

# Aquatic Organism Passage and the Rehabilitation of High Hazard Potential Dams

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Dams can pose an impediment to up and downstream migration for aquatic organisms and result in population declines. An aquatic connectivity decision framework can help dam owners decide between repairing or removing a high hazard potential dam, while also potentially leveraging additional resources for such activities. This fact sheet provides an example flowchart and other information to aid dam owners in project planning.

## Aquatic Organism Passage

Aquatic organism passage, also sometimes referred to as fish passage, is the ability of fish and other aquatic organisms to migrate freely upstream and downstream through or around human constructed infrastructure such as culverts, bridges, diversions, or dams. Connectivity of a stream, watershed, or entire aquatic ecosystem is important for fish and other aquatic organisms to successfully complete all necessary life history stages: birth, growth, reproduction, and death. Any obstruction or barrier within a stream can lead to habitat fragmentation and degradation and serve as a catalyst to severely alter an aquatic species' life cycle. Habitat fragmentation can also lead to genetic bottlenecks and declines in an aquatic species' population viability and resiliency.

- *Aquatic species population viability* is defined as the ability of a species to sustain reproducing populations in a natural aquatic ecosystem over a specified timeframe.
- *Aquatic species population resiliency* is how a specific species population responds to potential random or problematic events, such as the construction of dams within a watershed.

“Fish passage is the ability of fish or other aquatic species to move through an aquatic system among all habitats necessary to complete their life cycle.” – [United States Fish and Wildlife Service](#)

## The Impact of Dams on Aquatic Organism Passage

Aquatic ecosystems, and the species that reside within them, provide important benefits to communities, local economies, and the broader environment. From recreational, commercial, and subsistence fishing, to economic, cultural, and community resilience, intact and well-functioning aquatic ecosystems are essential to the lives and well-being of the American people and sovereign Tribal nations. Furthermore, aquatic organisms comprise many of



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the [federally listed–threatened or endangered–species](#) throughout North America. Dams and other barriers pose an impediment to up and downstream migration for aquatic organisms, and fish species are some of the most impacted by such structures. Many fish species migrate up or downstream to access specific seasonal habitats to complete certain life history stages, seek other optimal habitats as needed, or evade predation or catastrophic events. When anthropogenic barriers such as dams are present within a stream, watershed, or throughout an aquatic ecosystem, many of these fish migratory patterns are severely disrupted or completely halted. These disruptions can result in decreases in diversity and abundance that can contribute to species population declines, which in turn leads to species becoming imperiled or extirpated from an impacted ecosystem. When a species is considered a narrow endemic (*i.e.*, small geographic range and/or occupies distinct habitat limited by environmental conditions) dams can have an even more profound adverse impact.

Restoring connectivity of these aquatic corridors and reducing habitat fragmentation throughout entire watersheds provides one of the most holistic approaches and options to promote aquatic organism passage. Appropriate connectivity within aquatic ecosystems provides the flow, sediment, nutrient, and habitat complexity necessary for fish and aquatic organisms to meet multiple life history needs. When dam removal project opportunities arise within [critical habitat designation](#) areas, or other geographic priority areas, such efforts can have a profound positive benefit to the conservation of federally listed, and other ecologically or economically important aquatic species. A geographic priority area may be identified as a single stream (or segments thereof), a specific watershed, or any other habitat conservation area of relative significant importance. Such areas may contain known occurrence records for federally listed or other ecologically or economically important aquatic species and/or be designated as critical habitat for federally listed species.

## Dam Removal Versus Repair

As a dam ages and the structural condition worsens, rehabilitation is an opportunity to address environmental concerns, as well as threats to human life and property. The Rehabilitation of High Hazard Potential Dams (HHPD) program defines “rehabilitation” as the repair, replacement, reconstruction, or removal of a dam that is carried out to meet applicable state dam safety and security standards.

High Hazard Potential is a **classification** standard for any dam whose failure or mis-operation will cause loss of human life and significant property destruction.

A dam’s age, remaining function, and structural integrity are aspects to consider when assessing dam rehabilitation needs. Such assessments may determine that removal is the most practical and economical option.

Removal is the most desirable option when considering dam rehabilitation activities to address fish passage and promote the restoration of the local environment. Structural modifications performed during the repair of a dam to promote fish passage may be possible, but do not guarantee the intended beneficial results for the target aquatic organism(s) will be achieved. Logistical and economic constraints may also prove to be limiting factors.

## Example of an Aquatic Connectivity Decision Framework for Dam Removal Projects

An aquatic connectivity decision framework is a visual aid (e.g., flowchart) that can assist dam owners in deciding which rehabilitation option (i.e., repair or removal) is the best option for their respective circumstance. If dam removal becomes a potential option, identifying benefits to aquatic organism passage within geographic priority areas can potentially provide additional resources (i.e., technical and/or financial assistance) for project planning and implementation. An example flowchart for a decision framework concept outlining the process in determining potential benefits to aquatic organism passage is provided below (Figure 1). It can also be a process or planning document that outlines the goals, strategies, and objectives to aid dam owners more effectively in navigating the necessary considerations to efficiently implement a dam removal project, but it should not be considered prescriptive.

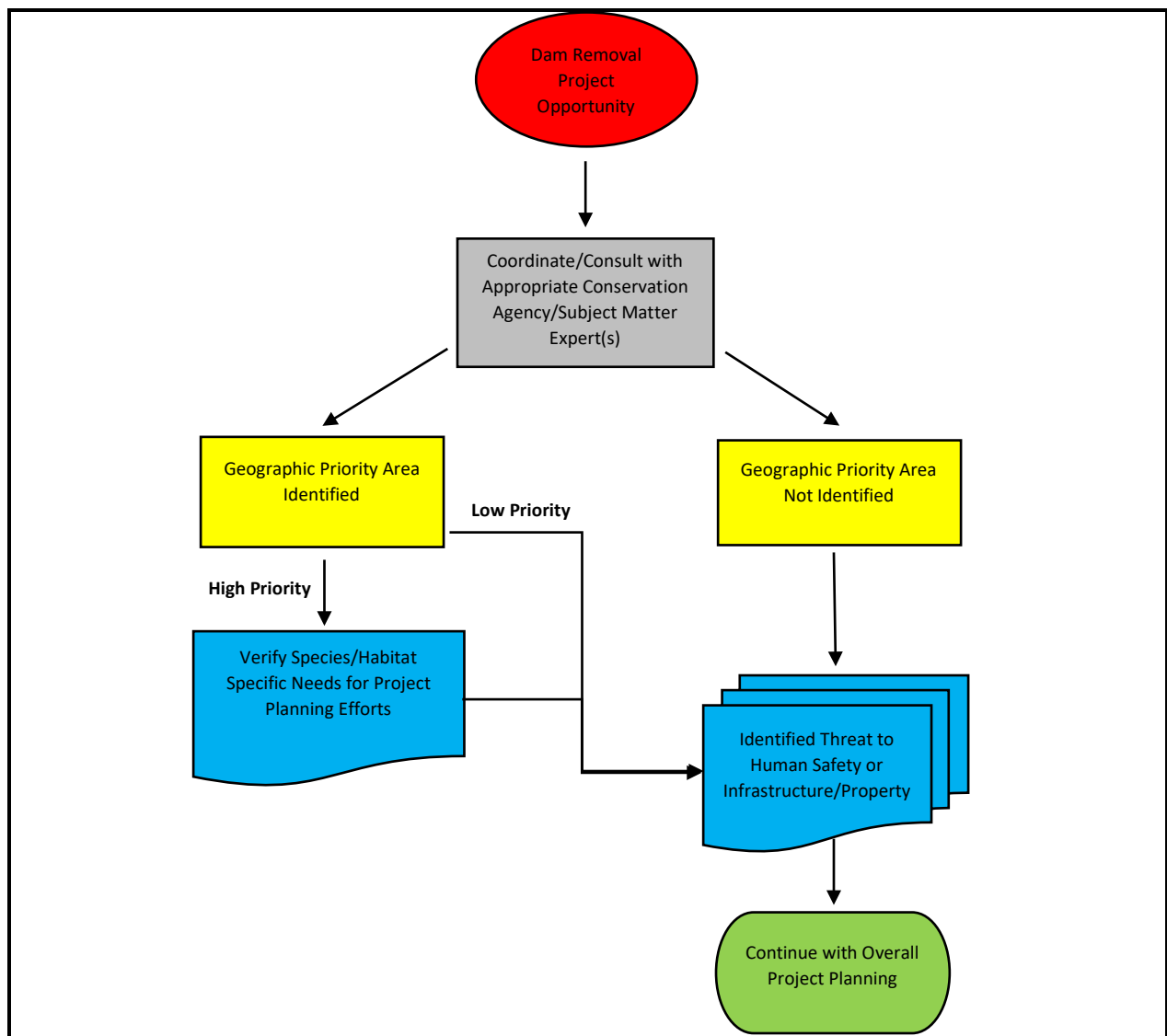


Figure 1. Example decision framework for prioritizing dam removal project efforts with fish passage as a consideration.

## Decision Framework Components

- **Primary Goal** (red starting oval) – “Dam Removal Project Opportunity” is the proposed effort, which assumes a willing owner has expressed a desire to explore dam removal as an option.
- **Strategy** (gray process rectangle) – Coordinate/consult with appropriate conservation agency (e.g., U.S. Fish and Wildlife Service [USFWS], National Oceanic and Atmospheric Administration [NOAA], state or tribal natural resource agency, etc.) and other potential subject matter experts (e.g., university researchers, non-governmental organizations, etc.) to determine if the project opportunity is within a geographic priority area and how to prioritize efforts to achieve the primary goal.
- **Objectives** (yellow process rectangles) – These two directives can be utilized to address the strategy, and ultimately achieve the goal as potentially related to fish passage considerations.
  - *Geographic Priority Area Identified* – the location of the potential dam removal project is within a confirmed geographic area that is a priority for aquatic species conservation efforts. If within a known geographic priority area, continue to coordinate with appropriate conservation agency (e.g., USFWS, NOAA, state or tribal natural resource agency, etc.) and other potential subject matter experts (e.g., university researchers, non-governmental organizations, etc.) to identify additional needs, concerns, and considerations for potential dam removal efforts.
  - *Geographic Priority Area Not Identified* – the location of the potential dam removal project is not within a confirmed geographic area that is a priority for aquatic species conservation efforts. Proceed with assessing HHPD criteria threat determinations.
- **Tactics** (blue document(s) shape) – Verification and identification for dam removal project priority justification(s) relative to aquatic organism passage benefits and/or HHPD efforts.
  - *High Priority* – The dam removal project opportunity has tremendous potential to benefit federally listed and/or other ecologically or economically important aquatic species and associated habitats. This may indicate that there are known occurrence records for such aquatic species within the stream and/or the project site is within associated habitat for such species. The recommendation is to continue to work with the appropriate entities to determine specific project planning needs for identified aquatic organisms.
  - *Low Priority* – No immediate apparent benefit to federally listed or other ecologically or economically important aquatic species, and/or their associated habitats, was identified. This does not preclude any dam removal efforts in benefiting the associated stream and aquatic ecosystem, rather it simply indicates that no known occurrence records for federally listed and other ecologically or economically important aquatic species and/or associated habitats exist for this project site. If no current aquatic species survey information is available for the project site, additional efforts to further validate the project site via species surveys may be warranted. Thus, the recommendation is to continue working with the appropriate conservation agency and other subject matter experts to determine specific project planning needs.

The primary driver for potential HHPD dam removal efforts is identified threats to human safety or infrastructure/property. However, if ancillary benefits to aquatic organism passage within geographic priority areas

can also be identified, dam removal projects will provide mutual benefits. These mutual benefits will lead to the streamlining of project development through additional collaborative efforts and coordination.

- Results (green terminating oval) – This is the product that will be produced from the tactics to support the objectives and potentially achieve the primary goal. Information should be available to justify whether efforts should continue with overall planning for the dam removal project opportunity, regardless of benefits to aquatic organism passage efforts.

## Additional Considerations

The example aquatic connectivity decision framework and associated descriptions within this document should serve as a guidance tool and not be definitive. Ultimately, each dam removal project opportunity will have varying logistical matters to consider, especially relative to threats to human safety and infrastructure or property. Aquatic organism passage should be considered an ancillary benefit when threats to human safety are an imminent risk. In circumstances where benefits to aquatic organisms and associated habitats are identified, additional resources, such as technical and financial assistance, may become available for the dam removal project.

*For additional information on fish passage and available resources, please visit the below links:*

- [Federal Interagency Fish Passage Task Force](#)
- [FEMA National Dam Safety Program](#)
- [U.S. Fish and Wildlife Service National Fish Passage Program](#)