

**NATURAL RESOURCES CONSERVATION SERVICE
CONSERVATION PRACTICE STANDARD**

FISH PASSAGE

(Mile)

CODE 396

DEFINITION

Modification or removal of barriers that restrict or impede movement or migration of fish or other aquatic organisms.

PURPOSE

Improve or provide [aquatic habitat connectivity](#) and upstream and downstream passage for fish and other aquatic organisms.

CONDITIONS WHERE PRACTICE APPLIES

All aquatic habitats where barriers impede passage for fish and other aquatic organisms.

CRITERIA

Planning and Evaluation

Evaluate sites for variations in stage and discharge, tidal influence, hydraulics, [stream alignment, immediate upstream and downstream](#) geomorphic impacts, sediment transport and continuity, [watershed conditions](#) and organic debris movement. Design passage features to account for the known range of variation resulting from this evaluation.

Minimize any foreseeable channel plan or profile shifts resulting from the modification or removal of a passage barrier.

Plan and locate passage for compatibility with local site conditions and stream geomorphology, to the extent possible.

Avoid locating fishway entrances and exits in areas that will obstruct function, increase harassment or predation, or result in excessive operation and maintenance requirements.

Design Requirements

[Design passage to insure that the crossing \(e.g. culvert, bridge, etc.\) mimic the stream profile, cross section, substrate composition and does not interrupt fluvial processes such as sediment transport under bankfull conditions.](#)

[Designs must follow the Vermont Department of Fish and Wildlife's \(VTFWD\) Guidelines for the Design of Stream/Road Crossings for Passage of Aquatic Organisms in Vermont \(2008\). Outlet drops at any flow and stream channel constrictions at bankfull flow will be avoided.](#)

Design passage to accommodate present and reasonably anticipated changes in watershed conditions.

Design passage structures according to known swimming and leaping capabilities of target species or a similar species with comparable swimming abilities. [This criterion will be used only where the Hydraulic Design option of the VTFWD Guidelines is required due to site conditions or other constraints.](#) Utilize hydraulic computations to document how designs satisfy the physiological requirements of target organisms.

Design and evaluate passage structures for hydraulic performance and structural integrity at the bankfull [\(1.5 to 2 year event\)](#) and 25-year peak flow events (at a minimum).

Design passage features to minimize or avoid energy deficits, physical stress, and harm to migratory organisms.

Design passage features to minimize or avoid excessive delays during migration periods.

Conservation practice standards are reviewed periodically, and updated if needed. To obtain the current version of this standard, contact the Natural Resources Conservation Service [State Office](#) or visit the [electronic Field Office Technical Guide](#).

Provide adequate attraction flow into a passage facility across the full range of discharge during which target species will move.

Use trashracks on culverts only if required or necessary. Ensure that trashracks are self-cleaning and/or easily maintained.

Select construction materials and methods that are non-toxic, minimize adverse consequences to aquatic organisms, and are resistant to degradation.

CONSIDERATIONS

Develop or adopt a quantitative method to identify and evaluate passage barriers (see References). Information derived from this method can assist planning and budgeting activities.

Consider removing a passage barrier before installing or retrofitting a new facility or structure. Complete or partial barrier removal usually provides better passage conditions, and is more economical than designing, constructing, operating, and maintaining many passage structures.

Culverts or bottomless arches that incorporate natural streambed substrates throughout their length are preferred over other culvert configurations for passage purposes. Natural streambeds provide numerous passage and habitat benefits to many life stage requirements for fish and other aquatic organisms compared to man-made surfaces.

Design and locate features to improve or provide passage for as many different aquatic species and age classes as possible.

Replacing or removing an existing instream structure may trigger channel adjustments (e.g., aggradation and/or degradation) upstream and/or downstream of the work site. Install grade controls or other slope modifications to mitigate adverse physical or ecological consequences (see Channel Stabilization – Code 584 and Grade Stabilization Structure – Code 410).

Analyze any potentially negative interactions, including hybridization, disease, competition, or predation, between target and aquatic nuisance species when passage is provided above a barrier. If serious consequences are likely, take steps to minimize adverse effects.

Where possible, consider the habitat requirements of other aquatic or terrestrial species that may be affected by a passage project. Some passage facilities may improve survival for terrestrial vertebrates by providing safe migration routes under roadways. [Design crossing structures shall be a minimum 1.0 to 1.25 times the bankfull width.](#)

Consider the amount of habitat upstream and downstream of a barrier to evaluate into project feasibility, cost effectiveness, and/or potential for connecting fragmented habitats. Using a watershed approach whenever possible provides a framework for project planning.

Fish passage facilities are often associated with water diversions or intakes that injure or kill aquatic species. Prevent fish entrainment, particularly juveniles, into diversions, penstocks, or pumps by installing screens.

Passage projects can affect water management practices such as diversion, power generation, or storage. Strive to balance aquatic organism passage with other water management objectives.

Consider upstream and larger watershed issues that may affect passage. Common solutions may include maintaining or restoring adequate instream flow and/or other water quality parameters (e.g., temperature, dissolved oxygen).

Barrier removal, especially dams and road crossings, can significantly affect wetlands, flooding potential, existing infrastructure, and social and cultural practices. Evaluate and address the full range of impacts when planning or designing barrier removal projects.

Floodplain and water development often alter historic river channel pattern and location. Consider bypassing a barrier by restoring streamflow to former, stable natural channels.

Passage facilities can assist population recovery and management. Where applicable, consider local, state, or federal brood stock collection and species management initiatives when planning passage features.

Consider using self-regulating tidegates in marine environments. These structures can be adjusted to automatically regulate saltwater intrusion into estuaries, and often improve estuarine functions and passage conditions.

In the case of low-water crossings, water quality impacts from vehicular pollutants and erosion caused by tire action can be severe. Where possible, reroute roadways or install hardened instream crossings.

All necessary local, state and federal permits shall be obtained by the landowner (or representative) prior to construction.

PLANS AND SPECIFICATIONS

Provide site-specific plans for this practice. Plans will specify passage structure design, layout, and overall objectives, and include (at a minimum):

- Location map and plan view of site;
- Detailed construction drawings showing site elevations (including headwater and tailwater fluctuations), description and analyses of design flows, and structural operating criteria;
- Construction specifications describing materials, logistics (including erosion control), and timing.
- Guidance for post-construction evaluation and monitoring to assess structural integrity and compliance with design criteria.

OPERATION AND MAINTENANCE

Develop an operation and maintenance plan for all applications of this standard. Within the plan, provide for periodic inspection and corrective action should passage conditions become impaired because a structure is damaged or inoperable. Typical operation and maintenance items include:

- Specify what entity is responsible for the daily operation and maintenance of a passage structure.
- Check a passage structure at regular intervals to ensure it is operating within design criteria.
- Clean trashracks and debris collectors or remove debris accumulations regularly.
- Adjust gates, orifices, valves, or other control devices as needed to regulate flow and maintain a passage structure within operating criteria.
- Periodically check staff gages or other flow metering devices for accuracy.
- Annually inspect passage structures for structural integrity and disrepair.
- Inspect gate and valve seals for damage.
- Replace worn or broken stoplogs, baffles, fins, or other structural components.
- Remove sediment accumulations from within passage structure where applicable.

REFERENCES

Guidelines for the Design of Road/Stream Crossings for Passage of Aquatic Organisms in Vermont, VTFWD, 2008
<http://www.vtfishandwildlife.com/library.cfm>

Fish Passage and Screening Designs, Technical Supplement 14-N to NEH-654 – Stream Restoration Design Handbook. NRCS. 2006.

Vermont Stream Geomorphic Assessment Protocols, VTDEC River Management, May 2005
http://www.anr.state.vt.us/dec/waterq/rivers/htm/rv_geoassesspro.htm

Design of Road Culverts for Fish Passage, Washington Department of Fish and Wildlife, May 2003,
<http://wdfw.wa.gov/hab/engineer/cm/>

Massachusetts River and Stream Crossing Standards: Technical Guidelines,
http://www.umass.edu/nrec/pdf_files/guidelines_river_stream_crossings.pdf