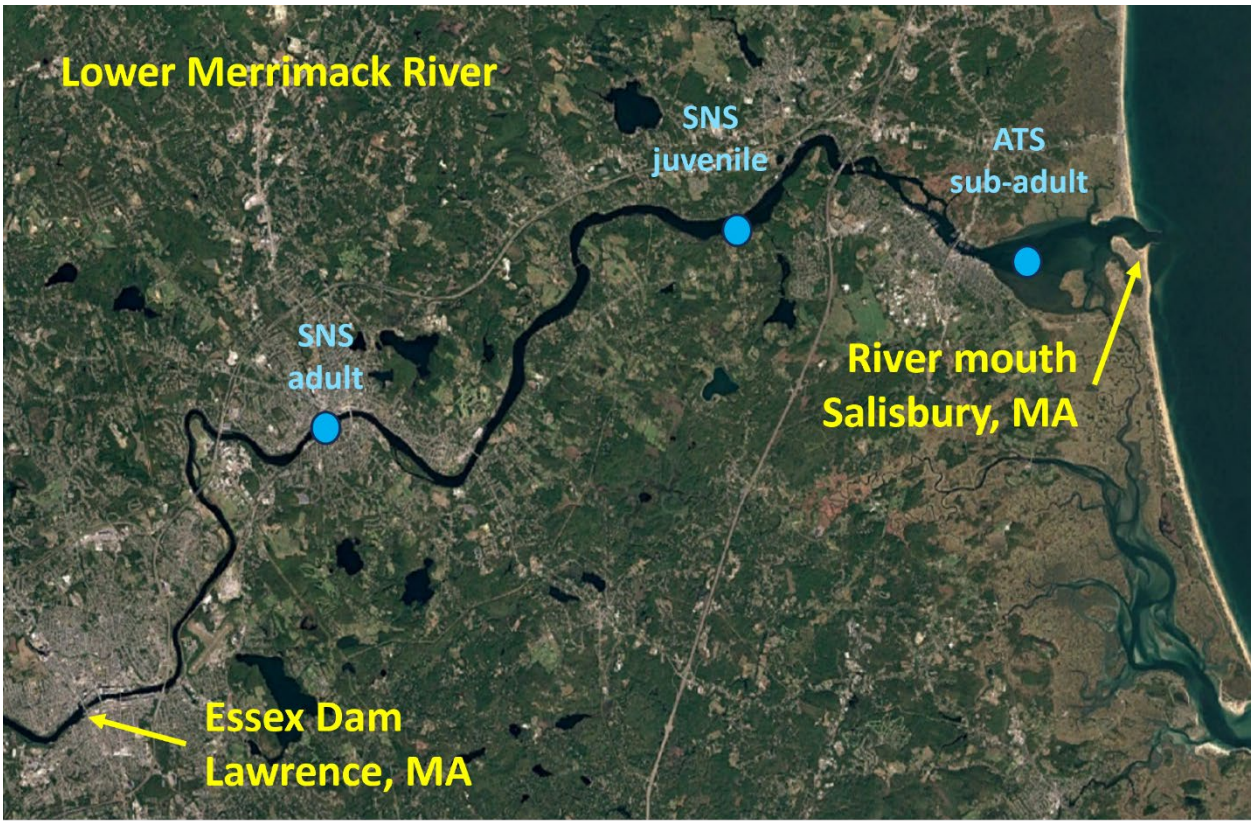


Figure 2. Acoustic receiver deployment locations at the Lawrence Hydroelectric Project (P-2800) as recommended in the FERC study plan determination.

Figure 3. Positions of USGS acoustic tag detection array receivers (yellow icons) monitoring the Merrimack River reach between the spring sturgeon tagging effort at the spawning each (blue icon) to the Essex detection array spanning the upper I-495 Bridge to the Essex Dam in Lawrence (see Figure 2).

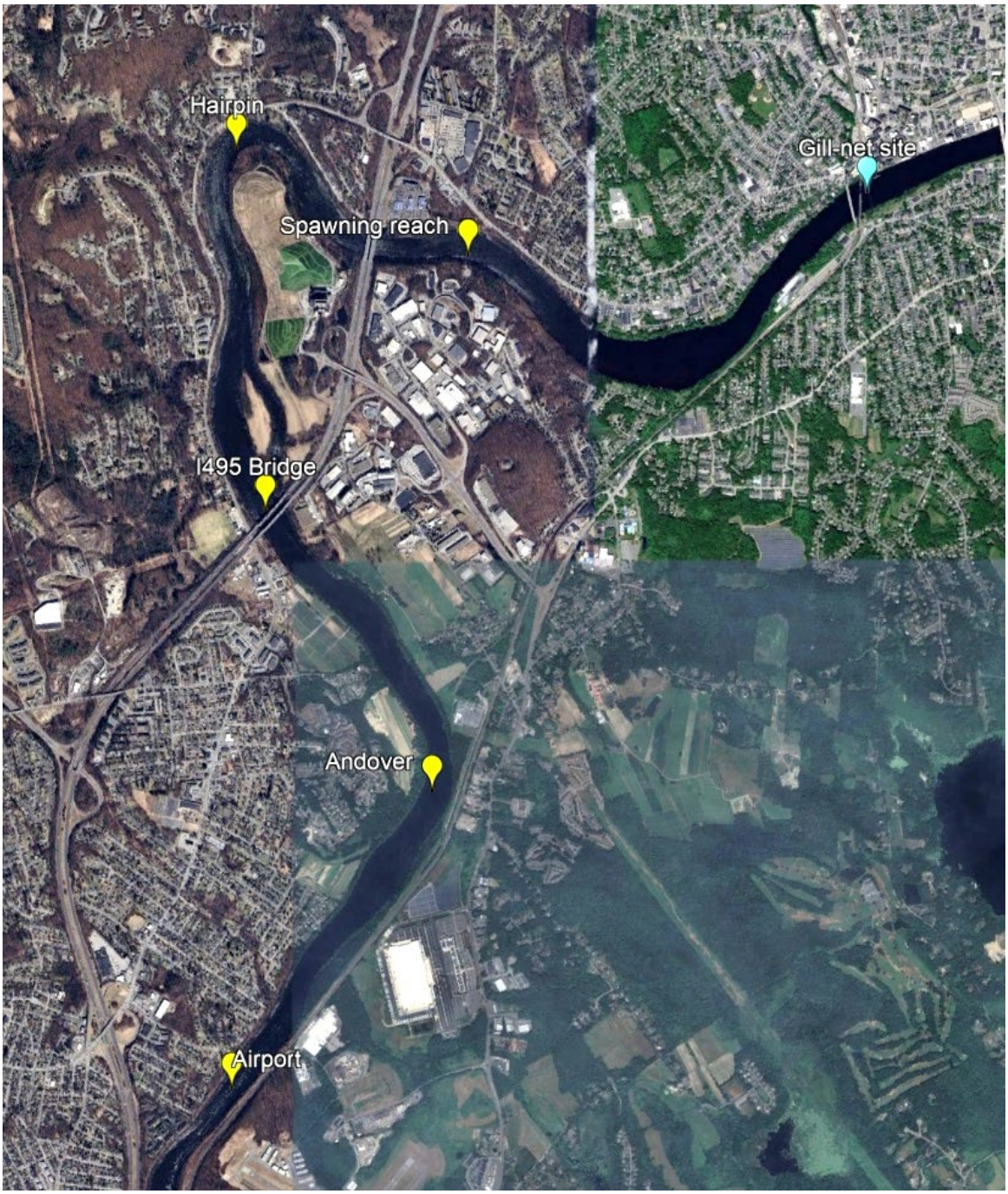
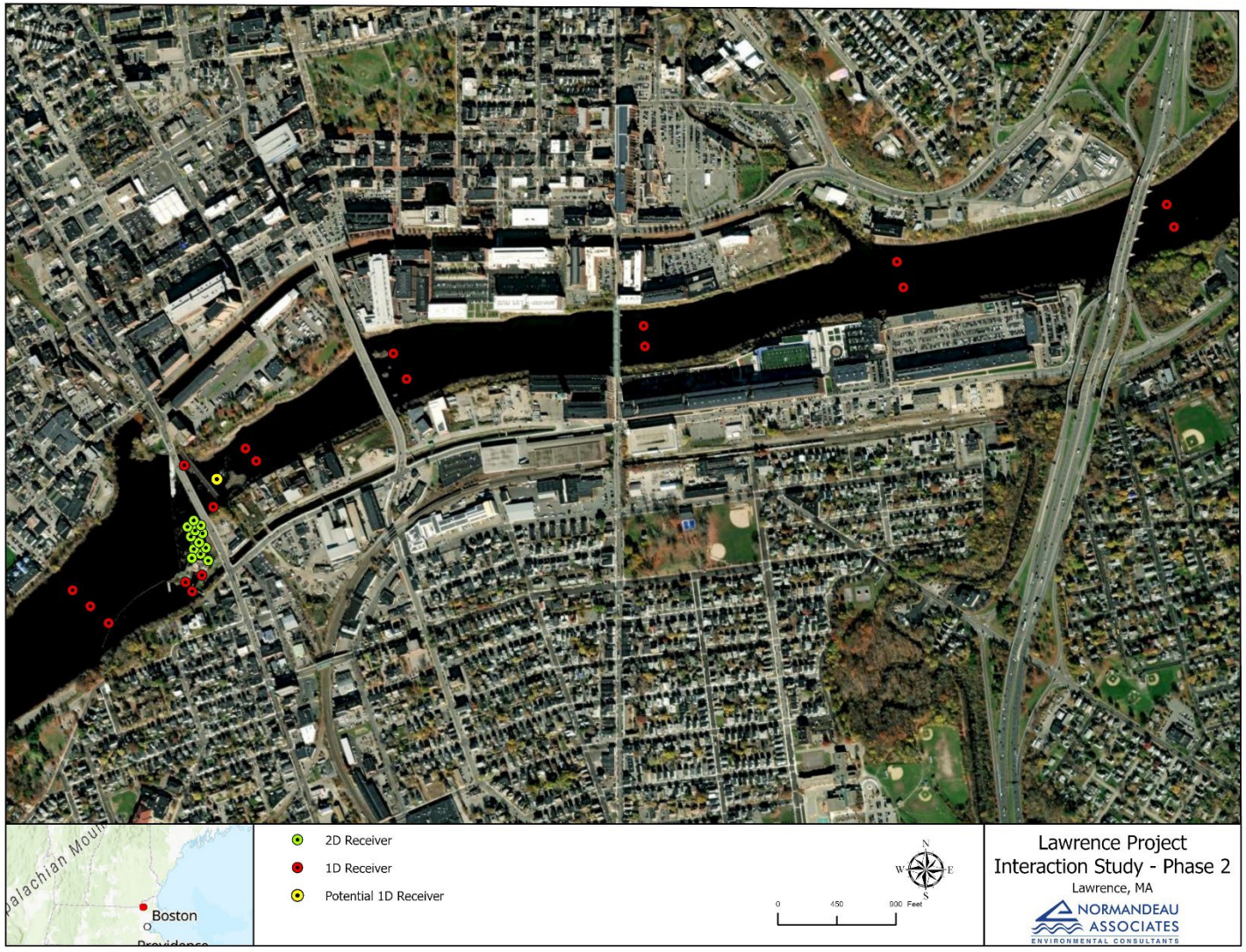


Figure 4. Positions of Essex JSATs tag detection array receivers monitoring the Merrimack River reach from the area immediately upstream of Essex Dam downstream to the I-495 Bridge in Lawrence.



Attachment E

ProFish 2022 Report

Feasibility study for the implementation of a telemetric network at the Chancy-Pougny power station with a view to monitoring the downstream movement of holobiotic fish from the Rhône.

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November 4, 2022

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A. CONTEXT AND OBJECTIVES

The Société des Forces Motrices de Chancy-Pougny (SFMCP) contacted the company Profish with the aim of determining the technical feasibility of monitoring the downstream movement of fish on the Chancy-Pougny site by telemetry. To meet this objective, our team, with numerous downstream monitoring of large structures in different countries and with different techniques, proposed to carry out field measurements. The objectives of these measurements were to determine the following:

1. Determine the monitoring tool that is best suited to carrying out this study taking into account: i) the hydro-morphological context of the Rhône and the area influenced by the power plant and the dam, ii) the biological questions posed by the operator in relation to the types of expected data.

2. Validate the detection ranges obtained with the selected tool, with the aim of subsequently being able to technically and financially dimension monitoring.

A team of 3 people therefore came to the site from October 11 to 13, 2022 to carry out this monitoring.

Figure 1 below shows the location of the study site on the Swiss route of the Geneva Rhône in downstream of Lake Geneva.

Figure 1: Geographical location of the Chancy-Pougny Dam along the Rhône, 3rd structure from Lake Geneva and the city of Geneva.

The Rhône downstream of Lake Geneva is a large river, with an average width of around a hundred meters in natural areas and up to 300 m in the Verbois dam reservoir. The depth varies but can reach more than 10 m deep near the structures. In the fastest sectors, the water speed most often exceeds 1m/s even under low flow conditions.

The data necessary to obtain for the project manager at the downstream level comes down to answering the following two fundamental questions.

- What is the distribution of fish downstream between the dam and the Chancy-Pougny power station?
- What is the distribution of fish as they pass through the different groups of the power plant?

It remains to define the biological models to target. Few data are available on downstream behavior in this section of the Rhône, as is often the case on large rivers. The downstream migration profiles of fish in these rivers have been documented in the Rhône through the doctoral thesis of Jean-Michel Olivier (1992). This work has mainly focused on fry. The daily and seasonal rhythms observed there were similar to a more recent study carried out in the Meuse in Belgium as part of another thesis which also used fish catches from cooling water intakes as a source of biological sampling (Sonny 2006). This thesis, based on 5 years of weekly catches concerned all fish species at all life stages, and highlighted the following trends:

- Spring (April-May): downstream migration of Salmonidae smolts (in low abundance in the Meuse).
- End of spring (May-June): downstream migration of post-reproductive spawners (bream, chub, roach, hotu) with high associated natural mortality for older individuals.
- Summer: drift from larval and juvenile stages.
- Autumn: massive drift of 0+ cyprins (roach, bleak, chub, hotu, barbel) during the bursts of water followed by predators (perch, perch, trout).

The main sources of information in the Geneva Rhône reside in fish counting and catch data in the Chancy-Pougny and Verbois fishways. Video counting monitoring has been carried out in the past by the FISHLAB office on the Chancy-Pougny, Verbois and Seujet sites on the Geneva Rhône. The corresponding reports are available on the SIG report download platform.

Among the numerous species recorded, some are known in the scientific literature to carry out downstream migrations following the spring breeding migration. This is the case of the barbel and the hotu (Ovidio et al. 2007, Panchan et al. 2022) for which we observe for certain individuals a fidelity to the egg-laying site over several years, with a return to the starting habitat after the reproduction. This type of behavior has also been observed in the Rhine based on repetitive detection profiles of certain fish several years in a row in the same fishway (EDF Rhine study in progress, personal communication).

It is therefore on the basis of fish migration profiles in the Rhône passes, combined with a good knowledge of the scientific literature linked to these species, that it seems most appropriate to select the biological models to follow in the framework of this study. This aspect is not the subject of this study.

B. CHOICE OF CONSIDERED MONITORING TECHNOLOGIES

1. Acoustic telemetry

Based on the hydromorphological conditions cited above, our first monitoring scenario focuses on the use of acoustic telemetry to carry out this monitoring. The acoustic telemetry system consists of three distinct parts: **(1)** a transmitting unit (transmitter), **(2)** a receiving unit (hydrophone) and **(3)** data reading software.

The transmitter unit is an acoustic active transmitter operated using an internal battery, which emits a signal in the ultrasonic range. It has an emission period of a few seconds to several minutes depending on the model. Their autonomy is between a few days and several years and depends
of the issue period. This transmitter must be implanted into the fish surgically.

Ultrasonic signals have the particularity of being effectively propagated in water but are not detectable outside of water. For this reason, hydrophone receivers must also be underwater to detect them.

The most commonly used systems in fish ecology operate at a frequency of 69 KHz, operated by several suppliers. In this frequency, many references indicate ranges of several hundred meters in a marine environment, in a lake or in calm areas of a large river. As soon as we approach a structure where the water will accelerate or a noisy structure (recurring passage of a boat, a sheet of water on a dam, a hydroelectric power station, etc.), the hydrophones lose their ability to detect signals in this frequency. This has been demonstrated in our past studies on the Meuse and the Seine, directly upstream of dams equipped with hydroelectric power stations. No signal could be detected by the hydrophones when they were placed less than 50 m from the structures (Sonny & Roy 2017, Beguin et al. 2018).

Other technologies work on higher ultrasound frequencies precisely with the aim of optimizing detection ranges near dams and hydroelectric power stations. The American supplier INNOVASEA (VEMCO) offers a telemetry range operating at 180 kHz.
Also in the USA, JSATS (Juvenile Salmonid Acoustic Telemetry System) technology was developed by 2 public laboratories for large-scale studies of the downstream migration of salmon smolts in the American West. This patented technology is now marketed by two North American suppliers
franchisees: LOTEK and ATS. The two companies have developed and marketed their own equipment operating at the frequency of 416.7 kHz.

During previous tests in Meuse and Seine, our team was able to see that the two technologies, VEMCO 180 kHz and LOTEK 416 kHz, indicated similar detection ranges. Since then, our team has favored LOTEK 416 kHz technology given the cost difference between the two suppliers, with equivalent performance. Since these tests, Profish is equipped with more than 100 LOTEK hydrophones, and more recently with around ten ATS hydrophones, the two technologies being compatible in JSATS frequency. These hydrophones have been used on a large scale routinely on a total of 7 dam-powerhouse-lock complexes on the Meuse and the Seine for 5 years.

This equipment having already demonstrated its performance for several years, our first approach consists of implementing this technology on the Chancy-Pougny site. However, the current speeds in the water intake and the main course of the Rhône are higher, and we know that the range of this equipment is reduced with the increase in the background noise generated by the friction of the particles. water on the hull of the hydrophones during heavy water. Furthermore, the range of the equipment, but also the background noise detected by the hydrophone, particularly in the form of ghost detections, can vary depending on the morphology of the civil engineering specific to each site. The feasibility of using JSAT technology on this site therefore had to be validated by an on-site measurement phase.

2. Radio telemetry

Radio telemetry follows the same operating principle as acoustic telemetry. Transmitters emit signals with a defined period over a longer or shorter duration depending on their built-in battery. The signals emitted are in the radio wave range. These waves are detected by radio receivers via antennas. The particularity of radio signals means that they propagate in water but also in the air, which offers the possibility of detecting fish via aerial and underwater antennas, whose ranges are different. Aerial signals are, however, limited by the depth of the emitting source and the conductivity of the water. For classic conductivities of large rivers (200 to 600

µSi), we can assume that radio signals emitted at a depth of more than 4 to 6 m will not be detected by aerial antennas. Underwater antennas have different ranges depending on their design and the frequencies used, but we can expect optimal ranges of less than 10 m in general.

In the event that JSATS acoustic telemetry is not satisfactory, the second variant would consist of using radio telemetry. Our teams have been using this technique successfully on large hydroelectric works for around ten years, and we know from experience that it is possible to use it to discriminate the passage of fish between each group using underwater antennas. marines.
On the other hand, it is undoubtedly less likely that the radio will work to detect the passage of fish in the feed canal, in the reservoir and the main course of the Rhône due to their great depth.

A third possible theoretical variant can use the two techniques combined by carrying out double marking of fish: acoustic for movements in the river, the reservoir and the inflow canal and radio in the water intakes.

Our approach during the field measurement phase therefore follows the following strategy:

1) Range test of JSATS acoustic telemetry on the different organs studied.
2) Protea test of radio telemetry if the acoustic measurements are not satisfactory.

C. ACOUSTIC MEASUREMENT CAMPAIGN

1. Equipment used and deployment methods

The acoustic measurement campaign began on the first day in the field on October 11, 2022. The areas a priori most limiting in terms of acoustic detection were tested as a priority in order to be able to evolve the tests towards radio technology if necessary without having to start again the entire protocol.
Successively, the order of the zones to be probed was: the water intakes of the groups, the intake channel, the upstream zone of the reservoir, the zone upstream of the dam gates, a downstream zone of the dam.

The transmitters used were LOTEK brand, model L-AMT-8.2, size 23 x 9 x 9 mm for 3.5 g in the air, emitting every 3 seconds (Figure 2).

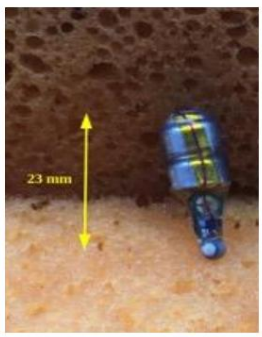

Figure 2: JSATS L-AMT-8.2 B acoustic transmitter

The receiving unit is a hydrophone **(Figure** 3). This must be submerged in order to detect the transmitters.
Three different models were used: the WHS 4250 from LOTEK, the SR3001 from ATS and the SR3017, a wired model from ATS (Figure 3).

Figure 3: ATS hydrophone (SR3001 on the left and SR3017 in the middle) and Lotek WHS 4250 hydrophone to the right. The reference rule is 30 cm.

The LOTEK 4250 hydrophones are autonomous, with an integrated battery for an autonomy of 6 months, they store the recorded data on an internal SD card. The same principle governs the ATS SR3001 hydrophone, but its autonomy is 6 weeks. On the other hand, the ATS SR3017 hydrophone has the particularity of having the detection probe decoupled from the electronics and storage via a cable, which allows direct access to the data and a continuous 12V power supply.

Based on recent tests carried out in the Seine, Meuse and Allier, we noted that the ATS hydrophones had much greater ranges than the LOTEK hydrophones, up to 4 times greater. However, there is no difference in range between the two ATS models. Therefore, the combination of these two technologies on large sites opens up interesting prospects.

The table below shows the ID and model of the hydrophones used.

Table 1: ID and model of hydrophones used for range testing.

ID	Model
L 014-993-995-996-997-999	Lotek WHS4250
A 118	ATS SR3001
A 083 - 111	ATS SR3017

The transmitters are placed in a piece of polyethylene tubing so that the transmitters are protected from impact, held horizontal underwater (as it would be in a fish) and with the transmitter tip in contact with the water free **(Figure** 4).

Figure 4: view of a transmitter installed horizontally in a plastic protective tube.

The piece of tube is attached to a thin weighted rope. **2 to 3 transmitters were used depending on depth.** For the tests upstream of the power plant groups, 3 depths were tested. For the other tests, 2 depths were tested. The transmitters are immersed for 7 minutes in order to have **at least**
least 5 minutes of complete detection per test.

The references of the issuers are as follows:

- 0B83: transmitter close to the surface (1 m below the surface)
- 39D2: transmitter at mid depth (5 m above the bottom (test 1-9) / 2 m above the bottom (test 10-18))
- 4B12: transmitter close to the bottom. (1 m above the bottom (test 1-9) / on the bottom (test 10-18))

Acoustic telemetry is quite sensitive to local environmental conditions: wind and the passage of boats can disrupt the detection of transmitters by hydrophones. Boat detection tests were carried out with the boat engine turned off.

The purpose of the tests is to define the detection ranges by studying the detection rate as a function of the distance from the hydrophone. The detection rate is the ratio of the **number of detections recorded** by a hydrophone to the **number of transmissions from a transmitter** during a given period. The detection rate is calculated as follows:

$$\text{It is} \qquad (\%) = \frac{\text{It is}}{\text{'It is}}$$

A relatively high detection rate indicates that the detection of the transmitter, and therefore of the fish potential, is correct. However, it is not necessary to have a detection rate close to 100% since **only a few detections are enough to identify the passage of a fish. Indeed with a short emission period (as is the case here with 3 seconds), even a low detection rate**
will make it possible to obtain a sufficient number of detections for the study of passageways.

2. Span test in the feed channel and group water intakes (Day 1)

Each group of the power plant is supplied by two separate water intakes 6 m wide and 11 m deep. The first tests were carried out at the right channel of Group 2 and the left channel of Group 3 **(Figure** 5.) The two Groups were running at 100 m3 /s during this test, or approximately 77% of their capacity.
Along the wall of each of its channels, a LOTEK WHS4250 hydrophone and an ATS SR3017 hydrophone head were attached to a rope, all suspended from the groups' guardrail, ballasted by a weight made up of a piece of 40 kg railway rail **(Figure** 6). The two hydrophones were positioned to have their detector heads at 1 m depth.

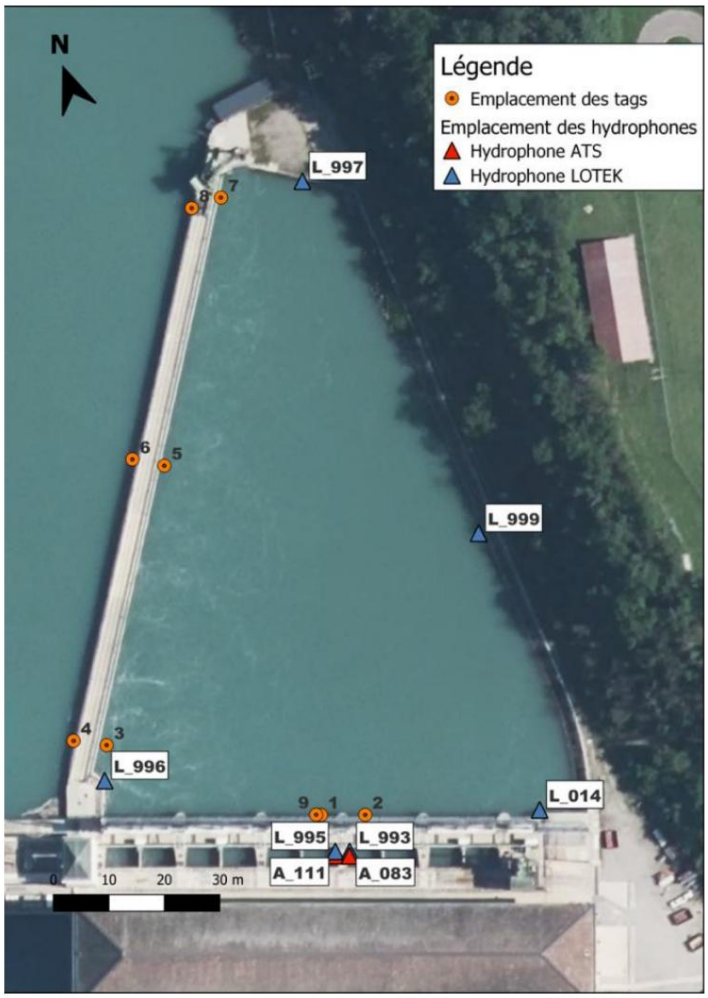

Figure 5: satellite view of the positions of the LOTEK (L_994-999) and ATS (A_111 and A_083) hydrophones during tests 1 to 9.

Figure 6: Positioning of the LOTEK and ATS hydrophones on a double rope stretched by a piece of railway rail, along the wall of groups 2 and 3.

The first tests 1 and 2 consisted of determining the detection capabilities of the ATS and LOTEK hydrophones in the water intakes, as well as verifying that the network's ability to discriminate the presence of a fish in the water intake undoubtedly in relation to the neighboring water intake. Although the transmitters were held by a rope from the gangway above the groups, the current carried the rope towards the groups, so that the transmitters were well within each channel. Tests 3 to 8 analyzed the detection rates of the hydrophones deployed for different fixed positions of the transmitters at the periphery of the inflow channel. Finally, test 9 was identical to test 1, but with Group 3 at full power. THE

Table 2 below presents the results for the 3 transmitters used.

Surface transmitter (0B83)

test n°	1	2	3	4	5	6	7	8	9
L_014	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
L_993	0,00	0,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00
L_995	0,03	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,03
L_996	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
L_997	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
L_999	0,00	0,23	0,00	0,00	0,00	0,00	0,00	0,00	0,00
A_083	0,00	0,6	0,00	0,00	0,00	0,00	0,00	0,00	0,00
A_111	0,63	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,84

Mid-depth transmitter (39D2)

test n°	1	2	3	4	5	6	7	8	9
L_014	0,00	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,00
L_993	0,00	0,19	0,00	0,00	0,00	0,00	0,00	0,00	0,00
L_995	0,06	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,05
L_996	0,00	0,00	0,22	0,00	0,00	0,00	0,00	0,00	0,00
L_997	0,00	0,00	0,00	0,00	0,00	0,00	0,04	0,00	0,00
L_999	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
A_083	0,00	0,7	0,00	0,00	0,00	0,00	0,00	0,00	0,00
A_111	0,97	0,00	0,00	0,00	0,30	0,00	0,40	0,00	0,95

Bottom transmitter (4B12).

test n°	1	2	3	4	5	6	7	8	9
L_014	0,00	0,00	0,01	0,00	0,00	0,00	0,00	0,00	0,00
L_993	0,00	0,16	0,00	0,00	0,00	0,00	0,00	0,00	0,00
L_995	0,04	0,00	0,00	0,00	0,00	0,00	0,00	0,00	0,00
L_996	0,00	0,00	0,30	0,00	0,00	0,00	0,00	0,00	0,00
L_997	0,00	0,00	0,00	0,00	0,00	0,00	0,11	0,00	0,00
L_999	0,00	0,00	0,00	0,00	0,01	0,00	0,00	0,00	0,00
A_083	0,00	0,73	0,00	0,00	0,00	0,00	0,00	0,00	0,00
A_111	0,95	0,00	0,00	0,00	0,00	0,00	0,01	0,00	0,77

Table 2: detection rate (%/5min) of surface, mid-depth and bottom transmitters deployed during the 9 locations tested in fixed position, recorded by the different hydrophones deployed.

Tests 1 and 2 indicate that in water intakes, LOTEK hydrophones have low detection rates (3-19%) compared to ATS hydrophones which detect, depending on the depths tested, from 60 to 97% of the signals emitted. . Tests 1 and 2 also indicate that signals emitted in one water intake are not detected in the neighboring water intake. Finally, among the other hydrophones deployed in the headrace, only the LOTEK 999 hydrophone detected 23% of the surface transmitter during test 2.

Tests 3-4, 5-6 and 7-8 were carried out along the coarse grid plane at the end, middle and beginning of the grid plane, odd tests on the intake canal side and even tests on the reservoir side of the dam. During these tests, the surface transmitter was most often out of the water, so it was never detected by the hydrophones.

We note that positions 4, 6 and 8, on the reservoir side, are not detected by any hydrophone, unlike positions 3, 5 and 7, which are weakly detected by the majority of hydrophones but only occasionally. It is at position 7 at mid-depth that signals are best detected by the hydrophones in the headrace and water intakes, but with maximum detection rates of 40% by an ATS hydrophone.

Finally, test 9 is identical to test 1 on the position, but with Group 3 pushed to 100% of its capacities, i.e. 130 m3 /s. There is good consistency with the results of test 1, except for the background transmitter which is not detected by the LOTEK hydrophone of the water intake concerned. We noted that the full-throttle current speed drove the emitter wire more strongly, and it is possible that the background emitter was driven close to or even beyond the grid plane during this test.

The compilation of these first data indicates the following hypotheses:

1. Hydrophones placed in water intakes should make it possible to discriminate the group taken when a fish passes. This is especially true since it is likely that the fish will stay for several minutes in front of the grid plane before possibly passing through. Measurements do not indicate apparent confusion between Groups when signals are emitted from inside the water intake.

2. Signals emitted along the plane of coarse grids outside the headrace are not detected by hydrophones located in the headrace and water intakes. It is possible that the steel veil and the grid plane act as acoustic shielding between the reservoir and the water intake.

3. The signals emitted along the coarse grid plane on the headwater channel side are weakly detected by the various hydrophones deployed in the headwater channel and in the water intake. A fish drifting in the headrace could be heard by all hydrophones leading to possible confusion about its position within the headrace. However, this confusion can be resolved to the extent that the detection profiles change radically when the signals enter the water intakes.

4. Depending on the type of hydrophone used in the design, it appears feasible to deploy a telemetric network making it possible to discriminate the presence of a fish in the reservoir, in the inflow channel and in the water intakes of each group .

3. Range tests in the reservoir (day 2).

On the second day in the field, we redesigned the hydrophone network in order to characterize the detection ranges in the reservoir *versus* the headwater channel. Two hydrophones (LOTEK_014 and ATS_118) were installed on a dead body approximately 400 m upstream of the dam, opposite a launching slipway located on the right bank. This position corresponds to a plausible area for installing a control point for a downstream slope approaching the structure. Tests 10 to 14 **(Figure** 7) were carried out at a fixed point in order to cross-reference the detections of these two hydrophones with 4 hydrophones still installed in the inflow channel.

(L_996-997-999 and A_111) as well as two hydrophones installed to the right of the piers of valves 1 and 2 (L_995 and L_993).

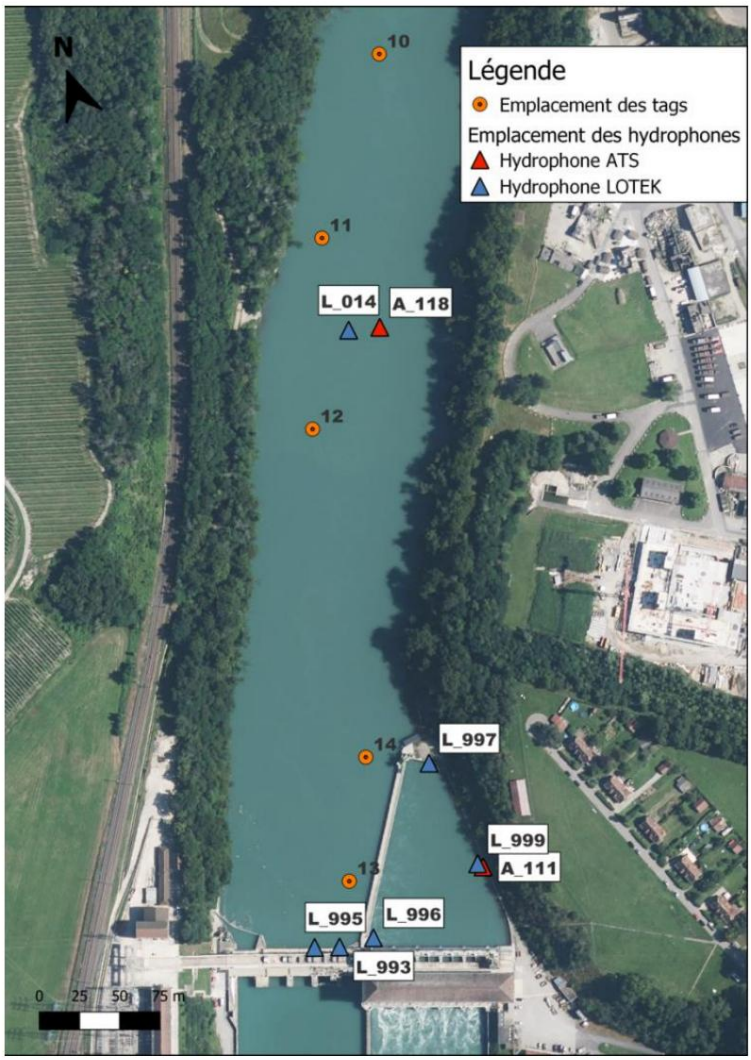

Figure 7: Satellite view of the deployed hydrophones and the positions of the tests carried out at a fixed point in the reservoir.

For these tests, only 2 transmitters were used, one near the bottom (4B12), the second 2 m above from the bottom (39D2). The flow rate of the Rhône at the time of the tests was 300 m3 /s The results of these different tests are presented in the tables below.

Transmitter 2 m above the bottom

test n°	10	11	12	13	14
14	0,04	0,50	0,02	0,00	0,00
993	0,00	0,00	0,00	0,00	0,00
995	0,00	0,00	0,00	0,88	0,25
996	0,00	0,00	0,00	0,02	0,00
997	0,00	0,00	0,00	0,00	0,12
999	0,00	0,00	0,00	0,01	0,00
ATS_SR22111	0,00	0,00	0,00	0,00	0,00
ATS_SR22118	0,55	1,00	0,65	0,00	0,05

Transmitter on the bottom

test n°	10	11	12	13	14
L_014	0,04	0,60	0,00	0,00	0,00
L_993	0,00	0,00	0,00	0,00	0,00
L_995	0,00	0,00	0,00	0,24	0,58
L_996	0,00	0,00	0,00	0,03	0,00
L_997	0,00	0,00	0,00	0,00	0,04
L_999	0,00	0,00	0,00	0,00	0,00
A_111	0,00	0,00	0,00	0,00	0,00
A_118	0,81	1,00	0,87	0,02	0,01

Table 3: detection rate (%/5min) of surface, mid-depth and bottom transmitters deployed during locations 10 to 14 tested in fixed position, recorded by the different hydrophones deployed.

Position 10, located 180m upstream of hydrophones L_014 and A_118, is detected by the two hydrophones at both emission depths. Detection is optimal in position 11, approximately 70m upstream of the hydrophones. In position 12, 60m downstream, the A_118 hydrophone still detects the signal emitted by the two transmitters very well, but the L_014 loses the signal from the bottom transmitter. During these 3 tests centered on the upstream station of the reservoir, no other installed hydrophone (headrace canal or dam) detected a signal.

Positions 13 and 14 were located near the coarse grid plane. On the headwater channel side, the hydrophone L_997, in the upstream zone of the headwater channel, weakly detected position 14 but not position 13, while the hydrophone L_999 only weakly detected position 13. A_111, at the same location, did not detect anything despite the better performance normally expected from ATS hydrophones. Finally, the L_996 hydrophone detected the closer position 13, but not position 14. On the reservoir side, the hydrophones of the dam detected the positions differently. The L_993 hydrophone did not detect anything while its neighbor the L_995 hydrophone detected the two transmitters in both positions very correctly. The difference in performance between these two hydrophones can potentially be explained by possible ice jams on the bottom affecting the detection capacity of the L_993.

Conclusion for these tests:

1) A station deployed upstream makes it possible to discriminate, without overlap, the entry of a fish into the study system. This information is valuable in interpreting fish behavior.

2) Contrary to the hypothesis formulated on the basis of the first day's tests, signals emitted in the reservoir can be weakly detected in the water intake, even at great distances, however with low detection rates.

4. Detection of moving trajectories in the reservoir (Day 2)

With the same network deployed in the reservoir and the water intake, we also carried out boat drifts, with the engine stopped, to simulate the approach of downstream fish following current speeds (Figure 8). The flow of the Rhône in the reservoir was 220 m3 /s during the two drifts.

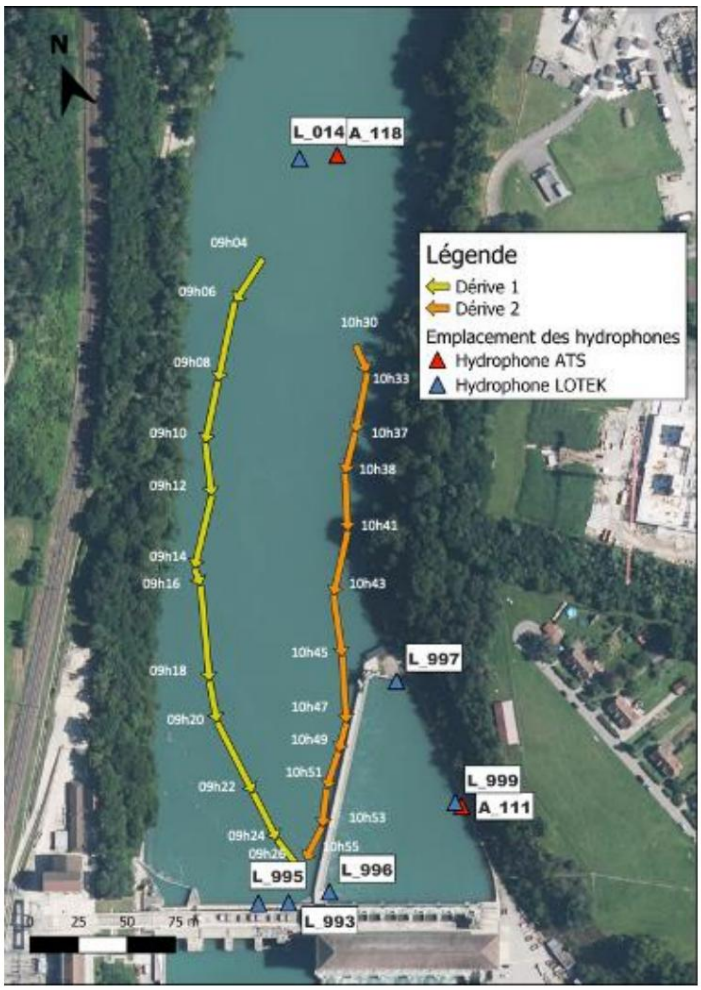

Figure 8: satellite view of the two passive drifts carried out in the reservoir with two active transmitters, within the deployed network. Times are expressed in UT0.

Drift 1 – Retained zone

The detection profiles of the network deployed in the reservoir during drift 1 are presented in the table below.

Table 4: detection rates observed by the different hydrophones installed in the reservoir with one transmitter near the bottom (4B12) and one 2 m above the bottom (39D2). Times are expressed in UT0.

DRIFT 1 (Right Bank) – RETAIL									
39D2	L_014	A_118	L_995	L_993	**4B12**	L_014	A_118	L_995	L_993
09h04		15,0%			09h04	7.5%	17.5%		
09h06	2.5%	80,0%			09h06		92.5%		
09h08		62,5%			09h08		80.0%		
09h10		45,0%			09h10		35.0%		
09h12		2,5%			09h12		45.0 % 5 0%		
09h14		5,0%			09h14		35.0%	5,0%	
09h16		32,5%			09h16		5.0%		
09h18		30,0%	2,5%		09h18		5.0%	25,0%	
09h20		15,0%	17,5%		09h20		2.5%	57,5%	
09h22		0,0%	62,5%		09h22			87,5%	
09h24		0,0%	40,0%		09h24			55,0%	
09h26		5,0%			09h26				

For the preflight hydrophones, the LOTEK_014 weakly detects the start of drift 1 for each transmitter, while the ATS_118 hydrophone detects almost all of the drift for each transmitter, but with a decreasing detection rate. The bottom transmitter is lost about 70 m upstream of the dam, while the open water transmitter is detected up to the dam with very weak detections.

For the barrage hydrophones (LOTEK_995 and 993), we first notice that the L_993 did not detect any signal. The operation of the hydrophone was checked and was normal, so it seems that an external factor prevented this hydrophone from detecting (bottom ice jam, etc.). The L_995 detects the bottom transmitter weakly from 200 m upstream of the dam, and the full-water transmitter approximately 110 m upstream of the dam. Both transmitters were detected with an increasing detection rate as they approached the dam.

Drift 1: inlet canal zone.

The Table below presents the detection profiles of the hydrophones deployed in the headrace during drift 1.

Table 5: detection rates observed by the different hydrophones installed in the inflow channel with one transmitter near the bottom (4B12) and one 2 m above the bottom (39D2). The time is expressed in UT0.

DRIFT 1 (Right Bank) - SUPPLY CANAL									
39D2	L_996	L_997	L_999	A_111	4B12	L_996	L_997	L_999	A_111
09h04					09h04				
09h06					09h06				
09h08					09h08				
09h10					09h10				
09h12					09h12				
09h14					09h14				
09h16					09h16				
09h18					09h18				
09h20					09h20				
09h22					09h22				2.5%
09h24					09h24				
09h26	2.5%				09h26				

The table indicates that the reservoir's hydrophones detected almost no signal. Only hydrophones A_111 and L_996 detected a single signal, which in itself is not sufficient to validate the presence of a fish.

Drift 2: retained area

Table 6 below presents the detection rates of the different hydrophones deployed in the retained during Drift 2.

Table 6: detection rates observed by the different hydrophones installed in the reservoir with one transmitter near the bottom (4B12) and one 2 m above the bottom (39D2). The time is expressed in UT0.

DRIFT 2 (Left Bank) – RESTRAINT									
39D2	L_014	A_118	L_995	L_993	**4B12**	L_014	A_118	L_995	L_993
10:30 a.m		8.3%			10:30 a.m		41.7%		
10h33		17.5%			10h33	1.3%	42.5%		
10h37		10.0%			10h37		10.0%		
10h38		31.7%			10h38		50.0%		
10h41		15.0%			10h41		17.5%	10.0%	
10h43		27.5%			10h43		47.5%		
10h45		27.5%			10h45		22.5%	2.5%	
10h47		37.5%	5.0%		10h47		10.0%	10.0%	
10h49		57.5%	5.0%		10h49		15.0%	40.0%	
10h51		30.0%	20.0%		10h51		10.0%	47.5%	
10h53		27.5%	40.0%		10h53			37.5%	
10h55					10h55				

Only the ATS_118 hydrophone of the upstream station detects the complete drift of the two transmitters, its neighboring hydrophone L_014 detecting an isolated signal at the start of the drift. At the dam, the LOTEK_995 detects approaching transmitters from a distance of approximately 100 m upstream for the open water transmitter and approximately 200 m for the bottom transmitter. Detection rates increase as you get closer to the dam to reach > 40% detection within 50 m upstream of the dam.

Drift 2: inlet channel area

Table 7 below presents the detection rates of the different hydrophones deployed in the
retained during Drift 2.

Table 7: detection rates observed by the different hydrophones installed in the inflow channel with one transmitter near the bottom (4B12) and one 2 m above the bottom (39D2). The time is expressed in UT0.

DERIVE 2 (Rive Gauche) - CANAL AMENEE									
39D2	L_996	L_997	L_999	A_111	4B12	L_996	L_997	L_999	A_111
10:30 a.m					10:30 a.m				
10h33					10h33				
10h37					10h37				
10h38					10h38				
10h41					10h41				
10h43					10h43				
10h45					10h45				
10h47		7.5%			10h47				10.0%
10h49					10h49				2.5%
10h51					10h51				2.5%
10h53					10h53	2.5%			7.5%
10h55					10h55				5.0%

The hydrophones in the headwater canal generally detected very little of the second drift. The hydrophone A_111, however, detected the background transmitter during the period when the drift was along the coarse grid plane, while its neighbor L_999 did not detect it.

Conclusions for drift 1 and 2:

The network deployed in the reservoir makes it possible to validate a progressive approach of a fish towards the dam. The ATS hydrophone at the upstream station detects almost the entire drift up to the dam, while the LOTEK hydrophone at this station has a more limited range. The LOTEK hydrophones deployed at the dam seem to easily cover the entire area of the reservoir located to the right of the headrace canal. In the intake channel, we see that the drifts in the reservoir are almost not detected, except by the ATS_111 hydrophone which detected the presence of a transmitter beyond the coarse grid plane. It is established and further verified here that the range of ATS is greater than for LOTEK hydrophones.

5. Span tests at the reservoir-headrace interface (day 2)

The latest tests carried out on the site focused on the interface zone between the dam and the intake channel, by adding an ATS_083 hydrophone on the right bank of the reservoir, close to the water intake of the fish pass **(Figure** 9). Only 2 transmitters were used during these tests, a transmitter near the bottom (4B12) and a transmitter approximately 2 m above the bottom (39D2). The flow rate of the Rhône was 220 m3 / s during this test. The tables below show the observed detection rates.

Figure 89: aerial view of the network and the positions tested at the dam-feeder canal interface.

Table 8: detection rate of the bottom transmitters (4B12) and 2 m from the bottom (39D2) during tests 15 to 17 with the deployed network presented in Figure 8.

	39D2				**4B12**		
Test N°	15	16	17	Test N°	15	16	17
L_993	0.11	0.00	0.02	L_993	0.56	0.00	0.00
L_995	0.07	0.33	0.25	L_995	0.32	0.00	0.19
L_996	0.00	0.22	0.18	L_996	0.00	0.10	0.07
L_997	0.00	0.01	0.01	L_997	0.00	0.13	0.03
L_999	0.00	0.02	0.00	L_999	0.00	0.00	0.00
ATS_083	0.12	0.00	0.02	ATS_SR19083	0.24	0.00	0.00
ATS_111	0.00	0.00	0.16	ATS_SR22111	0.00	0.06	0.03
ATS_118	0.00	0.00	0.00	ATS_SR22118	0.00	0.00	0.00

In position no. 15, flush with the coarse grids, on the reservoir side, the transmitters are detected by all the hydrophones on the dam side (LOTEK and ATS), but by no hydrophone on the intake channel. In position No. 16, 5 m downstream of the coarse grids in the headwater canal, the transmitters are detected mainly by the hydrophones of the headwater canal, partially by the hydrophones of the dam but not by the hydrophone on the right bank of the headwaters. restraint. In position no. 17, still in the feed channel but closest to the coarse grid plane, the signals are detected by 2 of the 3 hydrophones in the feed channel, the L_999 no longer detecting the signal. On the reservoir side, the hydrophones of the dam weakly detect the signals, as does the hydrophone located on the right bank. Finally, the ATS hydrophone at the upstream station did not detected no signal during these tests.

Conclusions for the dam/feeder canal interface zone : the data from the deployed network indicate a fairly clear separation of positions outside and inside the feeder canal. The coarse grid plane and the steel mask wall again seem to play an acoustic shielding role reducing the risk of signal overlap between these areas.

6. Range test on a downstream dam station (day 2)

As a final test, we went near the Pougny bridge, approximately 2 km downstream from the site, to validate the possibility of detecting the signals in the open river. This zone precedes a threshold, which results in a retention effect which makes the river more conducive to the good propagation of signals (Figure 10).
At this location, the width of the Rhône is approximately 100 m, the apparent current speed seems high. The flow rate at the time of testing was 220 m3 /s.

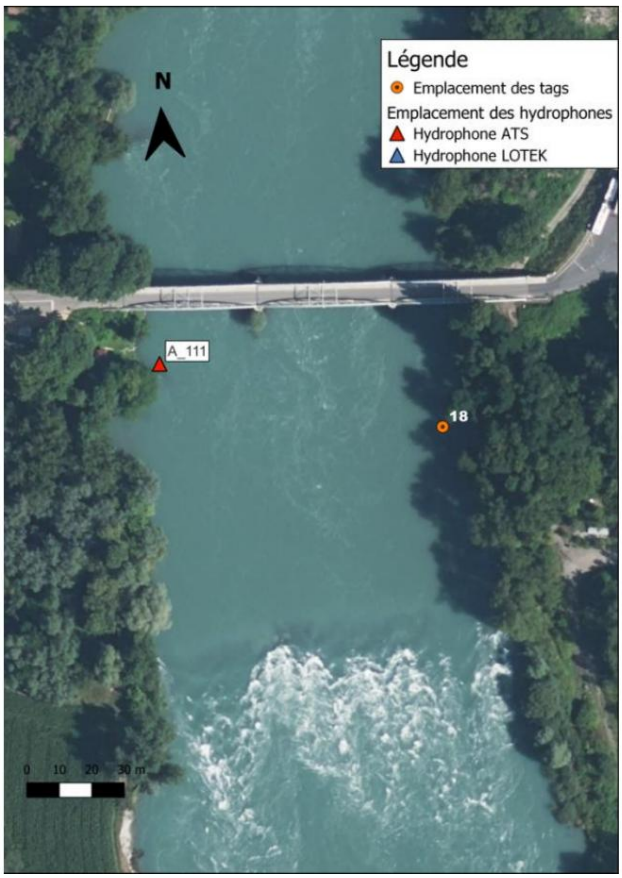

Figure 10: satellite view of the downstream area tested, bounded by the Chancy-Pougny bridge and a rock threshold.

The deployment of the transmitters was similar to previous tests, one transmitter near the bottom (4B12) and one transmitter 2 m above the bottom (39D2). The latter was close to the air-water interface at the location tested. Only the 4B12 transmitter was detected with a detection rate of 4% over a period of 5 min, i.e. a fairly low detection rate.

Conclusion for the downstream test : ATS long-range hydrophones cover the width of the river, but with a low detection rate. A downstream station must therefore be equipped with several hydrophones to be able to guarantee better signal coverage, but the technique remains validated also for this downstream station.

D. SUMMARY AND CONCLUSIONS

The various tests carried out over two days on the Chancy-Pougny site confirmed the choice of JSATS acoustic telemetry to study the downstream movement of fish to the right of this structure. We mainly note the following points:

1) The LOTEK and ATS hydrophones used during these tests indicate different detection ranges, with ranges and detection rates increased tenfold for the ATS compared to the LOTEK. This confirms trends already observed in past studies. These differences in scope can be exploited as an opportunity to build a network that best responds to the biological variables of interest.

2) The detection of signals in the water intakes of the groups is straightforward and is limited to the instrumented water intake. These detections validate the ability to discriminate the passage route of fish through the different groups of the plant.

3) Signals emitted within the headrace can be detected by both the intake and headwater hydrophones. However, the detection profiles remain quite clear and the overlapping zones between these two zones are limited by an apparent acoustic shielding effect played by the coarse grid plane.

4) In the middle of the Rhône downstream, at the level of the Chancy-Pougny Bridge, it is possible to deploy a detection station which confirms the downstream movement of fish through the dam/power station.

It is now up to the operator to define its specifications more precisely in order to be able to develop a complete protocol. Certain important aspects are not addressed in this study, for which the operator must provide additional information. Especially :

- Capturing and marking fish
- Desirable detected numbers
- Target species
- Monitoring period (seasons/years)
- Degree of behavioral precision (presence/absence *versus* 2D)

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Attachment F

Visitor Intercept Survey

2025 VISITOR-INTERCEPT RECREATION SURVEY

Lawrence Hydroelectric Project (FERC No. 2800)

Survey Technician: _____

Recreation Site: _____ Date: ____/_____/_____ Time: _____ AM/PM

Would you mind answering some survey questions? We anticipate this survey will take approximately 10 to 15 minutes. The information you provide will help guide current and future management of recreation opportunities, sites, and facilities for visitors to this area.

Thank you. Welcome to the recreation user survey conducted for the relicensing of the Lawrence Hydroelectric Project. The purpose of this survey is to gather information about recreation activities and opportunities along the Merrimack River and the North and South Canals and respective gatehouses. Essex Company owns and operates the Lawrence Hydroelectric Project which is undergoing relicensing by FERC. As part of this relicensing process, Essex is conducting a series of resource studies to enable FERC to prepare its environmental review document.

Any information you provide us today will remain anonymous. If at any time there is a question you prefer not to answer, feel free to skip that question and move to the next.

Demographics

1. What is your home zip code: _____ ☐ Prefer not to answer

2. What is your age?
   ☐ Under 16 ☐ 16-19 ☐ 20-30 ☐ 30-40 ☐ 40-50 ☐ 50-60 ☐ 65+
   ☐ Prefer not to answer

Current Trip Information and Experience

3. How many people are in your group today, including yourself? _____ people

4. How many vehicles did your group use to get to this recreation site? _____vehicles

5. On this trip, about how many miles did you travel to get to the Lawrence Project area?
   ☐ 0-25 miles ☐ 25-50 miles ☐ 50-75 miles ☐ 75-100 miles ☐ 100+ miles

6. Have you been to this recreation site before? ☐ Yes ☐ No

7. On this trip to the Lawrence Project area, when did you arrive?
   Arrival Date: ____/_____/_____ Arrival Time: _____ AM/PM

8. When do you expect to leave the Lawrence Project area?
   Departure Date: _____/_____/_____ Departure Time: _____ AM/PM

9. Is this recreation site the primary destination for your trip? ☐ Yes ☐ No

10. Which of the following recreation areas at or near the Lawrence Project have you visited during the past 12 months? Please let us know if you need a map to familiarize yourself to the area. (C*heck all that apply*)

    ☐ Lawrence Heritage State Park
    ☐ Pemberton State Park
    ☐ Merrimack River Trail
    ☐ Lawrence Riverfront State Park
    ☐ Spicket River Greenway
    ☐ Nunzio DiMarca Park
    ☐ Abe Bashara Boathouse
    ☐ Boys and Girls Club of Lawrence
    ☐ Oxford Park
    ☐ Campagnone (North) Common
    ☐ North Canal Carriage House Tour
    ☐ None of the above
    ☐ Other (Please specify): _____

11. During what month(s) do you typically participate in recreation activities at this site? (*Check all that apply*)

    ☐ January ☐ February ☐ March ☐ April ☐ May
    ☐ June ☐ July ☐ August ☐ September ☐ October
    ☐ November ☐ December ☐ No Response

12. Regarding the Lawrence Project area, do you consider yourself: (*Check all that apply*)

    ☐ A regular visitor to this area (*3 or more times per year*)
    ☐ An occasional visitor (*1-2 times per year*)
    ☐ An infrequent visitor (*Less than 1 time per year*)
    ☐ First time visitor

13. Are you staying overnight in the Lawrence Project area (not including at your own home) on this trip?

    ☐ Yes ☐ No

14. If you answered “yes” to **Question 13**, at what type of accommodations will you be staying? *(Check all that apply):*

    ☐ RV/Auto/Tent Campground ☐ Motel/hotel ☐ Bed and Breakfast
    ☐ Vacation or rental home ☐ Other (Please specify): _____

15. On this trip to the Lawrence Project area, which of the following recreational activities have you or are you planning on participating in at this site? **(***Select all that apply***)**

☐ Bank fishing	☐ Boating	☐ Walking tour
☐ Boat fishing	☐ Tent camping	☐ Museum-going
☐ Canoeing	☐ RV camping	☐ Picnicking
☐ Kayaking	☐ Photography	☐ Sightseeing

☐ Hiking
☐ Swimming
☐ Dog walking
☐ Off-highway vehicle (dirt bike/ATV)
☐ Running, walking, or jogging
☐ Shopping and/or dining
☐ Sunbathing
☐ Biking/cycling
☐ No response
☐ Heritage site visiting

☐ Other (please describe):_____

16. Of the activities you selected in Question 16 above, what is the **primary** activity that you participated in, or expect to participate in, on this visit?

    _____

17. Did you transport any recreation equipment with you? ☐ Yes ☐ No
    If yes, what equipment? _____

18. If boating, what type of boat did you use to access the Merrimack River? (check one): ☐ Fishing Boat ☐ Canoe ☐ Kayak ☐ Other Watercraft (please specify):_____

19. If boating, have you experienced any difficulty launching or retrieving your watercraft?
    ☐ Yes – Hand Carry ☐ No – Hand Carry ☐ Yes – Motorized ☐ No – Motorized
    ☐ No Response
    If yes, please explain: _____

Canal Vegetation and Waterborne Trash

20. During your visit to the Lawrence Project area, did you see the North Canal or South Canal?
    ☐ Yes ☐ No
    If yes, which canal(s)? ☐ North Canal ☐ South Canal ☐ Both Canals

21. During your visit to the Lawrence Project area, how would you rate the vegetation growth on the walls in any of the canals?

Location	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable
North Canal	1	2	3	4	5
South Canal	1	2	3	4	5

22. During your visit to the Lawrence Project area, how would you rate the waterborne trash in any of the canals?

Location	Totally Unacceptable	Unacceptable	Neutral	Acceptable	Totally Acceptable

North Canal	1	2	3	4	5
South Canal	1	2	3	4	5

23. Do you recall any details you would like to share on your observations of vegetation or waterborne trash (e.g location, content)?

_____
_____
_____
_____

24. Have you visited the North Canal Carriage House or participated in the tour? ☐ Yes ☐ No
If yes, is there anything you would like to share the facility, including the condition of the facility?

_____
_____
_____
_____

User Feedback

25. On a scale from 1 to 4, with 1 being not crowded, 3 being moderately crowded, and 4 being extremely crowded, how would you rate the crowdedness at this site today? *(Circle response)*

1	2	3	4
Not Crowded	Slightly Crowded	Moderately crowded	Extremely Crowded

26. On a scale from 1 to 5, with 1 being very dissatisfied and 5 very satisfied, how would you rate your satisfaction with the overall condition of this site today? *(Circle response)*

1	2	3	4	5
Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied

If you are dissatisfied with the site conditions, please explain why:

_____
_____

27. On a scale from 1 to 5, with 1 being very dissatisfied and 5 very satisfied, overall how satisfied are you with the availability of recreation facilities at this site? (*Circle response*)

1	2	3	4	5
Very Dissatisfied	Dissatisfied	Neutral	Satisfied	Very Satisfied

If you are dissatisfied with the availability of recreation facilities at this site, please explain why:

_____
_____

28. Are there any recreation facility or access enhancements that you would recommend for this recreation site or any sites within the Project area? ☐ Yes ☐ No

    If you answered yes, please provide any suggestions for enhancements and the areas that you would like to see those changes.

    _____
    _____
    _____

29. Do you have any other comments about this recreation site, including comments on existing or needed recreation facilities? (Please be as specific as possible).

    _____
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30. Do you have any comments or feedback regarding this survey?

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Thank you for completing the Recreation Survey!

Attachment G
Historically Significant Waterpower Equipment Study
Ownership Information

Historically Significant Waterpower Equipment Study - Owners

Resource ID	Owner					Comments
NC1	Essex Company LLC					
NC2	Nunez LLC	31 Merrimack Street	Lawrence	MA	01843	Headgate mechanisms were removed, and only sealed intakes remain. No waterpower equipment/headgate system are present.
NC3	Nunez LLC	31 Merrimack Street	Lawrence	MA	01843	Headgate mechanisms were removed, and only sealed intakes remain. No waterpower equipment/headgate system are present.
NC4	unknown					Original purpose of structure, and subsequent or present owner is unknown
NC5	Lawrence Redevelopment Authority	225 Essex Street, 1st Floor	Lawrence	MA	01840	
NC6	Mill Space LLC	29 South Canal Street	Lawrence	MA	01843	
NC7	Mill Space LLC	29 South Canal Street	Lawrence	MA	01843	
NC8	Union Canal Community Works LLC	4 Union Street, Suite 100	Lawrence	MA	01841	No waterpower equipment/headgate system are present.
NC9	EM Union Realty LLC	PO Box 686	Medfield	MA	02052	No waterpower equipment/headgate system are present.
NC10	unknown					The mill served by this intake remains undetermined. No waterpower equipment/headgate system are present.
NC11	unknown					The mill served by this intake remains undetermined. No waterpower equipment/headgate system are present.
NC12	unknown					The mill served by this intake remains undetermined. No waterpower equipment/headgate system are present.
NC13	unknown					Further legal and site research may be able to determine ownership. No waterpower equipment/headgate system are present.

NC14	unknown					Ownership of this structure is undetermined, pending legal research
SC1	Essex Company LLC					
SC2	City of Lawrence	200 Common Street	Lawrence	MA	01840	
SC3	City of Lawrence	200 Common Street	Lawrence	MA	01840	
SC4	unknown					Original purpose of structure, and subsequent or present owner is unknown. No waterpower equipment/headgate system are present.
SC5	City of Lawrence	200 Common Street	Lawrence	MA	01840	
SC6	City of Lawrence	200 Common Street	Lawrence	MA	01840	
SC7	presumably Essex Company LLC					Further legal and site research may be able to positively determine ownership
SC8	South Canal Real Estate Inc	168 North Policy Street	Salem	NH	03079	No waterpower equipment/headgate system are present.
SC9	unknown					Further legal and site research may be able to determine ownership
SC10	unknown					Further legal and site research may be able to determine ownership
SC11	National Grid-Mass Electric	40 Sylvan Road	Waltham	MA	02451	No waterpower equipment/headgate system are present.
SC 12	National Grid-Mass Electric	40 Sylvan Road	Waltham	MA	02451	
SC 13	Essex Company LLC					
SC14	NB Development Group	221 North Beacon Street	Brighton	MA	02135	
SC15	Essex Company LLC					No waterpower equipment/headgate system are present.

Attachment H

Repair Schedule Associated with Condition Assessment of Historic Properties and Canal System Study

(Filed Separately as an Excel File)