

# Brookfield

Renewable N.A.

April 6, 2026

***VIA E-FILING***

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

**RE: Brunswick Hydroelectric Project (FERC No. 2284), Diadromous Fish Behavior, Movement, and Project Interaction Study Schedule.**

Dear Secretary Reese:

Brookfield White Pine Hydro LLC (BWPH) is licensed by the Federal Energy Regulatory Commission (FERC or Commission) to operate the Brunswick Hydroelectric Project (FERC No. 2284). The Project is located on the Androscoggin River in the towns of Brunswick and Topsham, Maine (ME). The Project straddles the border between Cumberland and Sagadahoc counties.

On February 21, 2024, BWPH filed its Notice of Intent (NOI) and Pre-Application Document (PAD) with the Federal Energy Regulatory Commission (FERC or Commission) to pursue a new license for the continued operation of the Project. BWPH has been conducting studies as required by the Commission in its Study Plan Determination letter issued on December 30, 2024. BWPH filed its Initial Study Report (ISR) with the Commission on December 31, 2025, and held its ISR meeting on January 15, 2026.

BWPH completed Phase 1 of the Diadromous Fish Behavior, Movement, and Project Interaction Study (Project Interaction Study) during the 2025 field season and submitted the results to the Commission as part of the ISR. BWPH drafted a study plan for Phase 2 of the Project Interaction Study and held a meeting with relicensing participants on January 28, 2026, to review the study plan. A revised study plan was issued to relicensing participants on February 6, 2026, and the study plan was then further revised and finalized on February 9, 2026 (see [Attachment 1](#)).

Phase 2 of the study was planned to be completed during the spring passage season of 2026 (May – June). In mid-March 2026, during logistical setup and planning for Phase 2 of the study, BWPH determined that on-going construction at the Frank J. Wood bridge will likely interfere with the execution of the Phase 2 study. At that time, the Maine Department of Transportation (MaineDOT) indicated that the original date of March 15 for completion of the “old bridge” demolition (particularly the span over the tailrace “Span 1”) had been extended to May 15. In addition, a temporary work trestle (see [Figure 1](#)) which was put in place in February 2025 will remain in place until winter 2026/27, when an in-water work period that is stipulated in the construction permit would be available to remove it.

Additionally, both the temporary work trestle and the “old bridge” are currently supported by steel piles (see [Figure 2](#)). The piles for the “old bridge” are expected to stay in place until at least August 2026 after demolition is complete in May 2026, while the piles for the work trestle will stay in place until winter 2026/27 when the trestle is removed.

The presence/demolition of the “old bridge” during a portion of May, as well as the presence of both the work trestle and the support piles during all the planned Phase 2 study period will create river hydraulic and shadowing conditions that will not be representative of the site in the future. In addition, this infrastructure would necessitate adjusting the previously planned locations of several telemetry receivers in the vicinity of the bridges (see [Figure 1](#)) to allow for proper operation.

BWPH views the Project Interaction Study as a critical component in the analysis of upstream fish passage alternatives at the Project. Due to these circumstances related to the on-going bridge construction, BWPH has significant concerns that the study, should it be conducted in 2026, could yield biased results and would not be representative of future site conditions. Therefore, through an abundance of caution, BWPH has decided to postpone Phase 2 of the study until the 2027 spring passage season, when site conditions will be more representative of riverine conditions suitable for execution of the study.

BWPH’s Final License Application (FLA) will be filed with FERC on or about February 28, 2027. The FLA will contain an environmental analysis as well as proposed measures for the various resource areas (e.g., recreation, water quality, downstream fish passage, etc.), however, any proposed measures for upstream passage measures will be preliminary. After completion of the Phase 2 study and reporting (anticipated December 2027), BWPH will amend/supplement the upstream fish passage measures contained in the FLA, as needed, to account for the Project Interactions Study results (anticipated February 2028).

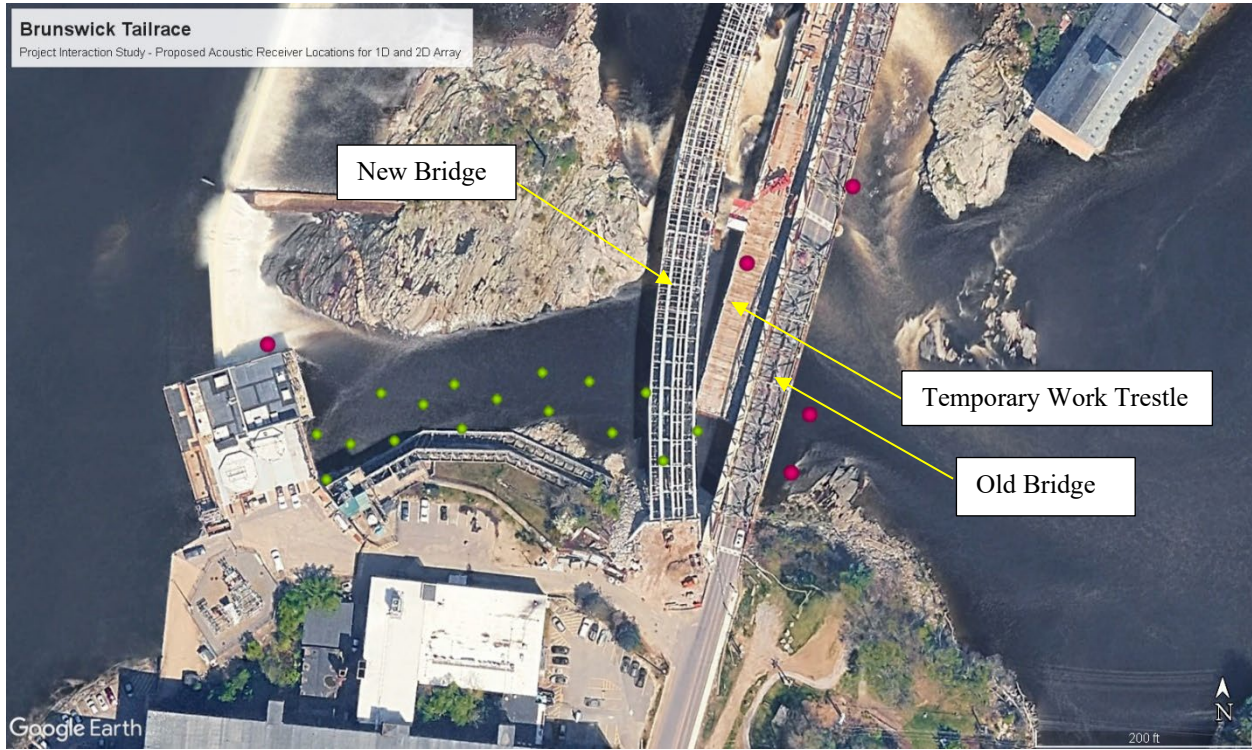
If there are any questions or comments regarding the RSP, please contact me by phone at (315) 566-0197 or by email at [Michael.Scarzello@brookfieldrenewable.com](mailto:Michael.Scarzello@brookfieldrenewable.com).

Sincerely,

A handwritten signature in black ink, appearing to read 'MSR', is positioned above the typed name.

Michael Scarzello  
Manager, Licensing

**Figure 1: Map of Project and Construction Work at the Frank J. Wood Bridge**



Proposed 1-D (red dots) and 2-D Receiver Locations (green dots)

**Figure 2: Photograph of Steel Piles Supporting the Work Trestle and Old Bridge**



**Attachment 1- Phase 2 Diadromous Fish Behavior, Movement, and Project Interaction Study**

---

## **FINAL STUDY PLAN FOR THE BRUNSWICK PROJECT INTERACTION STUDY**

### **February 9, 2026**

BWPH filed their Revised Study Plan with FERC on December 2, 2024, which included the proposed methodologies for Phase I and a framework for the eventual fish tagging and movement study to be conducted during Phase II of the Diadromous Fish Behavior, Movement, and Project Interaction Study. Results from the Phase I field study and a revised study plan for the Phase II Project Interaction Study were filed with FERC in the December 31, 2025, Initial Study Report (ISR) and were presented to the resource agencies as part of the January 15, 2026, Brunswick ISR meeting. BWPH further consulted with the resource agencies to finalize the study methodologies for the Phase II approach on January 28, 2026. The methodologies provided here were informed by findings from the Phase I study conducted during 2025 to determine whether JSATS is an appropriate tool to address the goal of the Project Interaction Study when considering the hydro-morphological conditions of the Androscoggin River and the downstream study area as influenced by the Project facilities and its operations and have been revised based on resource agency consultation following issuance of the ISR. The methodologies presented in this final study plan will be used during the execution of Phase II of the Project Interaction Study at Brunswick, anticipated to be completed during spring 2026.

### **PHASE II: GOALS AND OBJECTIVES**

The goal of the Project Interaction Study is to assess the Project's potential effects on select migratory (i.e., Alosines and Sea Lamprey) fish species behavior in the tailrace and proximal downstream reach. Phase II of the Brunswick Project Interaction Study specifically seeks to:

- Assess the distribution and movement of select migratory fish species (i.e., Alosines and Sea Lamprey) in the tailrace and downstream river reach.
- Assess Alosine and Sea Lamprey movement near the existing fishway entrance and near potential alternative fishway entrance locations.
- Determine the extent of fish (i.e., Alosines and Sea Lamprey) behavioral modification due to Project induced passage delay.

### **PHASE II: ACOUSTIC EQUIPMENT AND DEPLOYMENT APPROACH**

The field evaluations conducted during Phase I of the Project Interaction Study provided insight into the performance of ATS JSATS receivers at Brunswick. The proposed study design presented here has considered all information collected during the Phase I evaluation conducted during 2025.

#### **Transmitters**

A combination of ATS model SS300 and SS400 transmitters will be used during Phase II of this study. The SS300 transmitter weighs 3.0 g, measures 11 x 5 x 3 mm, and will operate for 37 days when set at a 5.0 second burst interval. The SS400 transmitter weighs 2.0 g, measures 15 x 3 mm, and will operate for 71 days at a 5.0 second burst interval ([Table A-1](#)). The SS300 and SS400 transmitters will both be incorporated into the Brunswick Phase II study design. When equipped with a pressure sensor, the SS300 transmitter produces a two-part transmission at the programmed pulse interval: part 1 consisting of the hexadecimal unique transmitter ID and part 2 (approximately 80 milliseconds later) consisting of the pressure reading. The pressure reading does not contain the unique tag identification associated with the transmitter and the user must infer that the received pressure reading is associated with a specific tag only using the temporal proximity of the initial tag transmission and subsequent pressure transmission detected by the hydrophone. When there are a limited number of tags present simultaneously in an array, it may be reasonable to associate pressure transmissions with an individual fish. However, when significant numbers of tagged fish

are present within an array, all transmitting pressure data, it may be impossible to know which tag transmitted an individual pressure reading. As a result, per the vendor’s recommendation, it is not suggested to have more than a handful of pressure tags simultaneously detectable within an array if the goal of the pressure data is to assign values to individual fish (i.e., z-axis of positional data). Transmitters utilized for this study, regardless of model, will be set at a fixed ping rate interval of 5.0 seconds.

**Table A-1. Attribute Summary for the ATS SS300 and SS400 Acoustic JSATS Transmitters**

Transmitter Parameter	Transmitter Model	
	SS300	SS400
Weight (mg)	300	200
Dimensions (mm)	10.7x5.0x2.8	15.0x3.3
Duration (days)		
@ 3 seconds	23	48
@ 5 seconds	37	71
@ 10 seconds	68	111
Pressure Sensor	Yes	No
Fish Attachment	Abdominal Incision	Abdominal Injection

**Receivers**

The Phase I evaluation assessed the performance of the ATS model SR3001 JSATS compatible receiver. The ATS SR3001 receiver provided viable estimates of detection range and rate across a suite of deployment conditions. The results of the Phase I evaluation support the use of the ATS SR3001<sup>2</sup> receiver for evaluation of fish movement downstream of Brunswick. Physical conditions and equipment performance during the Phase I assessment downstream of the dam was used to determine the spatial extent and resolution types (i.e., 2D versus 1D [present/absent]) of data collections that can be realistically accomplished during Phase II.

**Deployment Approach**

Following the conservative spacing recommendations developed from review of the detection range/rates for JSATS receivers deployed during Phase I (see 6.1.3 of the Project Interaction Study Report), a total of 46 fixed location receivers would be required to monitor the full spatial scale of the tailrace and downstream region identified in the RSP prior to the execution of the Phase I field assessment. [Figure A-1](#) presents the theoretical fixed receiver layout required to provide high resolution coverage of the excavated tailrace channel and the river right portion of the convergence area of the tailrace and spillway bypass flows. Field observations during Phase I noted that bottom topography within the region downstream of the ledge habitat located at the outlet of the spillway bypass area [i.e., river left portion of the convergence area of the tailrace and spillway bypass flows] is likely to hinder the effective collection of data to support 2D positional determination of JSAT transmitters and as a result, that area has been excluded.

BWPH understands the resource agencies interest in providing a robust “real time” accounting of tagged fish positions within the full tailrace and the proximal downstream reach. However, the logistical and financial considerations of installing and maintaining a 46-receiver array of this magnitude are considerably challenging. As a result, a reduced array to provide information specific to movement near the existing fishway entrance and potential alternative fishway entrance locations along the river right shoreline is presented in [Figure A-2](#). BWPH proposes to scale the spatial extent of the 2D array from the theoretical area presented in [Figure A-1](#) to the 16 fixed location receivers identified in [Figure A-2](#). The two downstream receiver “gate” locations identified for the full array and bracketing the tagged fish release locations on the upstream and downstream side have been retained along with the pair of receivers to provide 1D coverage of the spillway bypass pool. An additional pair of “gates” positioned just downstream of the 2D array have been added to provide input on fish which are “approaching” the tailrace area. In addition, a single receiver

---

<sup>2</sup> Note that the ATS model SR3017 should provide the same performance as the ATS model SR3001 with the difference being that the SR3017 is designed to be a shore-based and cabled model whereas the SR3001 is autonomous.

to provide 1D information on the presence of fish entering the area on the north side of the powerhouse and downstream of the ogee spillway section at that location has been added to inform on fish presence in that region. Lastly, to address agency interest in tagged fish presence in the region downstream of the ledge habitat located at the outlet of the spillway bypass area up to two additional stationary receivers will be installed in that region. Prior to receiver installation at the outlet of the spillway bypass area, staff will assess the intended detection zone under low tide conditions to identify specific locations which offer the best “line of sight” conditions for maximizing the likelihood of detecting tagged fish present in that area. If a single receiver location is determined to be insufficient to cover the targeted area then BWPH will install a second unit to provide the necessary coverage. When all proposed receivers included as part of the “reduced” array are considered, a total of 29 to 30 fixed location receivers are included in the study.

Receivers comprising any 2D array in the Brunswick tailrace will need to be installed in a manner which eliminates their ability to change position during the study and also provide overlap among all units to maximize the likelihood of multiple detections of any single tag transmission. Based on observations of substrate and flow conditions downstream of the Brunswick powerhouse, this will require the use of SCUBA divers to install custom bottom mounts to house each fixed location SR3001 ATS receiver ([Figure A-3](#)). If conditions are suitable, ATS model SR3017<sup>3</sup> receivers may be used, and those hydrophones will be affixed to project structures in locations where conditions permit. However, the tidal nature of this site and potential for debris scour along project structures (i.e., the upstream fishway) may limit the effectiveness and longevity of these units.

Receivers will be installed during late-April or early-May, dependent on river conditions and prior to the release of any tagged fish. The full receiver set will be maintained through June. As noted above, receivers installed as part of the 2D array in the powerhouse tailrace will require the use of divers to install the bottom mounts, affix the ATS receivers prior to the onset of the study, and remove equipment at the completion of the study. To safely accomplish these tasks, river conditions during each of these individual steps will need to be such that inflow can be wholly passed downstream via the left spillway section and two Tainter gates (i.e., no flow over the right spillway section which discharges into the tailrace or the three turbine units). Ideally, the full set of bottom mounts will be affixed to the substrate in advance of the fish passage season at the predetermined locations identified in [Figure A-2](#) and “dummy” PVC receivers will be installed in the mount tubes. Prior to the release of test fish, divers will substitute the “dummy” receivers with programmed ATS SR3001 receivers. Temporary installation of the dummy receivers will provide insight into the physical conditions each receiver will be installed at and help determine in advance of the study which areas may be at a greater risk of equipment damage. To ensure receiver coverage in the 2D zone will meet the study needs (i.e., high probability of simultaneous detection of a tag transmission by three or more receivers), range testing will be conducted. Following the movement of a geo-referenced test transmitter through the array zone, receivers will be returned to the surface, downloaded, and data will be evaluated for positional fit of estimated tag positions to the known boat track. If necessary, additional receivers may be added to the 2D zone based on results of the pre-study range test findings.

---

<sup>3</sup> ATS model SR3017 is equivalent to the ATS model SR3001 evaluated during Phase I. The difference is that the hydrophone component of the SR3017 is cabled, allowing the user to deploy it fixed to an in-water structure and power/interact from shore. The SR3001 is autonomous.

Figure A-1. Full Theoretical Acoustic Receiver Installation for Phase II of the Project Interaction Study at Brunswick



Figure A-2. Proposed Acoustic Receiver Installation for Phase II of the Project Interaction Study at Brunswick



**Figure A-3. Bottom Mount/Housing for ATS SR3001 JSATS Receivers to be Diver Installed During Phase II of the Project Interaction Study at Brunswick**



## **PHASE II: TARGET FISH SPECIES, SAMPLE SIZE DETERMINATION, AND TAGGING**

The target fish species, sample sizes for each, and the proposed methodology for procuring and releasing study fish during Phase II of the Brunswick Project Interaction Study are summarized here.

### **Target Fish Species**

To address resource agency requests relative to upstream fish passage at Brunswick, BWPH will assess three alosine species (American Shad, Alewife, and Blueback Herring) and Sea Lamprey during the Phase II evaluation.

### **Sample Sizes**

This study seeks to evaluate the movement and behavior of selected migratory fish species in the Project tailrace and proximal downstream reach to inform on the spatial and temporal distribution of those individuals relative to their positioning near the existing fishway entrance or potential alternative fishway entrance locations. The study is not intended to evaluate the effectiveness of upstream passage through the existing fishway. To inform an appropriate sample size for each adult alosine species (i.e., American shad and river herring), BWPH has assumed a comparison of time spent among four general regions (sitting linearly from the existing fishway entrance downstream beyond the current turn pool [see Array design in [Figure A-2](#)]). Assuming the use of a one-way ANOVA to compare the average time spent across the four general regions (with the intent of informing on which region yields the greatest level of activity), a power analysis was conducted using G\*Power. The power analysis conducted for a one-way ANOVA indicated that the minimum sample size to account for four regions and yield a statistical power of at least 0.8 at a significance level of  $\alpha = 0.5$  and a medium size effect of 0.25 is 180 fish per alosine species.

The power analysis conducted here for the adult alosine species does not take into consideration losses attributable to either fallback (i.e., downstream movement away from the study area following tagging and prior to entering the monitored reach) or predation. To account for those factors, the sample sizes for American shad and river herring should be adjusted by a total loss rate of 0.498 and 0.605, respectively. Where the total loss rate is calculated as:

$$\text{Total Loss Rate} = 1 - (1-F) * (1-P)$$

Where F = the species assumed fallback rate and P = the species assumed predation rate. Fallback and predation rates for both alosine species were estimated as part of study plans developed for the similar Lawrence Project (i.e., both Projects are the first mainstem dam) at 21% and 33% fallback and 50% and 25% predation for river herring and shad, respectively. The 2022 Brunswick upstream alosine radio telemetry study supports the fallback rate proposed for American shad as 29% of study fish tagged during that effort were classified as fallback (Normandeau 2023). When adjusted by the species-specific total loss rates attributable to fallback and predation, a total of 290 river herring and 270 American shad will be tagged.

With regards to sea lamprey, BWPH will mirror the sample size reported by Peterson et al. (2022) for the Milford Dam study of 150 individuals.

### **Fish Collection and Tagging**

Previous upstream passage evaluations of alosine species at the Project have relied on hook and line sampling for the collection of adult American Shad in the Androscoggin River downstream of the dam and the trap facility at the existing upstream fishway for river herring. In the USFWS, NMFS, and MDMR study requests for Upstream Fish Passage Effectiveness for Sea Lamprey, the resource agencies indicated that test fish should be captured at the existing Brunswick fishway facilities. Based on previous studies and agency suggestions, the most reliable source for river herring and Sea Lamprey will be the existing fishway. As with previous studies, American Shad will need to be collected by angling downstream of the dam. The presence of listed species and critical habitat immediately downstream of the Project provides additional challenges for alternative methods of collection (e.g., netting, electrofishing, etc.).

River herring and Sea Lamprey obtained from the trap/truck facility at Brunswick will be dip netted directly from the sorting tank. Following netting, each fish will be visually assessed to ascertain their suitability for tagging. Any individuals exhibiting excessive scale loss or other signs of significant stress will be deemed unfit for tagging and released. Individuals deemed acceptable will be measured (total length, nearest mm). River herring will be tagged proportional to the relative abundance of the two species (i.e., Alewife and Blueback Herring) on each tagging date<sup>4</sup>. Individuals will be transported via a trailered tank to the public boat launch located approximately one mile downstream of Brunswick.

Following rod and reel capture, American Shad will be immediately placed in a large, onboard, flow-through live well and the crew will navigate the boat to a safe shoreline location for tagging. Each fish will be visually assessed to ascertain their suitability for tagging. Any individuals exhibiting excessive scale loss or other signs of significant stress will not be considered and will be released back into the river untagged. Individuals deemed acceptable for tagging will be quickly measured (total length, nearest mm), and sex will be determined (when possible) by gently expressing eggs or milt from running-ripe fish.

<sup>4</sup> Species determination for adult river herring will be performed visually in the field secondarily to the priority of efficient tagging. Any tagged individuals for which a species is not quickly determinable from external characteristics (i.e., eye size, body depth, etc.) will be classified as “river herring”

Following tagging, tagged shad will be immediately released back into the Androscoggin River and the coordinates and date/time of release will be recorded.

The target total number of transmitters by species and type are presented in [Table A-2](#). The majority of individuals (80%) will be tagged using the ATS model SS400 transmitter which can quickly and effectively be injected into any of the target species using a hollow needle. This will minimize the duration of time test fish are out of the water and subjected to handling and tagging. A subset of each fish species (20%) will be tagged using the ATS model SS300 transmitter for the purpose of collecting pressure readings associated with each detection record. The SS300 transmitters will be used at a lower rate than the SS400 transmitters to reduce the likelihood signal collision impact on the proper pairing of transmitter identification codes and associated pressure readings (see prior subsection “Transmitters”). The use of these transmitters in a subset of test fish will allow for the evaluation of depth and provide a more robust evaluation of fish positions for individuals which ascend upstream into the receiver array within the Project tailrace and proximal downstream reach.

Tagging methodologies will be similar for the SS300 and SS400 transmitters, with the SS300 transmitters being inserted via a small abdominal incision and the SS400 transmitters being injected into the abdominal cavity via a hollow needle. All incisions/injections will be allowed to heal independent of the use of sutures.

**Table A-2. Sample sizes by Target Fish Species and Transmitter Type for Phase II of the Project Interaction Study**

Target Species	Total No. Tagged	Transmitter Model	
		SS300	SS400
River Herring*	290	58	232
American Shad	270	54	216
Sea Lamprey	150	30	120

\* River Herring will be tagged proportional to the relative abundance of the two species (i.e., Alewife and Blueback Herring) on each tagging date.

**PHASE II: DATA ANALYSIS AND REPORTING**

Following the completion of data downloads from each individual hydrophone, data analysis will proceed in two different ways, depending on whether the hydrophone is included in the 2D array or one of the several 1D checkpoints

Data files from hydrophones representing the 1D detection locations will be grouped as appropriate with any other hydrophones included in a particular “gate” location and then filtered to leave only the relevant information. Any detections for transmitter identification codes not included in the study will be removed as erroneous data. Additionally, detections will be filtered based on the release time of each fish to ensure that only valid detections are only retained representing the time after a particular fish was released. Data will then be arranged chronologically to provide insight into how individual fish moved up or down the river over time following initial release. For the subset of fish determined to have moved upstream to a point inside the bounds of the 2D array in the tailrace, a more robust analysis will be initiated to determine fish positions via the 2D analysis.

Data files from hydrophones comprising the 2D array in the powerhouse tailrace will be imported into R statistical software for analysis using a “time of arrival” methodology which will determine the X-Y position of a fish for each of the pings that are emitted from its transmitter at a five second PRI. For the full duration of residence time for a fish present within the bounds of the 2D array in the powerhouse tailrace, a latitude and longitude will be determined as long as three or more receivers successfully detected a single transmission. For each fish that spends time within the 2D array, positions over time will be determined and available for mapping within predetermined subsections of the tailrace. For individuals carrying the SS300 transmitter with pressure sensor, fish depth will be estimated based on the recorded pressure reading

associated with each tag transmission. For this subset of fish, data will be available to evaluate based on X-Y-Z positions. The full set of successfully determined positions of tagged fish representing the four species will be assessed to reveal patterns of movement and/or zones of preferred residency within the tailrace.

Acoustic data will be presented in two formats: bin densities and density plots. Bin densities will provide the percentage of tagged fish that were detected in each of the bins of space in the 2D array region. Bins will be provided by dividing the 2D array area into a uniform square grid. The exact grid spacing will be determined following review of the positional error of tag positions estimated during pre-study tag testing during spring 2025. The percentage of tagged fish detected in each bin will be recorded (by species) over the duration of the study and the percentage will be displayed on a color scale overlaid on the grid map. The use of bins will reduce the potential for a single fish to skew the results as its presence in an area is only counted a single time. This will provide insight into the spatial use of the 2D array area by test fish, rather than the amount of time spent in a particular area.

Density plots will be developed to present positions of tagged fish in the 2D array area and incorporate a temporal component of the detection data. Since these will include multiple detections for an individual, there is potential for data presented in this manner to be skewed by individual fish which may spend long periods of time in certain areas. Data will be examined and presented by species in this manner.

## **PHASE II: SCHEDULE, LEVEL OF EFFORT, AND ESTIMATED COST**

Phase II of the Project Interaction Study will be conducted during spring 2026. Findings will be compiled and provided as part of the Updated Study Report filing in January 2027. The cost for Phase II of the Project Interaction Study as currently designed is approximately \$680,000.