RECONNECTING RIVERS FOR PUBLIC SAFETY & CONSERVATION

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WHY IT MATTERS

Virginia's rivers, and the communities that depend on them, are threatened by aging infrastructure. Thousands of dams and stream barriers, including undersized or aging culverts, restrict the movement of aquatic species, fragment rivers, and degrade water quality across the Commonwealth.[1] Virginia sits within a global hotspot for freshwater **biodiversity**, yet this diversity is at risk as habitat connectivity declines.[2] Aquatic organisms depend on connected waters to access critical reproductive grounds, food, and refuge. Where rivers are fragmented, studies show declines in species diversity and abundance, weakening ecosystems and diminishing recreational opportunities such as fishing.[3] On the James River alone, dams and barriers block approximately 27% of historic American shad habitat, contributing to ongoing population declines among migratory species.[4]

Dams pose significant and often underrecognized safety risks. Virginia has 440 high-hazard potential dams, where failure is likely to result in loss of life.[5] Aging infrastructure and increasingly intense storms heighten these risks, as most dams were not designed to handle today's floods.[6] **Low head dams**, sometimes called "drowning machines," are especially dangerous, creating powerful currents that can trap and kill recreators. Virginia ranks among the top ten states with the highest number of fatalities at low head dams.[7]

Road-stream crossings, including culverts and bridges, are undersized for today's heavier storms, leading to backups, road overtopping, and infrastructure failures; nationwide, nearly two-thirds are considered insufficient.[8] Hurricane Helene underscored this risk, damaging 63 culverts and 26 bridges in Virginia, endangering lives and costing millions. Upgrading crossings that are designed to work with a stream's natural structure is essential for protecting our communities and aquatic ecosystems.

CURRENT LANDSCAPE

State law requires that dams obstructing fish passage include fishways. However, this requirement is neither consistently enforced nor applied; including on critical sections of the James, Nottoway, and Meherrin rivers. Over half of the James River is blocked to migratory fish due to a series of seven dams without any fish passages.

Water quality permitting frameworks also recognize the importance of aquatic connectivity. Both Section 404 of the federal **Clean Water Act** and **Virginia Water Protection (VWP)** permit regulations state that activities should not substantially disrupt the movement of aquatic life.[9,10] Despite this, culverts are frequently designed or installed in ways that impede passage, particularly when cost considerations outweigh ecological performance. Virginia lacks **aquatic organism passage (AOP)** standards or guidance for incorporating AOP into transportation design. While **ecological-design culverts** can improve flow, sediment transport, and organism passage while reducing long-term maintenance costs, they are not widely prioritized.[11,12] Dam safety oversight is similarly uneven. High-hazard dams are required to be inspected every two years, yet hundreds of Virginia dams have not been evaluated within that timeframe, according to the National Inventory of Dams.[13,14] Additionally, Virginia's dam safety regulations are based largely on size and failure potential, leaving many low head dams outside formal regulatory oversight despite their demonstrated safety risks to both humans and animals.

Liability frameworks further complicate risk management. Under Virginia Code § 29.1-509(F), dam owners who voluntarily install safety signage at low head dams are shielded from liability, potentially reducing incentives for more comprehensive safety improvements or removal.[15]

OPPORTUNITIES

Virginia can strengthen its approach to river restoration by aligning infrastructure, ecological, and public safety priorities. Expanding the use of ecological-design culverts represents one such opportunity. These structures are designed to accommodate natural stream processes, improving AOP, lowering community flood risks, and reducing long-term maintenance needs. The higher upfront investment can lead to considerable long-term savings and resilience gains.

Virginia has already begun advancing this work through initiatives such as the Virginia Department of Transportation's Aquatic Organism Passage Study, which evaluates and prioritizes road-stream crossings for ecological upgrades.[16] Integrating these findings into transportation planning and capital programs can accelerate progress at scale.

In addition to expanding AOPs in culverts, investments are needed to improve fish passage at dams. Fish ladders, nature-like bypass channels, and technical fishway retrofits at priority dams where removal is not feasible can restore access to historic habitat for aquatic species. Fish passage funding is available through the **National Oceanic Atmospheric Administration** and **U.S. Fish and Wildlife Service** federal

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grants, which can be paired with dedicated state programs and technical expertise to systematically reopen river miles to improve connectivity, fisheries recovery, and public safety.

At the state level, the **Virginia Department of Conservation and Recreation** provides grants through the **Virginia Dam Safety, Flood Prevention and Protection Assistance Fund** to improve dam safety by reducing or mitigating the hazard posed by a dam, including removal.

Targeted funding, dedicated staff, and technical assistance for dam removal and fish passage design can support addressing obsolete and unsafe structures. Developing clear, state-level requirements on dam removal processes can also reduce project timelines and costs.

Ultimately, greater attention is needed on low head dams as a distinct public safety threat. State inventories, required safety signage, and clear expectations for owner responsibility can reduce risk for both dam owners and Virginia's river users while informing long-term decisions about modification or removal.

TOP TAKEAWAYS

River fragmentation threatens both biodiversity and public safety in Virginia, particularly as aging infrastructure and stronger storms increase risks.

Current policies recognize aquatic connectivity and dam safety but face significant gaps in enforcement, oversight, and design standards.

Ecologically-designed culverts, fish passages, stronger dam safety programs, and strategic dam removal are practical, state-level approaches to improving resilience and protecting communities and wildlife.

ENDNOTES

1. *National Aquatic Barrier Inventory.* (n.d.). National Aquatic Connectivity Collaborative. https://aquaticbarriers.org/inventory/
2. *Biology, Ecology, and Management of Virginia's Freshwater Fishes.* (2025). Virginia Cooperative Extension. https://www.pubs.ext.vt.edu/content/dam/pubs_ext_vt_edu/CNRE/cnre-73/CNRE-188.pdf
3. Nislow, K. H., Hudy M., Letcher B.H., and Smith E.P.. (2011). *Variation in local abundance and species richness of stream fishes in relation to dispersal barriers: implications for management and conservation. Freshwater Biology*, (56), 2135–2144. https://doi.org/10.1111/j.1365-2427.2011.02634.x
4. *A Framework for the Recovery of American Shad (Alosa sapidissima) in the James River, Virginia.* (2023, November). Virginia Institute of Marine Science. https://rga.lis.virginia.gov/Published/2023/RD587/PDF
5. *National Inventory of Dams.* (n.d.). U.S. Army Corps of Engineers. https://nid.sec.usace.army.mil/nid/#/dams/search/sy=@stateKey:VA%20@hazardId:(4)
6. Perera, D., Smahktin, V., Williams, S., North, T., & Curry A.. (2021). Ageing Water Storage Infrastructure: An Emerging Global Risk. *United Nations University.* https://seprem.es/articulos_f/Debate_Riesgo/Ageing-Water-Storage-Infrastructure-AnEmerging-Global-Risk_web-version.pdf
7. *Low Head Dam Fatalities Database.* (n.d.). Low Head Safety Initiative. https://www.lowheaddamfatalities.org/
8. *States must modernize stream crossing standards to protect communities from flooding.* (2025, November 20). Headwater Economics. https://headwaterseconomics.org/natural-hazards/flooding/why-stream-crossing-standards-matter/
9. *Overview of Clean Water Act Section 404.* (n.d.). Environmental Protection Agency. https://www.epa.gov/cwa-404/overview-clean-water-act-section-404
10. State Water Control Board, VWP general permit. 9VAC25-680-100. (2016) https://law.lis.virginia.gov/admincode/title9/agency25/chapter680/section100/
11. Higgins, D., & Donner, D. M. (2025). Designing flood resilient road-stream crossings: A case study from the July 2016 northwest Wisconsin flood. *(General Technical Report NRS-231). U.S. Department of Agriculture, Forest Service, Northern Research Station.* https://doi.org/10.2737/NRS-GTR-231
12. O'Shaughnessy, E., Landi, M., Januchowski-Hartley, S. R., & Diebel, M. (2016). Conservation leverage: Ecological design culverts also return fiscal benefits. *Fisheries, 41* (12), 750–757. https://doi.org/10.1080/03632415.2016.1246875
13. *Dam Safety Program.* (n.d.). Department of Conservation and Recreation. https://www.dcr.virginia.gov/dam-safety-and-floodplains/dam-safety-index
14. *National Inventory of Dams.* (n.d.). U.S. Army Corps of Engineers. https://nid.sec.usace.army.mil/nid/#/dams/search/sy=@stateKey:VA%20@hazardId:(4)
15. Requirement for fishways. § 29.1-101.9. (1992). https://law.lis.virginia.gov/vacode/title29.1/chapter1/section29.1-101.9/
16. Amy Golden, personal communication VSWCC presentation. (March 6, 2026)