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# Stakeholder Questionnaire on Fish Passage Facilities at U.S. Hydropower Developments



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Environmental Sciences Division

**STAKEHOLDER QUESTIONNAIRE ON FISH PASSAGE FACILITIES AT U.S.  
HYDROPOWER DEVELOPMENTS**

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January 2026

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## ABSTRACT

To mitigate the environmental impacts of hydropower dams on fish populations in rivers, fish passage infrastructure may be required by regulatory authorities or recommended by state or federal agencies to allow migratory fish to pass hydropower barriers and complete their life histories. However, information on the location, types, and characteristics of fish passage infrastructure is incomplete at the national scale. This lack of information limits understanding of current fish passage capabilities and hinders efforts to anticipate future passage requirements during project licensing or relicensing. To address this knowledge gap, researchers at Oak Ridge National Laboratory partnered with federal agency and industry stakeholders to create the first national-scale database of fish passage infrastructure at U.S. hydropower developments. As part of this effort, a stakeholder questionnaire was created and deployed to solicit information on fish passage infrastructure, including engineering characteristics, operational schedules, targeted species, and costs. This online questionnaire was designed to allow respondents to provide highly detailed information regarding fish passage capabilities at U.S. hydropower developments as efficiently as possible. The questionnaire improved database coverage and accuracy by providing valuable development- or passage-specific stakeholder knowledge that is not otherwise publicly available. However, questionnaire response rates were low, and stakeholders showed a preference for providing data via the spreadsheet template. This is likely because most stakeholders had high-level knowledge about fish passage existence and type at many features, and few stakeholders had highly detailed, feature-specific knowledge of fish passage infrastructure, cost, operational scheduling, and capabilities. Nonetheless, the development and deployment of the stakeholder questionnaire advanced the project in several fundamental ways, and a similar questionnaire may be valuable for future database expansion via targeted dissemination to stakeholders with confirmed knowledge of detailed fish passage information at specific hydropower projects.

## 1. BACKGROUND

Hydropower facilities provide Americans with *reliable, affordable, and secure* electricity, ensuring homes and businesses across the country have power when they need it. Hydropower provides nearly 6% of total U.S. utility-scale electricity generation and 26.8% of the country's total utility-scale renewable electricity generation. Pumped storage hydropower is the largest contributor to U.S. energy storage, representing 96% of utility-scale energy storage capacity in the United States as of 2022. Hydropower plants contribute significantly to the flexibility and stability of the electricity grid by providing electricity on demand. Facilities can ramp up or down and start and stop quickly to ensure communities stay up and running.

To mitigate the environmental impacts of dams, power plants, and other hydropower infrastructure on riverine fishes, fish passage facilities frequently are installed to allow migratory fish species to pass hydropower barriers to complete their life histories. Fish passage facilities typically are installed to comply with regulatory requirements stipulated by the Federal Energy Regulatory Commission (FERC; for non-federal hydropower developments) or as prescribed by the National Marine Fisheries Service (NMFS) or U.S. Fish and Wildlife Service (USFWS) under the Fish and Wildlife Coordination Act (for federal hydropower developments). Information on fish passage infrastructure at hydropower developments is currently incomplete at a national scale, which limits understanding of when, where, and why fish passage is deployed. Likewise, this lack of information hinders the community's ability to anticipate potential future passage requirements during licensing, relicensing, or other decision-making processes. Such information is necessary to assess progress toward a modernized hydropower fleet that can protect river ecosystems and fisheries resources while providing affordable, reliable energy to

consumers. To address this knowledge gap, the National Hydropower Fish Passage Database (FPD) was created, which describes fish passage infrastructure, operational scheduling, capabilities, and costs at hydropower developments in the conterminous United States (CONUS).<sup>1</sup> This is the first national-scale database of fish passage capabilities at hydropower projects to be freely available to members of the hydropower community. The first component of this database is available as a dataset showing the existence of fish passage facilities and fish passage technologies present at hydropower developments,<sup>2</sup> and users can explore these data in an interactive webmap (<https://hydrosorce.ornl.gov/tools/hydropower-fish-passage-webmap/>).

Detailed information on fish passage facility location, type, operation, target species, and costs is held by a diverse range of stakeholders and frequently is not publicly available. The most accurate knowledge of this infrastructure is often held by the owners and operators of hydropower developments; such knowledge includes information on passage facility technologies, operations, species usage, and costs of capital construction, operations, and maintenance. This information has tremendous value to the broader hydropower community but has rarely been available due to a lack of centralized data repositories or mechanisms by which the data could be collected and unified. Web-based questionnaires are increasingly valuable tools for detailed data collection from large, diverse populations. These tools can be designed and disseminated with sophisticated, user-friendly software that minimizes the effort required of respondents (e.g., by implementing survey logic to allow respondents to skip irrelevant sections or questions) while maximizing the breadth and depth of information collected, which is in digital format and can be easily processed as it is received. To improve the coverage and accuracy of the FPD, a web-based questionnaire was developed to collect highly detailed information about fish passage infrastructure, costs, capabilities, and operational scheduling from stakeholders with valuable, project-specific knowledge that was not otherwise publicly available.

## 2. METHODS

The questionnaire was built and disseminated using Qualtrics, a for-purchase, subscription-based software (<https://www.qualtrics.com/>). A tremendous amount of effort was made to design a questionnaire that minimized the time and effort required of respondents to report valuable fish passage information at specific hydropower developments. These efforts included providing questionnaire access via mobile or desktop devices, allowing respondents to opt out of questions or sections for which they were unable to provide information, and providing a downloadable User Guide for respondents to reference while completing the questionnaire. An overview of questionnaire design, deployment, and advertising efforts is presented below.

### 2.1 TERMINOLOGY AND LEVEL OF DETAIL

The FPD uses specific terminology to refer to hydropower infrastructure that potentially impedes fish passage and the technologies, operations, and infrastructure designed to allow fish to pass those barriers. This terminology was also used throughout the questionnaire for consistency and was clearly defined at the beginning of the questionnaire and in the User Guide.

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<sup>1</sup> Matson, P. G., Bozeman, B. B., DeRolph, C. R., Oladosu, G. A., Singh, D., Morales, J., Pica, J., Sojkowski, B., Lake, B., Anderson, N., Ames, S., Fischer, M. (2025). National Hydropower Fish Passage Database. HydroSource. Oak Ridge National Laboratory, Oak Ridge, Tennessee, USA. [https://doi.org/10.21951/Fish\\_Passage\\_Database\\_2025/2997582](https://doi.org/10.21951/Fish_Passage_Database_2025/2997582).

<sup>2</sup> Matson P. G., Bozeman, B. B., Derolph, C. R., 2025. Overview of Fish Passage Facilities at Hydropower Developments across the Conterminous United States. HydroSource. Oak Ridge National Laboratory. Oak Ridge, Tennessee, USA. [https://doi.org/10.21951/Fish\\_Passage\\_Webmap\\_Dataset\\_V1/2563190](https://doi.org/10.21951/Fish_Passage_Webmap_Dataset_V1/2563190).

**Hydropower Features** are dams or other discrete pieces of infrastructure (e.g., powerhouses, conduits, etc.) that control or augment flows at a specific location within a river system for the purpose of hydropower production and potentially impede up- or downstream movement of fish within the river system. Multiple hydropower features may belong to the same hydropower project or development (or share a FERC docket number) but function as multiple distinct barriers to fish movement in a river system.

**Fish Passage Facilities** are structural, operational, or technological (or some combination of these) installations or activities designed to facilitate fish movement upstream, downstream, or bidirectionally across specific hydropower features. These include (but are not limited to) upstream fishways, lifts, or locks, downstream open or pressurized bypass conduits, bidirectional nature-like fishways or bypass channels, and non-volitional forms of passage such as trap and transport. These do not include fish-friendly turbines.

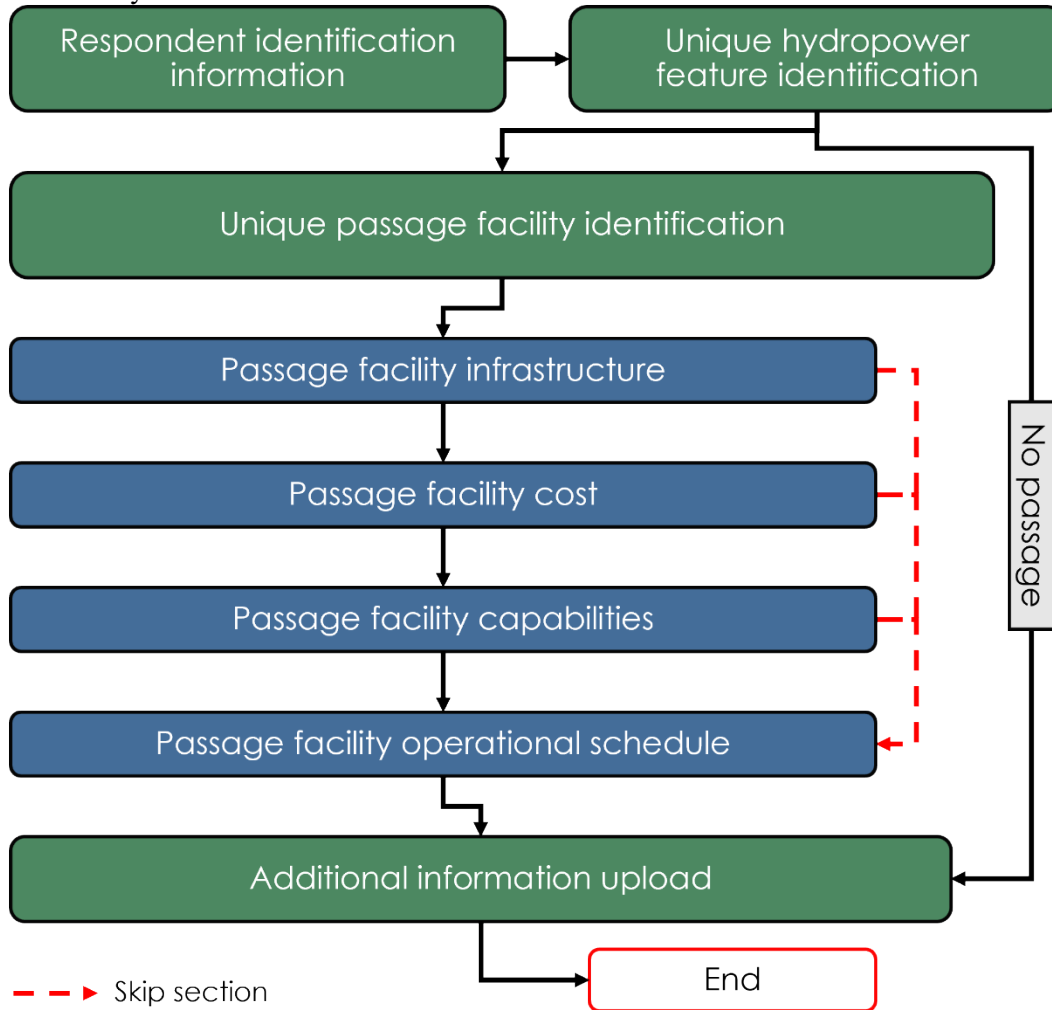
The FPD contains more than 50 variables, most of which were captured by questions in the questionnaire. To minimize the number of questions in the questionnaire and the time requirements of respondents, the questionnaire was designed to describe **a single fish passage facility at a distinct hydropower feature**. Designing the questionnaire to allow respondents to provide information on multiple fish passage facilities in a single response was unnecessarily complex and burdensome for the Qualtrics survey software and would require extensive and impractical time and information commitments from respondents. Respondents with information on multiple fish passage facilities at one or more hydropower features were encouraged to submit separate questionnaire responses for each fish passage facility they wished to describe. To streamline this process, a link was provided to begin a new questionnaire to describe a separate fish passage facility on the final page of the questionnaire after respondents had submitted a response.

## 2.2 ORGANIZATION

The stakeholder questionnaire was divided into sections that allowed respondents to identify themselves and the hydropower feature for which they were providing fish passage information and provide information related to fish passage facility existence and characteristics at that feature. Specifically, the questionnaire: 1) identified the respondent; 2) directed the respondent to identify the unique hydropower feature for which they had fish passage information; 3) identified the passage facility (if present) and collected infrastructure, cost, capability, and scheduling information; 4) allowed the respondent to share additional, supplementary information (e.g., passage performance studies); and 5) thanked the respondent and provided a link to submit additional questionnaire responses to describe other fish passage facilities (Figure 2.1).

At the beginning of each information section, respondents were asked if they were able to provide information relevant to that section (e.g., cost information). Respondents who indicated they were unable to provide information pertaining to a given category section were passed to the next information section while respondents who indicated they were able to provide information encountered relevant questions on the next page. Respondents were encouraged to leave questions blank for which they did not have information and were able to navigate forward and backward within the questionnaire to adjust answers as desired. For respondents who were able to provide information for all questionnaire sections, completion was anticipated to require 30 to 45 minutes. Respondents who were only able to provide information for a portion of the questionnaire sections or questions, or who could confirm that passage does not exist at a given hydropower development, could expect the questionnaire to take 5 to 20 minutes

to complete. Respondents could return to an in-progress questionnaire for up to two weeks from their most recent activity in the software.



**Figure 2.1** Conceptual diagram of FPD stakeholder questionnaire organization. Blue boxes indicate information type sections. Red dashed lines indicate that respondents could skip entire information type sections for which they were unable to provide information.

### 2.2.1 Identifying a Unique Hydropower Feature

A critical component of the questionnaire was correctly identifying the hydropower feature for which respondents were providing information. The easiest way to do this was by directing respondents to the fish passage database interactive webmap (<https://hydrosource.ornl.gov/tools/hydropower-fish-passage-webmap/>) linked within the unique hydropower feature identification section of the questionnaire. Respondents could use the map to navigate to the hydropower feature for which they were providing information, click on the point representing that feature, and view details about the feature in the pop-up window, including the unique FPD identifier (FPD\_ID), which they were then prompted to provide in the questionnaire. Respondents who were unable or otherwise unwilling to access the webmap were prompted to enter additional identifying information (dam name, National Inventory of Dams [NID] ID, FERC docket number, etc.), which allowed for correct identification of the described feature.

### 2.2.2 Identifying a Unique Fish Passage Facility

Once the unique hydropower feature was identified, respondents were prompted to indicate whether the feature had at least one dedicated fish passage facility. This was the first major pivot point in the questionnaire; respondents who indicated “No” or “Unknown” were passed to the final section of the questionnaire while respondents who indicated “Yes” were passed to the unique fish passage facility identification section (Figure 2.1). Note that respondents were strongly encouraged to complete the questionnaire even if a hydropower feature did not have a fish passage facility. Confirmation that a feature did not have passage was equally valuable to the database as confirmation of passage and took fewer than 5 minutes to indicate in the questionnaire.

For features that had at least one passage facility, the questionnaire prompted respondents to indicate the direction and type of passage. Common passage facility types were provided in a list for the respondent and were also listed in the User Guide (Table 2.1). Respondents were able to input their own passage facility description if their facility type was not included in the provided list. Finally, to streamline the user experience, Qualtrics’ piped text feature was used to reference the direction and type of passage facility reported by the respondent in question prompts throughout the rest of the questionnaire (e.g., “The questions in the following sections pertain to this **Upstream Vertical slot fishway**.”).

**Table 2.1** Common fish passage facility types, descriptions, and typical directions.

<b>Type</b>	<b>Typical direction</b>	<b>Description</b>
<b>Pool and weir fishway</b>	Upstream	Pool-and-weir fishways are characterized by a series of pools separated by overflow weirs that break the total head into discrete, passable increments. Submerged orifices are often included as an alternate route of passage (for salmonids) and may also promote streaming flow under threshold conditions. Pool-type upstream fishway.
<b>Ice harbor fishway</b>	Upstream	An ice harbor fishway is a modified pool-and-weir ladder that has two weir crests separated by a non-overflow central baffle and two submerged orifices centered below the crests. Pool-type upstream fishway.
<b>Half ice harbor fishway</b>	Upstream	The half ice harbor is a low flow variant of the pool-and-weir-style ice harbor fishway. The geometry of a half ice harbor is, as the name implies, equivalent to a lateral section of the full ice harbor cut along a plane of symmetry defined by its central axis. Accordingly, the low flow fishway consists of one weir crest, one orifice, and a non-overflow baffle between fishway pools. Pool-type upstream fishway.
<b>Single vertical slot fishway</b>	Upstream	A vertical slot fishway is a pool-and-weir type fish ladder characterized by a rectangular channel with a sloping floor in which a series of regularly spaced baffles separate the pools. Water flows from pool to pool via a vertical slot at each baffle. These designs are applicable to medium head dams and, unlike pool-and-weir fishways, may accommodate large fluctuations in headwater and tailwater levels. Another advantage of the vertical slot is that it offers passage along the full depth of the slot, thus it theoretically provides passage to a wider variety of species. Distinguished by number of slots in each baffle; single or dual. Pool-type upstream fishway.
<b>Dual vertical slot fishway</b>	Upstream	A vertical slot fishway is a pool-and-weir type fish ladder characterized by a rectangular channel with a sloping floor in which a series of regularly spaced baffles separate the pools. Water flows from pool to pool via a vertical slot at each baffle. These designs are applicable to medium head dams and, unlike pool-and-weir fishways, may accommodate large fluctuations in headwater and tailwater levels. Another advantage of the vertical slot is that it offers passage along the full depth of the slot, thus it theoretically provides passage to a wider variety of species. Distinguished by number of slots in each baffle; single or dual. Pool-type upstream fishway.
<b>Serpentine fishway</b>	Upstream	Serpentine fishways create hydraulic conditions favorable to fish movement over fluctuating reservoir levels. They are a pool-and-weir-style fishway. They reduce flow energy by directing water in a serpentine pattern. Similar to vertical slot fishway but with baffles that extend only partway across the width of the channel. Pool-type upstream fishway.

<b>Pool and chute fishway</b>	Upstream	A pool and chute ladder is a hybrid that operates under varying river flow conditions. This ladder is designed to operate as a pool and weir ladder at low river flows and as a roughened chute-style fishway at higher river flows. Pool-type upstream fishway.
<b>Standard Denil fishway</b>	Upstream	Denil designs are a family of baffled-chute ladders that utilize roughness elements (i.e., baffles) to dissipate the kinetic energy of water moving through a flume to create a low velocity zone of passage for migratory fish. The baffles turn a portion of the flow to oppose the main current in the flume. This change in inertia results in a decrease in flume velocity but also generates considerable turbulence that can reduce passage efficiency. Though limited in biological capacity, Denil fishways have demonstrated an efficacy in the passage of salmonids, alosines, and other species at relatively steep slopes. Chute-type upstream fishway.
<b>Steppass fishway</b>	Upstream	A Denil variant, the steppass is a baffled-chute type fishway designed to be highly portable and is applicable to low head dams. Typically, this fishway is prefabricated in 10-foot sections made of sheet aluminum or steel and bolted together on site. Compared to a Standard Denil fishway, a steppass has a lower flow capacity and greater form roughness. It's widely used in the state of Alaska and is commonly used on the East Coast for salmonids and river herring. Chute-type upstream fishway.
<b>Fish lift</b>	Upstream	Fish lifts or elevators are non-volitional upstream fishways that are comprised of numerous mechanical, hydraulic, and electrical components. Generally, fish lifts have a smaller footprint than large volitional passage designs. The cycle of a fish lift consists of the following sequences: fishing (fish attracted to fishway at entrance and enter holding pool), crowding (fish mechanically crowded above hopper), lifting (fish lifted within hopper to exit channel), releasing (fish released from hopper into exit channel), and return (empty hopper returned to fishing position). Mechanical-type upstream fishway.
<b>Fish lock</b>	Upstream	A fish lock is a non-volitional fishway consisting of a columnar structure that, when filled with water, acts as a passage route for migrating fish. The design principle of the columnar structure within a fish lock is similar to the hopper and lift tower within a fish lift. Controllable gates at the headwater and tailwater openings are used to fill the structure with water. Locks are characterized by the particularly long cycle times required to evacuate fish from the lock. Mechanical-type upstream fishway.
<b>Eel ramp</b>	Upstream	Conventional eel ramps consist of linear metal, plastic or wooden channels lined with climbing substrate and equipped with an attraction water delivery system. Eels utilize the wetted substrate to propel themselves up the ramp.
<b>Eel lift</b>	Upstream	Analogous to fish lifts, eel lifts or "eelevators" are non-volitional passes applicable to higher head barriers. The lower portion of an eel lift typically consists of a ramp (or ramps) terminating in a trap that also serves as the elevator carriage (i.e., hopper). Unlike a simple

		ramp and trap that requires manual collection, the trap-carriage can be mechanically lifted above the barrier through a “hoistway” (i.e., lift tower) and flushed to the headpond.
<b>Delaware-style eel pass</b>	Upstream	This eel pass can be constructed by providing a hole through flashboards, surface gates, or other structures near the crest of the dam. By passing trawl netting or similar rope-like material through the hole (and optionally sheathed in a length of PVC pipe to train the flow), a roughened route for eels to ascend over the dam is created. The hole should penetrate the barrier below the normal headpond level; this ensures a consistent flow and wetted netting.
<b>Laterally sloped eel ramp</b>	Upstream	This is an adaptation of an eel ramp with laterally sloped channel sides to provide eels access to important substrate regardless of amount of intake flow.
<b>Helical eel ramp</b>	Upstream	A helical eel ramp consists of a water-retaining channel coiled around a central shaft, with climbing substrate installed on the channel bottom. The unit is installed vertically, thereby connecting the headpond to the tailwater at a climbing angle equivalent to the pitch of the helix.
<b>Trap and transport</b>	Bidirectional	Collection and transport of migrating fish past dams, impoundments, and other migration barriers to facilitate migration and dispersal (Kock et al. 2020). Mechanical-type fishway.
<b>Full-width roughened channel nature-like fishway</b>	Bidirectional	Roughened channels include rock ramps, arch rapids and similar channelized structures that use natural boulders, bedrock outcroppings or engineered materials (e.g., pre-cast concrete) to moderate high water velocities driven by gravitational forces. In general, the slopes of roughened channels are milder than step-pool structures. Further distinguished by location: full-width, partial-width, or bypass (outside of the channel). Nature-like-type fishway.
<b>Partial-width roughened channel nature-like fishway</b>	Bidirectional	Roughened channels include rock ramps, arch rapids and similar channelized structures that use natural boulders, bedrock outcroppings or engineered materials (e.g., pre-cast concrete) to moderate high water velocities driven by gravitational forces. In general, the slopes of roughened channels are milder than step-pool structures. Further distinguished by location: full-width, partial-width, or bypass (outside of the channel). Nature-like-type fishway.
<b>Bypass roughened channel nature-like fishway</b>	Bidirectional	Roughened channels include rock ramps, arch rapids and similar channelized structures that use natural boulders, bedrock outcroppings or engineered materials (e.g., pre-cast concrete) to moderate high water velocities driven by gravitational forces. In general, the slopes of roughened channels are milder than step-pool structures. Further distinguished by location: full-width, partial-width, or bypass (outside of the channel). Nature-like-type fishway.
<b>Full-width step-pool nature-like fishway</b>	Bidirectional	Step-pool designs approximate pool-and-weir technical fishways. Notionally, fish move through these structures by bursting over a weir then momentarily resting in the upstream pool. Further distinguished by location: full-width, partial-width, or bypass (outside river channel). Nature-like-type fishway.
<b>Partial-width step-pool nature-like fishway</b>	Bidirectional	Step-pool designs approximate pool-and-weir technical fishways. Notionally, fish move through these structures by bursting over a weir then momentarily resting in the upstream

		pool. Further distinguished by location: full-width, partial-width, or bypass (outside river channel). Nature-like-type fishway.
<b>Bypass step-pool nature-like fishway</b>	Bidirectional	Step-pool designs approximate pool-and-weir technical fishways. Notionally, fish move through these structures by bursting over a weir then momentarily resting in the upstream pool. Further distinguished by location: full-width, partial-width, or bypass (outside river channel). Nature-like-type fishway.
<b>Full-width hybrid nature-like fishway</b>	Bidirectional	Complex combination of roughened channel and step-pool nature-like fishways. Further distinguished by location: full-width, partial-width, or bypass (outside river channel). Nature-like-type fishway.
<b>Partial-width hybrid nature-like fishway</b>	Bidirectional	Complex combination of roughened channel and step-pool nature-like fishways. Further distinguished by location: full-width, partial-width, or bypass (outside river channel). Nature-like-type fishway.
<b>Bypass hybrid nature-like fishway</b>	Bidirectional	Complex combination of roughened channel and step-pool nature-like fishways. Further distinguished by location: full-width, partial-width, or bypass (outside river channel). Nature-like-type fishway.
<b>Open flume bypass</b>	Downstream	Downstream migrating fish may be conveyed to the receiving water plunge pool through a flume via open flow in a channel or flume.
<b>Pressurized conduit bypass</b>	Downstream	Downstream migrating fish may be conveyed to the receiving water plunge pool via a conduit, particularly when the bypass route must penetrate a power canal wall or other structure. Gravity-driven submerged bypasses, including siphons, perform as pressurized conduits. Such bypasses often penetrate new or existing intake screens (i.e., bar racks) or cannibalize existing low-level outlets.

### 2.2.3 Information type sections

After the respondent identified the unique hydropower feature and the fish passage facility to be described in the questionnaire, they encountered four information type sections organized by the information category: infrastructure, cost, capabilities, and operational schedule. At the beginning of each information type section, the respondent was informed of the forthcoming section and the types of questions it contained and asked whether they were able to provide information for that section (Figure 2.2). Respondents who indicated “Yes” were passed to the first question in the section; respondents who indicated “No (proceed to the cost questionnaire section)” skipped the section and were passed to the next information type section prompt (in this case, cost).

The information type sections contained questions designed to collect information to populate variables in the FPD, which were developed in partnership with Oak Ridge National Laboratory scientists and economists, fish passage engineers from the USFWS and NMFS, and hydropower experts from the Low Impact Hydropower Institute (LIHI). There were 47 total questions split across the information type sections: 13 infrastructure questions, 14 cost questions, 12 capability questions, and 8 operational schedule questions. The entire questionnaire instrument, including introductory text, sections, questions and answer options, and accompanying survey logic (e.g., skip question, force response) that respondents encountered in the Qualtrics survey software, is documented in Appendix A.

**OAK RIDGE**  
National Laboratory

**Passage facility infrastructure section**

The questions in this section of the questionnaire pertain to **infrastructure information** associated with this **Upstream Ice harbor fishway**.

Passage facility infrastructure information includes details about number and type(s) of facility entrances, protection or guidance mechanisms, and passage hydraulic capacity and slope.

Are you able to provide information regarding infrastructure for this passage facility?

Yes

No (proceed to the cost questionnaire section)

**Figure 2.2** Information type section prompt displayed to respondents at the beginning of each of the four information type sections.

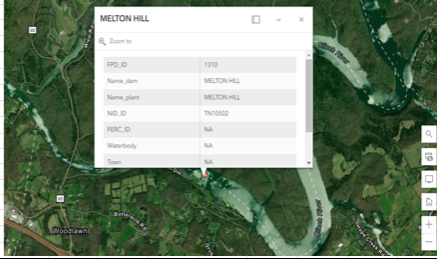
#### **2.2.4 Request for additional information**

The final section of the questionnaire allowed the respondent to provide any additional relevant information regarding the infrastructure, cost, capabilities, or operation of the described passage facility that may not be publicly or readily available. This included passage performance studies, cost, or FERC documentation. Respondents were able to upload a document within the survey software or email multiple documents to the project leader via an email hyperlink that was automatically populated with the subject “FPD Questionnaire Document Share.” The questionnaire submission button was located at the bottom of this section and passed respondents to the exit page where they were thanked and provided with project team contact information and a link to begin a new questionnaire to describe another fish passage facility.

### **2.3 ACCESS, DISTRIBUTION, AND SUPPORT**

Hydropower stakeholders could access the questionnaire through a variety of avenues. These included links on the project webpage and in the interactive webmap, and listserv emails and newsletters from project partners USFWS, NMFS, LIHI, and the U.S. Department of Energy Water Power Technologies Office (WPTO). Project team members also distributed questionnaire access links directly to relevant stakeholders via email or QR codes shared during conferences, industry meetings, or webinars. Because the questionnaire was distributed to different stakeholder groups via different avenues, a link source tag was incorporated in Qualtrics to track which questionnaire submissions come from which online link.

It was anticipated that the questionnaire would be time-consuming, especially for respondents with information on many fish passage facilities. Therefore, a spreadsheet template of the questionnaire was created to facilitate the provision of information about several fish passage facilities at one or more hydropower features within a shorter timeframe. This approach, however, compromised survey logic and other intuitive user-friendly elements available in Qualtrics. The spreadsheet template of the questionnaire was available via a link in the welcome page of the web-based questionnaire and was also shared directly with respondents by request. This template also contained a “Read\_me” sheet that provided much of the introductory and orienting information found in the early sections of the questionnaire (Figure 2.3), as well as a “Data\_example” sheet that exhibited the desired data entry format for each variable. Respondents who used/requested the spreadsheet template also received access to the User Guide.

<p align="center"><b>Fish Passage Database Project – Stakeholder Questionnaire</b></p>	<p>Please provide information on hydropower features and/or fish passage facilities in the Data_attribution sheet such that there is one feature and/or facility per spreadsheet row.</p>	<p align="center"><b>Identifying Unique Hydropower Features in the database for data attribution</b></p>
<p><b>Project overview</b></p>	<p><b>Questionnaire organization</b></p>	<p><b>Using the interactive webmap to identify a unique hydropower feature</b></p>
<p>We are a team of scientists at Oak Ridge National Laboratory working to create the first national-scale database of fish passage capabilities at hydropower dams in the continental United States of America. We have developed an electronic questionnaire for distribution to hydropower dam owners to collect data about technical, economic, and operational characteristics of fish passage facilities that may not be publicly available.</p>	<p>This questionnaire is designed to collect information pertaining to a single, unique fish passage facility at a specific hydropower feature.</p>	<p>There are over 2700 unique hydropower features in the continental United States in our database, and we must match the hydropower feature(s) described by questionnaire respondents to the correct feature(s) in our database.</p>
<p><b>Questionnaire terminology</b></p>	<p>Hydropower features may have one to many fish passage facilities designed to allow fish to move upstream and/or downstream within the river network. Fish passage facilities that function separately to allow fish to move upstream or downstream of a specific hydropower feature (e.g., an upstream vertical slot fishway and a downstream open flume bypass) should be described in separate questionnaire responses. Bidirectional passage facilities (e.g., nature-like fishways) should be described as single, distinct passage facilities in a single questionnaire response.</p>	<p>The easiest way to do this is using our interactive fish passage database webmap.</p>
<p>This questionnaire uses the terms <b>hydropower features</b> and <b>fish passage facilities</b> to describe infrastructural elements associated with hydropower production and fish passage capabilities within river networks.</p>	<p><b>If you have information about multiple fish passage facilities at one or more hydropower features, we ask that you submit a separate questionnaire for each facility.</b></p>	<p align="center"><a href="#">Fish Passage Database Webmap</a></p>
<p><b>Hydropower features</b> are dams or other discrete pieces of infrastructure (e.g., powerhouse, conduits, etc.) that control or augment flows at a specific location within a river system for the purpose of hydropower production and potentially impede up- or downstream movement of fish within the river system.</p>	<p>This questionnaire is divided into sections pertaining to the categories of information in the database. The opening sections of the questionnaire serve to identify the unique hydropower feature, denote whether it has one or more installed fish passage facilities, and identify the direction and type of the single fish passage facility to be described in the following sections of the questionnaire.</p>	<p>Respondents can use the map to navigate to the hydropower feature for which they are providing information, click on the point representing that feature, and view details about the feature in the pop-up window. The first value displayed in the pop-up window is the FPD_ID, which is the unique identifier of each hydropower feature in our fish passage database. Entering this value in column E in the Hydropower Feature Identification section of this questionnaire template will ensure that the hydropower feature described in the rest of the questionnaire is correctly matched with the corresponding entry in the database.</p>
<p><b>Fish passage facilities</b> are structural, operational, or technological (or some combination of these) installations or activities designed to facilitate fish movement upstream, downstream, or bidirectionally across specific hydropower features. These include (but are not limited to) upstream fishways, lifts, or locks, downstream open or pressurized bypass conduits, bidirectional nature-like fishways or bypass channels, and non-volitional forms of passage such as trap and transport. These do not include fish-friendly</p>	<p>Note: Not every question will be relevant to every type of fish passage facility. For instance, passage facility slope is not relevant for Fish Lifts. Users should provide information for variables that are relevant to the passage facility you are describing and leave others blank. Please refer to the User Guide for more information.</p>	
<p align="center">Please return completed templates to the project leader, Paul Matson, with your name or the name of your organization in the file name via the email address below (e.g., FPD_Questionnaire_Spreadsheet_Template_HydropowerCompany)</p> <p align="center"><a href="mailto:matsonpg@ornl.gov">matsonpg@ornl.gov</a></p>	<p><b>If you are unsure about the answers to any question(s) in this questionnaire, please leave those cells blank.</b></p>	<p>Note that many hydropower features on the webmap are located quite close together such that their points overlap when the map is viewed at large extents. Please be sure to zoom in far enough so that the point representing the specific hydropower feature of interest is the only point selected.</p>
	<p>The sections of the questionnaire that describe characteristics of the identified fish passage facility are:</p> <ol style="list-style-type: none"> <li>1. Infrastructure information</li> <li>2. Cost information</li> <li>3. Capability information</li> <li>4. Operational schedule information</li> </ol>	<p>If you are unable to use the interactive webmap, please enter additional identifying information (dam name, city, county, state, waterbody, etc.) in the Hydropower Feature Identification questionnaire section which will allow us to correctly identify the described feature.</p>
	<p>The final section of the questionnaire allows users to upload or link any additional documentation that may be helpful in describing fish passage capabilities at a given hydropower feature.</p>	
	<p>We encourage respondents to complete the questionnaire by filling out only the sections for which they have information and leaving the other sections blank. This will minimize the amount of time it takes to complete and submit the questionnaire.</p>	

**Figure 2.3** Image of the “Read\_me” sheet in the questionnaire spreadsheet template that oriented respondents to the terminology, information sections, and other important instructions associated with the questionnaire.

Despite efforts to provide respondents with supporting information (e.g., the User Guide), clearly explain terminology and questionnaire layout, and implement intuitive questionnaire flow and logic to optimize the user experience, questions and complications were anticipated. Accordingly, the project team members emphasized visibility and accessibility at multiple points throughout the questionnaire, the User Guide, the spreadsheet template, and more broadly throughout the project. This protocol worked well; early in the project, the team leader was contacted via the email link in the interactive webmap by industry members, who were able to provide updated database information during a subsequent meeting.

The stakeholder questionnaire was developed and beta tested with project partners and selected industry members in spring 2023 and deployed in summer 2023. The questionnaire was advertised through many avenues from summer 2023 through summer 2024, including the project website, the database interactive webmap, and international and domestic academic and industry conferences (in poster and oral presentations). The questionnaire was presented and demonstrated at a Water Power Technologies Office National Fish Passage Database Webinar, an American Fisheries Society Bioengineering Webinar, and a U.S. Fish and Wildlife Service online fish passage conference. Project partner networks and connections were leveraged to disseminate the questionnaire access link and User Guide to online networks of the Low Impact Hydropower Institute, the National Hydropower Association (NHA), the Electric Utility Cost Group (EUCG), and the WPTO. Finally, the stakeholder questionnaire was advertised to members of the hydropower community via word of mouth at every opportunity (e.g., while networking at conferences or industry summits). The questionnaire was typically advertised alongside the spreadsheet template as the two primary methods of providing fish passage capability information for the FPD.

### **3. RESULTS AND DISCUSSION**

Despite active and intentional advertising efforts, the questionnaire received only a small number of responses. A total of 30 questionnaire responses were received, 20 of which were complete. Questionnaire responses were received from seven individuals (1–6 responses per individual) affiliated with nongovernmental organizations, federal resource management agencies, and power companies. Questionnaire respondents were based on the East Coast of the U.S. (from Vermont to North Carolina) and accessed the questionnaire in several different ways, including links shared internally with project partners, externally through hydropower community networks (e.g., LIHI, NHA), or embedded within the project webmap or at the end of the questionnaire. Respondents described fish passage capabilities at hydropower features in Massachusetts, Connecticut, Maine, Vermont, New Hampshire, Pennsylvania, and West Virginia.

The questionnaire was programmed to allow respondents to pause their response and return to complete it within two weeks of their latest activity in the software. Three respondents took advantage of this; one respondent completed the questionnaire 14 hours later during the same day they began the questionnaire, one completed the questionnaire two days after beginning, and another 13 days after beginning. Of the 17 respondents who completed the questionnaire in one sitting, the average duration was 36 minutes, which was in line with the advertised estimated duration of 30–45 minutes. Questionnaire duration depended on whether the described feature had a fish passage facility. Average questionnaire duration for features with passage facilities was 43 minutes compared to only 15 minutes for features without passage facilities.

Of the 20 complete questionnaire responses, 16 indicated that fish passage facilities were present at the described feature and four indicated that fish passage facilities were not present. Due to the organization of the questionnaire, the four responses that reported no fish passage provided no additional information; respondents were passed to the end of the questionnaire after confirming that fish passage did not exist at the identified feature. The 16 questionnaire responses that indicated that fish passage was present reported fish passage facilities at 10 distinct hydropower features (1–3 passage facilities per feature), and no two

passage facilities were described twice (i.e., different respondents describing the same facility at the same feature). Twelve upstream passage facilities and four downstream passage facilities were reported (Figure 3.1A). Most hydropower features identified in questionnaire responses had facilities that provided only unidirectional passage, but two features had passage facilities reported for both upstream and downstream passage (no bidirectional passage facilities were reported).

The reported upstream passage facilities were fish lifts (7), eel ramps (4), and one fish ladder (Figure 3.1A). For these upstream fish passage facilities, nine questionnaire respondents reported at least some details about passage facility infrastructure (e.g., entrance gates, hydraulic capacity, slope, etc.), one respondent reported passage facility cost information (e.g., estimated and actual planning, construction, and operation costs), 10 respondents provided information about passage capabilities (e.g., target species, counting technology, performance standards, etc.), and seven respondents provided information about passage operational scheduling (e.g., passage owner and operator, operation schedule, initiation cue, etc.). The fish lifts and fish ladder were reported to facilitate passage of American Shad, Blueback Herring, Alewife, Sea Lamprey, and Atlantic Salmon. The eel ramps were reported to serve American Eel (Figure 3.1B).

The reported downstream passage facilities were open flume bypasses (2) and fish pipes or tubes (2), all of which were classified as bypasses in the database (Figure 3.1A). Of these four questionnaire responses, all respondents provided some details about passage facility infrastructure, no respondents provided facility cost information, two respondents provided details about passage capabilities, and all respondents provided information about passage operational scheduling. Downstream passage facilities were reported to serve Blueback Herring, Alewife, American Shad, American Eel, and Atlantic Salmon, and all were reported to operate periodically (as opposed to continuously) based on calendar date, temperature, or biological cue (Figure 3.1B).

At multiple points within the questionnaire, respondents were given the opportunity to provide additional details that may not have been captured in questionnaire questions using a long-form text box. Ten respondents took advantage of this feature and provided helpful comments that clarified their answers to previous questions or identified supplementary online resources where additional information could be obtained about fish passage capabilities at the identified hydropower feature.

Although it is disappointing that the stakeholder questionnaire did not yield many responses, the development and advertisement of the questionnaire advanced the project in multiple ways. First, constructing the questionnaire in the Qualtrics survey software and drafting the User Guide provided a better understanding of the terminology used to describe features and facilities in the database and more broadly within the fish passage engineering industry. This allowed refinement of the data dictionary to more completely encompass the full suite of available fish passage technologies.

Second, the limited number of questionnaire responses that were received tended to provide greater detail on specific fish passage facilities than the spreadsheet templates. This experience helped to better understand stakeholder preferences for providing different types of information. Because of the organization of the spreadsheet template, it is possible that respondents who provided information in this manner quickly reported high-level information (i.e., passage facility existence, direction, and type) for as many hydropower features as possible before exploring the breadth of variables (i.e., columns) located to the right of the more fundamental variables in the spreadsheet, which they may not have had the time or bandwidth to complete. In contrast, the structure of the questionnaire forced respondents to consider the full breadth of requested information per hydropower feature and fish passage facility before moving to the next feature or facility (the equivalent to moving left to right in the spreadsheet before moving from top to bottom), which potentially encouraged respondents to provide greater levels of detail than they may have when presented with the spreadsheet.

Interestingly, when presented with both the questionnaire link and the spreadsheet template, most stakeholders opted to complete and return the spreadsheet template rather than engage the questionnaire. This preference was not anticipated. In addition to differences in format of spreadsheet and questionnaire data collection methods (breadth versus depth), it also is possible that these differing response rates reflect the nature of the engaged stakeholders, most of whom were affiliated with federal or state agencies or environmental nongovernmental organizations. In general, the approach to data solicitation did a poor job of engaging with hydropower owners and operators via either the questionnaire or spreadsheet template data collection methods, despite dedicated advertising efforts, including in outlets that cater to this stakeholder group (e.g., EUCG and NHA). It is therefore unclear if questionnaire responses were low relative to spreadsheet template data collection because the spreadsheet was easier to complete, or because the stakeholder groups who were responsive to the project advertisements (federal and state agency personnel, resource managers, and environmental NGOs) were more apt to have coarse information about many features in their jurisdiction rather than detailed information about one or a few features (which may better describe hydropower owner and operator knowledge types).

The limited number of questionnaire responses received relative to the large amount of data received from spreadsheet templates (a substantial proportion of data included in the FPD) and the different types of information reported therein provide insight into similar data collection strategies in the future. Web-based questionnaires and spreadsheet templates should not be viewed as equivalent tools for collecting the same data but rather should be used sequentially to collect different types of information. Future data collection efforts should first define the breadth of knowledge held by stakeholders via quick and inexpensive direct communication followed by more detailed data solicitation processes targeted to specific subsets of stakeholders most likely to have desired information as indicated in the initial direct communication outreach effort. In the context of the FPD, future database expansion efforts should consider using spreadsheet templates to collect high-level information about fish passage existence, direction, and type at a large number of hydropower features. This initial step could then be followed by a more informed data collection strategy with questionnaires disseminated to targeted stakeholders with direct knowledge of passage facilities that are already known to exist. Targeted questionnaire dissemination to stakeholders with whom relationships already existed would likely be better received and also could be shortened by omitting unnecessary questions on respondent and feature identification and passage facility existence.



**Figure 3.1** Reported fish passage facility types by direction (A) and by species targeted for use (B).

#### 4. CONCLUSIONS

In summary, developing and deploying the stakeholder questionnaire was a productive phase of the broader FPD project because it helped to better understand the structure and format of the database and the terminology used therein, formulate documentation that aided stakeholders in providing information, and gave a better understanding of how stakeholders prefer to provide information. Both the web-based

questionnaire and the spreadsheet template provided useful information that expanded and improved the database, albeit in different ways. Future detailed database information solicitation efforts should not consider questionnaires and spreadsheet templates as equivalent, parallel methods of obtaining the same data, or as equally appropriate for different types of stakeholders. Rather, these information collection methods should be used in sequence to first obtain low-level information about many features and then obtain detailed information about features identified as having fish passage capabilities. For example, a simplified questionnaire could be sent out to a list of stakeholders to identify who has information that they are interested in sharing and able to share. Those interested stakeholders could then be sent a spreadsheet to collect more detailed data. Data collection methods should also be specifically tailored to the stakeholder group to which they will be disseminated. Stakeholders with greater breadth than depth of information versus those with greater depth than breadth may be better suited for data collection methods that align with their knowledge base.

## **APPENDIX A. QUESTIONNAIRE INSTRUMENT**

## APPENDIX A. QUESTIONNAIRE INSTRUMENT

This Appendix contains all questionnaire questions, answer options, and accompanying text that respondents encountered in the questionnaire, with specific instances of force response or survey logic noted per question.

### QUESTIONNAIRE INTRODUCTION

We are a team of scientists at Oak Ridge National Laboratory working to create a database of fish passage facilities at hydropower dams in the continental United States of America. This database will contain information on the technology, infrastructure, operational scheduling, and costs associated with fish passage capabilities at hydropower dams in the USA. The database will be available at no cost to members of the hydropower community.

This questionnaire is divided into sections based on the categories of information we are collecting about fish passage facilities: infrastructure, cost information, passage capabilities, and operational scheduling. If you have information on one or more of these categories that you would be willing to share, please complete the relevant section(s) of this questionnaire. Answers to any questions you are unsure of may be left blank.

The questionnaire should take approximately 45 minutes to complete.

No personally identifiable information will be published and any provided information regarding fish passage cost will not be publicly linked to the location or name of affiliated dams or facilities.

For more information about this project, see our [project webpage](#) and [project factsheet](#).

If you have questions or concerns about this project or the questionnaire, or would like to learn more about our hydropower research at ORNL, please contact the project leader, Paul Matson, at [matsonpg@ornl.gov](mailto:matsonpg@ornl.gov).

### PARTICIPANT IDENTIFICATION

Please provide the following identification information

1. Name
  - a. [enter text]
2. Email address
  - a. [enter text]
3. Phone number
  - a. [enter text]
4. Affiliation (*Name of power company, federal or state agency, non-profit organization, etc.*)
  - a. [enter text]
5. [FORCE RESPONSE] May we use the information you provided above to contact you regarding your responses to the questions in this questionnaire?

- a. Yes
- b. No

## UNIQUE HYDROPOWER FEATURE IDENTIFICATION

In this questionnaire, you will see the terms “hydropower features” and “fish passage facilities” used repeatedly.

**Hydropower features** are dams or other discrete pieces of infrastructure (e.g., powerhouses, conduits, etc.) that control or augment flows at a specific location within a river system for the purpose of hydropower production and potentially impede up- or downstream movement of fish within the river system.

**Fish passage facilities** are structural, operational, or technological (or some combination of these) installations or activities designed to facilitate fish movement upstream, downstream, or bidirectionally across specific hydropower features. These include (but are not limited to) upstream fishways, lifts, or locks, downstream open or pressurized bypass conduits, bidirectional nature-like fishways or bypass channels, and non-volitional forms of passage such as trap and transport. These do not include fish-friendly turbines.

Please answer the following hydropower feature identification questions. These questions will allow us to match the information provided in this questionnaire to hydropower features in our database. Note that the questions in this questionnaire pertain to discrete fish passage facilities at a single hydropower feature. If you have information about fish passage capabilities at multiple hydropower features (e.g., multiple dams within a hydropower development), we ask that you submit a separate questionnaire response for each unique hydropower feature.

- 6. Using the interactive webmap (linked), navigate to the location of the hydropower feature for which you are providing information, click on the orange point delineating this feature on the map, and enter the FPD\_ID value in the pop-up box in the space below.

*Note that some of the hydropower features on the map are quite close together such that the orange points overlap. Please be sure to zoom in far enough so that the point representing the specific hydropower feature of interest is the only point selected.*

- a. [enter text]
- 7. What is the name of the hydropower feature for which you are providing data? (*Example: Orono Dam*)
    - a. [enter text]
  - 8. In what state and county is this hydropower feature located? If located on a state and/or county border, please list the state and/or county where the majority of the feature infrastructure is located.
    - a. [select from drop-down menu]
  - 9. [FORCE RESPONSE] Have you already submitted a questionnaire response for another fish passage facility at this hydropower feature?
    - a. Yes [pass to fish passage facility existence question]
    - b. No [pass to next hydropower feature identification question]

10. In what city or town is this hydropower feature located? If not located directly within a town or city, please list the nearest town or city in the state and county you selected earlier in the questionnaire.
  - a. [enter text]
11. On what waterbody is this hydropower feature located? (*Example: Connecticut River*)
  - a. [enter text]
12. If applicable, please provide this hydropower feature's Federal Energy Regulatory Commission (FERC) docket number. Example format of FERC docket number is P-1001.
  - a. [enter text]
13. If applicable, please provide this hydropower feature's National Inventory of Dams (NID) ID number. Example format of NID ID number is CT00123.
  - a. [enter text]
14. Who owns this hydropower feature?
  - a. [enter text]
15. [FORCE RESPONSE] Does this hydropower feature have at least one fish passage facility that allows migratory fish to pass the dam upstream, downstream, or in both directions?

Fish passage facilities include (but are not limited to) upstream fishways, lifts, or locks, downstream open or pressurized bypass flumes, bidirectional nature-like bypass channels, and non-volitional passages such as trap and transport. Hydropower features that have fish friendly turbines but do not have dedicated infrastructure and technologies to pass fish are not currently considered to have fish passage.

- a. Yes [pass to fish passage facility identification section]
- b. No [pass to request for additional information section]
- c. Unknown [pass to request for additional information section]

## **UNIQUE FISH PASSAGE FACILITY IDENTIFICATION**

Hydropower features may have one to many unique fish passage facilities designed to allow fish to move upstream and/or downstream within the river network.

Some hydropower features may have multiple fish passage facilities (e.g., an upstream vertical slot fishway and two separate downstream open flume bypasses). These should be classified as separate fish passage facilities at the same hydropower feature and should therefore be described in separate questionnaire responses. Bidirectional fish passage facilities (e.g., nature-like fishways) should be described as single fish passage facilities at a given hydropower feature in a single questionnaire response.

This questionnaire is designed to record information about individual, unique fish passage facilities at a given hydropower feature.

If you have information on multiple fish passage facilities at one or more hydropower features, we ask that you submit a separate questionnaire for each facility.

All information reported in the following sections of this questionnaire should pertain to an **individual, unique fish passage facility** at the hydropower feature defined in previous questions.

1. What direction is this fish passage facility designed to provide passage for? Please select the single option that best describes the direction of passage provided by this facility (not all passage facilities at this hydropower feature). If you are unsure, please leave this question blank.
  - a. Upstream
  - b. Downstream
  - c. Bidirectional
  
2. [FORCE RESPONSE] Please select the method of conveyance that most appropriately describes this passage facility.

A passage facility conveyance is the structure that facilitates actual passage of migrating fish from one side of a barrier to another. The conveyance type is often the conventional word or name used to describe or reference a given type of passage facility (e.g., a fish lift).

For more information on common types of conveyances, see these conveyance descriptions (linked).

*Note: the "Combination fishway" option below refers to distinct fish passage facilities that contain multiple conveyance types (e.g., alternating ice harbor fishways and vertical slot fishways) along the same fish passage channel and migrating fish must navigate both conveyance types successively to reach the other side of the hydropower feature. If migrating fish must use multiple types of conveyances to reach the other side of the hydropower feature, select the "Combination fishway" option. If multiple conveyance types exist at a single feature and migrating fish can reach the other side of the feature by using any one of these conveyances, please describe each conveyance as a unique fish passage facility in separate questionnaire responses.*

- a. [list of all conveyance types from the data dictionary including "Combination fishway" and "Other" with text entry option]
  
3. [DISPLAY LOGIC] If you selected the "Combination fishway" option above, please list the different conveyance types that comprise the single, unique fish passage facility in the space below.

*Note: combination fishway conveyances are passage facilities that contain multiple types of conveyances (e.g., vertical slot fishways and alternating ice harbors) within the same fish passage channel where migrating fish pass successively through both types of conveyances to reach the other side of the hydropower feature. Multiple types of conveyances that do not have to be used successively should be considered as separate fish passage facilities and described in separate questionnaire responses.*

- a. [enter text]

The questions in the following sections will ask for information pertaining to this **[Direction & Conveyance type specified above]**.

This questionnaire is divided into four sections, each pertaining to a different category of information. They are:

1. Infrastructure
2. Cost
3. Capabilities
4. Operational scheduling

If you are unable to provide information about this passage facility for one or more sections, you will automatically be passed to the next section to minimize the length of the questionnaire. You may return to previous sections at any time. Please leave answers to any questions for which you do not have information blank.

### **PASSAGE FACILITY INFRASTRUCTURE INFORMATION**

1. **[FORCE RESPONSE]** The questions in this section pertain to **infrastructure information** associated with this **[Direction Conveyance type]**.

Passage facility infrastructure information includes details about number and type(s) of facility entrances, protection or guidance mechanisms, and passage hydraulic capacity and slope.

Are you able to provide information regarding infrastructure for this passage facility?

- a. Yes [pass to next infrastructure question]
  - b. No (proceed to the cost questionnaire section) [pass to cost information section]
2. What type(s) of entrance(s) does this **[Direction Conveyance type]** have?

A passage facility entrance is a designated gate, weir, or orifice through which migrating fish access upstream, downstream, or bidirectional fishways. Entrance gates are more commonly associated with upstream passage facilities. Weirs and orifices are more commonly associated with downstream passage facilities.

Please select all options that apply. If you are unsure, please leave this question blank.

- a. Vertical entrance gate
  - b. Lateral entrance gate
  - c. Sloped entrance gate
  - d. Surface weir
  - e. Uniform acceleration weir
  - f. Low-level orifice
  - g. Other entrance type
3. **[DISPLAY LOGIC: Q2 not empty]** How many of each entrance type are installed at this **[Direction Conveyance type]**?
    - a. [enter text] [answer choice display logic for each choice selected above]

4. [DISPLAY LOGIC: Q2 not empty] What is the width (in feet) of each entrance for this **[Direction Conveyance type]** reported above?
  - a. [enter text] [answer choice display logic for each choice selected above for up to five of each entrance gate type]
5. [DISPLAY LOGIC: Q2 not empty] Are the entrance type(s) of this **[Direction Conveyance type]** designed to track expected normal tailwater fluctuations?

*Note: this only applies to passage facility entrance gates and not to weirs or orifices. If you are unsure, please leave this question blank or select "Unknown."*

- a. Yes [answer choice display logic for each choice selected above for up to five of each entrance gate type]
  - b. No
  - c. Unknown
6. Please provide any additional information on entrance gates at this **[Direction Conveyance type]** not captured in the previous questions in the space below.
  - a. [enter text]
7. [DISPLAY LOGIC: Q2 is not Upstream] What protection or guidance mechanisms are installed at this **[Direction Conveyance type]**?

Guidance mechanisms consist of physical (bars, racks, or louvers) or behavioral (sound or air) barriers that prevent migrating fish from entering dangerous hydropower infrastructure (e.g., penstocks, intakes, or turbines) and guide them toward designated fish passage facilities. These mechanisms are more typically associated with downstream passage facilities.

Please select all that apply. If you are unsure, please leave this question blank.

- a. Angled bar screen
  - b. Louvers
  - c. Inclined bar screen
  - d. Eicher screen
  - e. Floating guidance systems and booms
  - f. Behavioral barriers
  - g. Other (with text entry)
  - h. None
8. [DISPLAY LOGIC: Q7 selected options include louvers and/or screens] What is the rack spacing (in inches) for these guidance mechanisms at this **[Direction Conveyance type]**?

*Note: this only applies to screen and louver guidance mechanisms.*

  - a. [enter text] [answer choice display logic for each screen and louver type selected above]
9. What is the maximum hydraulic capacity (in cubic feet per second) of this **[Direction Conveyance type]**?
  - a. [enter text]

10. What is the percentage of passage facility flow relative to the total hydraulic capacity of the hydropower feature?
  - a. [enter text]
11. [DISPLAY LOGIC: Q2 is Upstream or Bidirectional] Has the tailrace channel been modified to improve the ability of fish migrating upstream to find and access this **[Direction Conveyance type]**?
  - a. Yes
  - b. No
  - c. Unknown

12. If applicable, what is the percent slope of this **[Direction Conveyance type]** conveyance?

If you do not know the percent slope of the conveyance, please provide the total length (in feet) and gross height (in feet) of the conveyance from entrance to exit.

Total length is the complete length of the conveyance that a fish must navigate in order to pass the barrier, including switchbacks and other engineered features. Gross height is the full height that fish must scale to cross the barrier, not the net height from conveyance entrance to exit.

If you do not know any of these values, please leave this question blank.

- a. Percent slope (%) [enter text]
  - b. Total conveyance length (ft) [enter text]
  - c. Gross conveyance height (ft) [enter text]
13. Please provide any additional information about the infrastructure of this **[Direction Conveyance type]** not captured in the previous questions in the space below.
  - a. [enter text]

## PASSAGE FACILITY COST INFORMATION

1. [FORCE RESPONSE] The questions in this section of the questionnaire pertain to **cost information** associated with this **[Direction Conveyance type]**.

Passage facility cost information includes details about estimated and actual planning, construction, capital, and operational and maintenance costs of fish passage facilities.

Note: none of the cost information provided in this section will be publicly linked with the name or location of this **[Direction Conveyance type]** or **[Hydropower feature]**.

- Are you able to provide information regarding estimated and actual costs for this passage facility?
- a. Yes [pass to next cost question]
  - b. No (proceed to the capabilities questionnaire section) [pass to capabilities information section]

2. What were the estimated total capital costs of **[Direction Conveyance type]**?
  - a. [enter text]

3. What were the estimated annual operational and maintenance costs associated with **[Direction Conveyance type]**?
  - a. [enter text]
4. What year were the costs estimated for this **[Direction Conveyance type]**?
  - a. [select from year drop-down]
5. What were the actual total capital costs of this **[Direction Conveyance type]** (to the nearest thousand U.S. dollars)?
  - a. [enter text]
6. In what year were actual capital costs incurred?
  - a. [select from year drop-down]
7. What are the actual annual operational and maintenance costs associated with this **[Direction Conveyance type]** (to the nearest thousand U.S. dollars)?
  - a. [enter text]
8. What are the annual monitoring costs associated with this **[Direction Conveyance type]** (to the nearest thousand U.S. dollars)?
  - a. [enter text]
9. What is the annual cost of generation loss due to water use or other needs of this **[Direction Conveyance type]** (to the nearest thousand U.S. dollars)?
  - a. [enter text]
10. What were the planning costs associated with this **[Direction Conveyance type]** (to the nearest thousand U.S. dollars)?
  - a. [enter text]
11. Were there any additional costs associated with planning, constructing, operating, or maintaining this **[Direction Conveyance type]** that were not captured in the above questions? If so, please list them below.
  - a. [enter text]
12. What year was construction of this **[Direction Conveyance type]** completed?

*If this passage facility is currently under construction, please list the year it is scheduled to be completed.*

  - a. [select from year drop-down]
13. Approximately how many months did it take to construct this **[Direction Conveyance type]**?
  - a. [enter text]

14. Please provide any additional information on estimated or actual costs associated with the planning, construction, operation, or maintenance of this **[Direction Conveyance type]** not captured in the previous questions in the space below.
- [enter text]

## PASSAGE FACILITY CAPABILITY INFORMATION

1. **[FORCE RESPONSE]** The questions in this section of the questionnaire pertain to **capability information** associated with this **[Direction Conveyance type]**.

Passage capability information includes details regarding species designated for passage at a given facility as well as facility counting capabilities and technology.

Are you able to provide information regarding passage capabilities for this passage facility?

- Yes [pass to next capability question]
  - No (proceed to operational schedule questionnaire section) [pass to operational schedule section]
2. What migratory species is this **[Direction Conveyance type]** specifically designed to pass?

These are species that the passage facility was **specifically designed and built to allow to pass** the hydropower feature and not all species known to use this passage facility.

Please select all that apply from this list of migratory species commonly affected by hydropower dams. You may list any additional species not listed here in the following question. Click on a selected option to deselect it.

- [select from list]
3. Please list any **additional migratory species that this facility is designed to pass** but which are not included in the list above.
- [enter text]
4. Please list any additional species that are known to use this passage facility but **for which the facility is not intentionally designed** here.
- [enter text]
5. Does this **[Direction Conveyance type]** have a mechanism for selective passage to intentionally prevent passage of certain invasive or nonnative species?
- Yes
  - No
  - Unknown
6. **[DISPLAY LOGIC: Q5 is Yes]** Please list the species for which passage is intentionally prevented or limited at this **[Direction Conveyance type]**.
- [enter text]

7. What is the estimated number of fish that this **[Direction Conveyance type]** is designed to accommodate?
  - a. [enter text]
8. Does this **[Direction Conveyance type]** have prescribed passage performance standards?
  - a. Yes
  - b. No
  - c. Unknown
9. [FORCE RESPONSE] Does this **[Direction Conveyance type]** have fish counting capabilities?
  - a. Yes
  - b. No
  - c. Unknown
10. [DISPLAY LOGIC: Q9 is Yes] What type(s) of counting capabilities does this **[Direction Conveyance type]** have?

Please select all that apply. Click on a selected option to deselect it.

- a. Counting software
  - b. Counting technician (via fish passage window)
  - c. Other (with text entry)
  - d. Unknown
11. [DISPLAY LOGIC: Q9 is Yes] What is the maximum observed annual count of the total number of fish using this **[Direction Conveyance type]**?

*Note: you may also provide the maximum observed annual count of a specific species or group of species if counting is only conducted for the species targeted for passage (e.g., 100,000 River herring).*

- a. [enter text]
12. [DISPLAY LOGIC: Q9 is Yes] What year was the maximum annual fish passage count reported above observed?
    - a. [select from year drop-down]
  13. Please provide any additional information on passage capabilities of this **[Direction Conveyance type]** not captured in the previous questions in the space below.
    - a. [enter text]

## **PASSAGE FACILITY OPERATIONAL SCHEDULE INFORMATION**

1. [FORCE RESPONSE] The questions in this section of the questionnaire pertain to **operational schedule information** associated with this **[Direction Conveyance type]**.

Passage operational scheduling information includes details regarding owner(s) and operator(s) of unique passage facilities and whether the facility is continuously or periodically operational.

Are you able to provide information regarding passage operational scheduling for this passage facility?

- a. Yes [pass to next operational schedule question]
  - b. No (proceed to final questionnaire section) [pass to request for additional information section]
2. Who owns this **[Direction Conveyance type]**?
- a. [enter text]
3. Who operates this **[Direction Conveyance type]**?
- a. [enter text]
4. Does this **[Direction Conveyance type]** operate continuously (i.e., year-round) or periodically (e.g., only during certain seasons or time windows when fish are known to be migrating)?
- a. Continuously
  - b. Periodically
  - c. Unknown
5. [DISPLAY LOGIC: Q4 is Periodically] Please choose the option(s) that best describe(s) the window of time during which this **[Direction Conveyance type]** is operating.

For example, a passage facility might be operational only during known migration months or seasons, or during specific hours when fish may be cued to migrate based on environmental or biological factors.

Please select all that apply. Click on a selected option to deselect it.

- a. Monthly or seasonally
  - b. Weekly
  - c. Hourly or nightly
  - d. Other (with text entry)
  - e. Unknown
6. [DISPLAY LOGIC: Q4 is Periodically] Please choose the option(s) that best describe the event(s) that trigger the start of periodic passage operation for this **[Direction Conveyance type]**.

Please select all that apply. Click on a selected option to deselect it.

- a. Temperature
  - b. Calendar date
  - c. Biological cue (e.g., species abundance)
  - d. Other (with text entry)
  - e. Unknown
7. [DISPLAY LOGIC: Q4 is Periodically] If you would prefer, please use this space to briefly describe the periodic operational schedule of this **[Direction Conveyance type]**, and also list different operational schedules for different species or groups of species if applicable.

*Example: Passage is operated from April 1st to December 15th for American eels and from May 1st through July 31st for Blueback herring.*

- a. [enter text]
8. Please provide any additional information on operational scheduling of this **[Direction Conveyance type]** not captured in the previous questions in the space below.
  - a. [enter text]

## REQUEST FOR ADDITIONAL INFORMATION

Thank you for providing information about the **[Direction Conveyance type]** at **[Hydropower feature]**.

1. Do you have any additional information regarding this fish passage facility and/or hydropower feature not captured by any of the questionnaire sections that you are able to share?

This includes passage feasibility or design studies, monitoring documentation, passage performance studies, or other documents or online links.

Please use the spaces below to upload any relevant documents and/or provide links to any relevant online documents or resources.

2. Please upload any relevant documents here.

Note: this question only allows for a single document upload. If you have multiple files you would like to share, you may email them to us at [matsonpg@ornl.gov](mailto:matsonpg@ornl.gov).

- a. [document upload]
3. Please copy and paste links to any relevant online documents or resources here.
  - a. [enter text]

## QUESTIONNAIRE CONCLUSION

Thank you for completing the Fish Passage Database Stakeholder Questionnaire!

Your response has been recorded.

The information you provided on fish passage facilities and hydropower features will help us build the first national-scale database of fish passage capabilities in the United States.

If you would like to provide information regarding another fish passage facility at this or another hydropower feature, please submit a new **[Questionnaire link]**.

If you have questions or concerns about the project or questionnaire, would like to update your responses, or would like to learn more about other hydropower projects at ORNL, please contact Paul Matson, the project leader, at [matsonpg@ornl.gov](mailto:matsonpg@ornl.gov).

