

Federal Funding for Dam Removal in the United States

Issue Brief 20-12 by **Margaret Walls** and **Leonard Shabman** — December 2020

1. Introduction

Dam removals can generate environmental benefits and, simultaneously, in the case of old and deficient dams, reduce safety problems. Finding money to pay for dam removal is a challenge, however. This Issue Brief describes federal government programs that are used to fund dam removal and some of their limitations and possibilities. The programs reside in the US Fish and Wildlife Service (FWS), National Oceanic and Atmospheric Administration (NOAA), US Army Corps of Engineers, Federal Emergency Management Agency (FEMA), and US Department of Agriculture's Natural Resource Conservation Service (NRCS). We also describe a federal partnership program led by the US Environmental Protection Agency (EPA), the Great Lakes Restoration Initiative (GLRI), which has provided funding in the Great Lakes region. Most of the programs target ecosystem restoration and fish passage, but two focus on rehabilitation of failing dams.¹ We describe how these latter programs may have the potential to be used more for removals in particular circumstances, sometimes with modifications. This is one in a series of

four RFF issue briefs on alternative funding approaches for dam removal. See Walls and Shabman (2020) for an introduction to the series.

2. FWS

The FWS supports dam removals, and other barrier removal and bypass projects, through its National Fish Passage Program (NFPP). Biologists and engineers in eight regional offices work with nonprofit and state government partners, providing technical assistance in the planning, design, implementation, and monitoring of fish passage projects, as well as grant funding. According to the FWS, the program has removed or bypassed 3,202 barriers and opened up 57,736 miles of upstream habitat for fish and other aquatic organisms since its inception in 1999.²

Key criteria for project selection include demonstrable benefits for federal trust species,³ permanence of fish passage benefits, a large number of partners on the project, and maximum matching funds. In recent years, the annual budget for the NFPP has averaged \$10–\$14

1 The National Fish and Wildlife Foundation, which is a nonprofit organization partially funded by the federal government, also provides grants for dam removals. These grants are offered under different programs that have particular landscape, region, and species focuses. Funding is usually pulled together from a combination of corporate sponsors, FWS, US Forest Service, and philanthropic foundations. NFWF's IDEA program uses mitigation funds and Natural Resource Damage (NRD) settlement funds, working with permitting agencies, permittees, and other stakeholders to disburse money for the benefit of impacted species, habitats, and resources. See <https://www.nfwf.org/> for more information; we do not discuss NFWF further in this Issue Brief. Funding from mitigation and NRD is covered in a separate Issue Brief (Shabman and Stephenson 2020).

2 <https://www.fws.gov/fisheries/fish-passage.html>.

3 As defined in 16 US Code § 3772.1: "The term 'federal trust species' means migratory birds, threatened species, endangered species, interjurisdictional fish, marine mammals, and other species of concern."

million.⁴ The average grant size is \$70,000. According to NFPP staff, approximately 40 dam removal projects were funded over the four-year period between 2015 and 2018, with grants averaging approximately \$40,000.⁵ Dam removal projects account for roughly 25 percent of all projects funded in the NFPP.

On many dam removal projects, the FWS contribution comprises much less than 50 percent of the total costs and many other sources of funds are brought to the table. Nonetheless, the NFPP has been one of the most consistent and important sources of support for dam removals for the past 20 years. In addition to direct dollars, FWS regional staff provide a great deal of in-kind support. Costs for dam removal projects go well beyond direct deconstruction costs and include project management, permitting, community engagement, various mitigation requirements, and a host of other activities. FWS regional staff often take on these responsibilities and help move these projects from plans and ideas through to fruition.

Since 2006, the FWS has also led the National Fish Habitat Partnership Program, which works through regional partnerships to implement the National Fish Habitat Action Plan. The program provides some grant funding for projects to conserve and restore fish habitat, which can occasionally include dam removals.⁶

3. NOAA

NOAA provides financial and technical assistance for dam removals in coastal states (excluding the Great Lakes states) through its Community-Based Restoration

Program (CBRP). The CBRP's goal is to recover and sustain fisheries, with an emphasis on species that are listed as endangered or threatened under the Endangered Species Act.⁷ Since its start in 1996, the CBRP has provided nearly \$203 million in grant funding to more than 2,180 coastal habitat restoration projects.⁸ The majority of these have not included dam removals, however. In the most recent round of awards, announced in July 2020, 31 restoration projects received \$13 million. Nine included dam removals (some of them multiple removals in a single river basin), totaling \$1.9 million.⁹

NOAA also runs the Pacific Coastal Salmon Recovery Fund (PCSRF), which Congress established in 2000. NOAA provides PCSRF grant funding to tribes and the states of California, Oregon, Washington, Idaho, and Alaska to support salmon and steelhead conservation and restoration efforts. As of October 2019, \$1.4 billion had been awarded over the 19 years of the program.¹⁰ The states typically use PCSRF money to provide grant funding and technical assistance for a variety of different restoration projects, which can include dam removals. Thus, although we mention the PCSRF in this summary of federal grant programs, it is the states that apply the funds to particular projects and decide whether dam removals are a qualifying and priority use for NOAA grant funding. All the states use the funds to operate their own grant programs; California, Oregon, and Washington add state money to the federal PCSRF allotment. We describe these programs in a companion Issue Brief on state and local funding (Walls 2020a).

4 The annual budget justification reports for the FWS provide prior years' spending in various program categories. For FY2020, for example, see <https://www.fws.gov/budget/2020/FY2020-FWS-Budget-Justification.pdf>. Spending figures are available on "Habitat Assessment and Restoration," which includes the NFPP but also other activities. NFPP expenditures are reported separately in only a few years; requested increases in the NFPP budget are available in each budget. Together, this information allows for a rough sense of annual spending in most recent years.

5 Michael Bailey, National Coordinator, FWS Fish Passage Program, personal communication with the authors, November 8, 2020.

6 <http://www.fishhabitat.org/>

7 <https://www.fisheries.noaa.gov/topic/endangered-species-conservation>.

8 <https://www.fisheries.noaa.gov/national/habitat-conservation/community-based-habitat-restoration>.

9 <https://www.fisheries.noaa.gov/feature-story/nearly-13-million-noaa-funding-recommended-coastal-and-marine-habitat-restoration>.

10 Information on the PCSRF can be found at <https://www.fisheries.noaa.gov/west-coast/endangered-species-conservation/pacific-coastal-salmon-recovery-fund>.

4. GLRI

The GLRI was launched in 2010 to increase efforts to protect and restore the Great Lakes, which are the largest system of fresh surface water in the world. It is a multiagency initiative led by the US EPA; it has authority to supplement base agency budgets and, as of March 31, 2020, it had spent more than \$2.7 billion on 5,441 projects in Illinois, Indiana, Iowa, Michigan, Minnesota, New York, Ohio, Pennsylvania, and Wisconsin.¹¹ Projects focus on reducing nonpoint source pollution, cleaning up toxic substances, preventing and managing invasive species, and restoring wetlands and other habitats.

From our review of the database of individual projects provided on the GLRI website, approximately \$36.2 million has been spent on 88 projects involving dam removals from fiscal year (FY) 2010 to FY2019. These projects included design studies and implementation and were led by five agencies: Bureau of Indian Affairs, EPA, FWS, NOAA, and Army Corps of Engineers.¹²

The Forest Service spent an additional \$13.6 million of GLRI funds from FY2010–19 on aquatic organism passage projects in national forests in Minnesota, Michigan, and Wisconsin. These are mainly culvert replacements but also include some dam removals. The exact number is uncertain because individual Forest Service projects are not reported in the GLRI database.

5. Army Corps of Engineers

The Army Corps of Engineers undertakes water resource development projects in the US at the direction of Congress, through various authorizations

and appropriations. Typically, Congress passes an omnibus authorization bill biennially, which is given the title of Water Resources Development Act (WRDA). Through the annual appropriations process, particular activities and projects are then funded, subject to the limits in WRDA. This means that, to proceed with a given project, the Corps of Engineers needs both a congressional authorization and appropriation for it. The Continuing Authorities Program (CAP) is an exception to this requirement. The CAP is a group of nine legislative authorities that were established to allow for expedited project development and approval. Each CAP is preapproved without the need for additional congressional authorization. One CAP, established in Section 206 of the 1996 WRDA, authorizes the Corps to plan, design, and build projects to restore aquatic ecosystems for fish and wildlife. Some dam removals have been funded under Section 206, which is part of the Corps' Ecosystem Restoration Authorities (ERA).¹³ The ERA also includes a CAP established in Section 1135 of the 1986 WRDA, which allows changes in operations or modifications to Corps-owned structures to improve watershed environmental conditions. Section 1135 requires that the original purposes of the project be maintained, so removal of a Corps dam would not be an option. However, changes in operations at the dam may support removal of a non-Corps dam in another part of the watershed.

The Corps has also funded dam removals in the Great Lakes region under Section 506 of the WRDA of 2000, which established the Great Lakes Fishery and Ecosystem Restoration program. This program gave the Corps study and spending authority and a region-specific focus on fish passage as an acceptable goal for project evaluation. The law authorized an annual

11 Information available at <https://www.glri.us/projects>. The GLRI is one of several federal-state environmental partnership programs. The Chesapeake Bay Program is another. EPA's National Estuary Program oversees 28 local programs in estuaries of national significance and provides some annual funding for each—\$290 million was allocated between 2006 and 2019. To our knowledge, only the GLRI has provided funding for dam removals, however, so we limit our discussion to that program.

12 A significant share of this money went to dam removal projects on the Boardman River in Michigan. Three major dams were removed, the Brown, Boardman, and Sabin Dams, between 2013 and 2018; a fourth, the Union Street Dam, is being reconfigured and given a state-of-the-art fish passage that will allow native species through and keep invasive sea lamprey out of the lakes. The projects received funding from a wide array of sources, in addition to the GLRI. For more information, see <http://theboardman.org/>; for information on the Union Street Dam, see Tasker (2020).

13 <https://www.nae.usace.army.mil/Missions/Public-Services/Ecosystem-Restoration-Authorities/>. Most ERA spending goes to large-scale projects and programs in the California Bay Delta, Chesapeake Bay, Everglades, Great Lakes, and Upper Mississippi and Missouri Rivers.

spending limit of \$100 million, but much less has been appropriated in most years.¹⁴ With this authority, the Corps has contributed to removal of six dams, including two on the Boardman River¹⁵ and the Elkhart River Dam in Elkhart, Indiana, which was part of a large river revitalization project.¹⁶

The process for ecosystem restoration projects begins when a nonfederal project sponsor (such as a local government) requests Corps of Engineers assistance. The Corps prepares a feasibility study, which includes estimating of the overall scope and cost of the study, identifying ecosystem benefits, and determining whether the project is in the federal interest. The nonfederal sponsor must provide 50 percent of the cost of the feasibility study beyond the first \$100,000. If the feasibility study determines that Corps participation is justified at the district level, the project must then compete with projects across the nation for the available limited funds. In FY2020, Section 206 appropriations totaled \$10 million and Section 1135 \$8 million, far less than the \$67.5 million and \$50 million annual legislative limits for the two CAPs (Normand 2020). If a project is approved, the Corps funds a maximum of 65 percent of the cost of design and construction, and the sponsor contributes 35 percent. There is also a cap on federal funding of \$10 million for a single project, but this can sometimes be lifted by the Secretary of the Army.¹⁷

In evaluating a project for funding, the Corps calculates the project's cost-effectiveness and compares it, along with other trade-offs, to alternative ways of achieving various restoration outcomes. For dams, this can sometimes but not always lead to removal. A dam on the Mill River in Stamford, Connecticut, was removed

in 2009 after the Corps' analysis determined that removing the obsolete dam, which had minimal value, would restore stream habitat and eliminate a barrier to anadromous river herring runs (Oliver et al. 2018; US Army Corps of Engineers 2004). The Smelt Hill Dam on the Presumpscot River in Maine, which had been used for hydroelectric power production until it was damaged in a flood in 1996, was also removed after the Corps' analysis found that doing so would restore anadromous fish runs.¹⁸ Like the Mill River dam, it was not serving a useful purpose at the time of its removal. The Cuddebackville Dam on the Neversink River in New York was also removed with Corps funding (US Army Corps of Engineers 2002). The Corps determined that three dams on the Ten Mile River in East Providence, Rhode Island, however, should be left in place because they were still of value; fish ladders were added to each dam instead (Oliver et al. 2018).

In conclusion, Corps of Engineers funding for dam removal is constrained by administrative hurdles and limits on available funds. Under the CAPs, the amount of money available each year is relatively small and spread thin across many other ecosystem restoration projects. It is noteworthy, though, that the Great Lakes program was authorized explicitly to promote aquatic restoration and fish passage, so it may be possible for the Corps to receive special authority, via WRDA legislation, that implicitly elevates dam removal. The current WRDA bill in Congress includes a provision that would modify Section 206 of the 1996 law to add anadromous fish habitat and passage as a benefit to consider for restoration projects (H.R. 7575, Title I, Sec. 126).¹⁹ Passing the bill could raise the prospects for dam removal, provided that annual appropriations are adequate.

14 <https://www.fws.gov/habitatconservation/Omnibus/WRDA2000.pdf>.

15 The projects funded so far under Section 506 are described and mapped at <https://celre-gis.maps.arcgis.com/apps/MapJournal/index.html?appid=d71acffa5fdb46bf9331623dee1e054e>. For more on the Boardman River funding, see <https://www.lre.usace.army.mil/Media/News-Stories/Article/1699900/restoring-the-boardman/>.

16 <https://www.abc57.com/news/elkhart-awarded-grant-from-indiana-department-of-natural-resources..>

17 This happened for removal of dams on the Chattahoochee River in Georgia, for example. https://www.sam.usace.army.mil/Portals/46/docs/planning_environmental/docs/RP/Chattahoochee%20Dam%20Removal%20Sec%202006%20Review%20Plan_18%20May%202011.pdf.

18 <https://www.nae.usace.army.mil/Portals/74/docs/Topics/Presumpscot/FactSheet.pdf>.

19 <https://transportation.house.gov/imo/media/doc/BILLS-116hr7575eh.pdf>.

6. FEMA Hazard Mitigation Programs

FEMA runs five separate but related grant programs—the Hazard Mitigation Grant Program (HMGP), which provides funds for implementing long-term hazard mitigation planning and projects following a presidential disaster declaration; the HMGP Post-Fire Program, which provides similar assistance after wildfires; the Flood Mitigation Assistance Program, which provides funds for buildings insured under the National Flood Insurance Program that have been subject to repetitive flooding; the Pre-Disaster Mitigation Program, for hazard mitigation planning and projects that will reduce the costs of disasters before they occur; and the new Building Resilient Infrastructure and Communities (BRIC) program, which will soon replace the Pre-Disaster Mitigation Program. It is unclear how BRIC will differ from the earlier program, but FEMA states that it “aims to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience.”²⁰ Nature-based solutions to flood risks are to be one emphasis in the new BRIC program.

We are aware of two FEMA hazard mitigation grants for dam removal. The Rattlesnake Creek Dam removal project in Missoula, Montana, received funding from an HMGP grant that FEMA had awarded to the state after a 2018 wildfire disaster. The state had money remaining after the wildfire mitigation projects had been completed and opened up the funding for other projects.²¹ Trout Unlimited, a partner on the Rattlesnake Creek project, applied for and received \$700,000. Trout Unlimited also received \$1.1 million from the FEMA Pre-Disaster Mitigation grant program for removing the Ninemile Creek Dam, an old mining dam in a rural area of Montana. In both cases, funding was based on a calculation of the benefits and costs of the projects

using FEMA-approved methodologies and where the benefits are expected reductions in flood damages.²² Failure of the Rattlesnake Creek Dam would have resulted in flooding developed properties in Missoula, and the dam was in very poor condition and serving no useful function. (It supplied water to Missoula but had not been used for that purpose for many years.) Thus, according to Trout Unlimited staff, the benefit-cost ratio was quite high, well above the 1.0 threshold for funding.²³

Although the FEMA programs have been applied in only a very limited way to dam removals, they might work in other settings. Moreover, the new BRIC program may be more amenable to dam removal projects as a form of nature-based solutions to flood mitigation. In FY20, \$500 million in grant funding is available in the BRIC program.²⁴ The two Montana awards were sizeable, especially in comparison with grants made through the FWS Fish Passage Program and other similar grant programs. This is another appeal of the FEMA programs. The key condition necessary for dam removals to qualify for funding is avoided flood damage benefits in excess of costs, and these benefit and cost calculations must be made using FEMA’s approved methodology. Removing a dam may not always reduce expected flood losses, so the program may only work in limited settings. But a high hazard dam—that is, one whose failure is expected to lead to enough flooding to cause a loss of human life (FEMA 2004)—that is in very poor condition may qualify. In some settings, it may be necessary to invest in floodplain restoration as part of the dam removal project, to provide replacement flood protection.

7. Federal Programs Targeting Primarily Dam Repairs

Some federal programs provide grant funding for dam rehabilitation, which can include removal but more commonly indicates repair. We discuss two of these

20 <https://www.fema.gov/grants/mitigation/building-resilient-infrastructure-communities>.

21 Rob Roberts, Project Manager, Trout Unlimited, personal communication with the author, September 24, 2020.

22 Although the benefit-cost methodology was required for both projects, the Rattlesnake project was selected among potential state projects, whereas the Ninemile Creek project was part of FEMA’s national Pre-Disaster Mitigation Grant Program competition.

23 Rob Roberts, Project Manager, Trout Unlimited, personal communication with the author, September 24, 2020.

24 Information on the BRIC Program and the first round of grant funding is available at <https://www.fema.gov/grants/mitigation/fy2020-nofo>.

here, one new FEMA program and the Watershed Rehabilitation Program, operated by the NRCS of the US Department of Agriculture.

7.1 FEMA

The 2016 Water Infrastructure Improvements for the Nation (WIIN) Act (P.L. 114-322) established a new grant program for dam rehabilitation. The Rehabilitation of High Hazard Potential Dams Grant Program is administered by FEMA and designed to provide grant funding for rehabilitation—including repair or removal—of high hazard potential dams. Although the program was authorized in the WIIN Act at \$10 million for FY2017 and FY2018, \$25 million for FY2019, \$40 million for FY2020, and \$60 million for FY2021–26 (that is, \$445 million over 10 years), there has only been one round of appropriations thus far, in FY2019, at \$10 million.

Grants are awarded to state agencies that house the state dam safety program, but they are pass-through grants that go to subrecipients, such as local governments and nonprofit organizations. Federally owned dams, licensed hydroelectric dams, and dams built under the authority of the USDA are ineligible for the funds. A 35 percent nonfederal match is required for each project funded by the program (but in-kind contributions are allowed).

In the first round of funding, in FY2019, only 26 states applied for and received grants. The allocation to states is based on a formula, not on the costs of the dam repair or removal projects. One-third of the available funds is distributed equally to all states that applied, and the remainder is “need-based”—based on the number of high hazard dams in the state as a proportion of high hazard dams in all states that applied for grants. The maximum any one state can receive is 12.5 percent of the available funds or \$7.5 million, whichever is less. In the first round, the average grant award was \$384,615.

New York and Ohio each received the maximum allowed, \$1.25 million; Minnesota and Washington received the smallest awards at \$153,000 each.²⁵

States submit projects they plan to fund and are required to use a risk-based prioritization method to rank them and make choices based on available money once they receive the award. It is unclear whether any state plans to use its funds on dam removals. At least one dam safety official with whom we spoke feels that removal may be a more cost-effective use of the funds, providing the greatest reduction in risk for the dollars spent.²⁶ But it is unclear how widespread this thinking is. In our view, the program contains an inherent tension. On the one hand, it is targeted to high hazard dams, which tend to be larger dams that, in many cases, are still serving a useful function and thus may not be realistic targets for removal (Walls 2020b). On the other hand, several studies have shown that removal is often less costly than repair, so removal may get the state more “bang for the buck” (ICF Consulting 2005; Massachusetts Division of Ecological Restoration 2015; Born et al. 1998). Because most state dam safety programs, with a few exceptions, do not promote removing dams, even when they are in poor condition, we think it is unlikely that the FEMA funds will be used on dam removals in most states. If some adjustments to the program were made—for example, requiring no matching funds on dam removals, only on repairs (as some states do in their grant programs), or allowing a certain share of the grant money in each funding round to be used on, say, low-head dams (to reduce drowning risks) regardless of hazard classification—states might be more inclined to use some of this grant money on removals.²⁷ But unless Congress appropriates more money—something closer to the authorization in the WIIN Act—the program will not be able to fund very many repairs or removals. It is noteworthy that a single FEMA Pre-Disaster Mitigation grant (for the Ninemile Creek Dam removal project in Montana) received almost as much funding (\$1.1 million) as the maximum total

²⁵ James Demby, FEMA, personal communication with the authors, January 31, 2020.

²⁶ John McCain, South Carolina Dam Safety Program, personal communication with the authors, October 2, 2020. South Carolina is soliciting proposals for projects, which will be selected in December 2020. However, in the first round of funding, the state plans to fund only design projects, with future year funding for implementation.

²⁷ Both changes would require amending the legislation and might affect the underlying political coalitions that resulted in the program.

state award (\$1.25 million) under the Rehabilitation of High Hazard Potential Dams Grant Program.

7.2 NRCS

The US Department of Agriculture NRCS (formerly the Soil Conservation Service) has built 11,841 dams throughout the United States since the 1940s (Caldwell 2020). These dams' primary purpose is flood control, protecting agricultural lands and rural communities.²⁸ Today, the median age of these dams is 50 years; 19 percent are high hazard dams (Caldwell 2020).

Beginning in the late 1990s, people began to recognize that many of the NRCS dams needed repairs and rehabilitation. In 2000, legislation was passed to create the Watershed Rehabilitation Program, authorizing the USDA to assist watershed project sponsors (local governments and soil conservation districts) with technical and financial assistance to plan, design, and rehabilitate aging watershed dams.²⁹ The USDA can provide 65 percent of total project costs, with local sponsors required to provide the remaining 35 percent, which may be in-kind contributions. According to Caldwell (2020), appropriations over FY2000–20 totaled \$955.7 million (in inflation-adjusted 2020 dollars), for an average of \$45.5 million per year. As of April 2020, 366 dam rehabilitation projects had been funded in 36 states, three percent of all NRCS dams. Of the 366, 205 were still in the planning or design phase and 161 had been completed.

The Watershed Rehabilitation Program funds are not used on dam removals, though this option has been suggested and discussed over the years. The USDA's evaluations of the NRCS dams, which involve comparing expected flood damages to property and cropland with and without the dams, generally show positive benefits.

Thus, removal may be unlikely for many of the dams unless it included investment in natural infrastructure in the floodplain to replace their flood protection benefits. Some local governments or special districts, such as soil conservation districts, that are left in charge of dams constructed by the NRCS decades ago often feel financial pressures from having to maintain the dams and meet dam safety requirements. Certain dams may no longer serve the original purpose for which they were built, so removal may be warranted in some cases. In the western United States, many of the NRCS dams were constructed to provide water supply but have never served that function. Some may be targets for removal.

It is worth noting that NRCS funding in the Watershed Rehabilitation Program, at approximately \$46 million per year, is generous in comparison with most of the other programs we have reviewed here. Moreover, the money is spent directly on dams and not across a variety of aquatic restoration projects. Revising the program to allow and even encourage (perhaps by waiving the matching requirement and/or allowing funds to be applied to complementary floodplain restoration activities) use of funds on dam removal might be worthwhile.³⁰

8. Summary

Federal funding for dam removal is scattered across many different programs and agencies. It is difficult to track down exactly how much money is available in each of these programs each year and especially difficult to figure out how much has been spent on projects that include dam removal. Table 1 summarizes the numbers we were able to find from various sources, but these are approximations in most cases. Moreover, we urge caution in comparing funding levels across the programs, given their disparate objectives.

28 NRCS dams were built under the auspices of USDA's Watershed Programs, which were authorized by four laws: the Flood Control Act of 1944 (P.L. 78-534), the Pilot Watershed Program of 1944 (Public Law 83-156), the Watershed Protection and Flood Prevention Act of 1954 (P.L. 83-566), and the 1962 Resource Conservation and Development Act (Public Law 87-703) (Woodward 2015).

29 Information on the Watershed Rehabilitation Program can be found at https://www.nrcs.usda.gov/wps/portal/nrcs/detail/null/?cid=nrcs142p2_034921.

30 The NRCS Wildlife Habitat Incentive Program, which provided technical and financial assistance to landowners to establish and improve fish and wildlife habitat, funded a few dam removals, including a dam on the Sandy River in Maine and the Briggsville Dam on the Hoosic River in Massachusetts. The program ended in 2014.

Table 1. Federal Programs Funding, and Potentially Funding, Dam Removal

Program	Annual funding^a (in millions)	Annual funding for dam removal (in millions)	Comments
FWS National Fish Passage Program	\$10–14	~\$0.4 ^b	National; all fish passage but many culvert & bridge replacements, other projects, in lieu of dam removals
NOAA Community-Based Restoration Program	\$13	\$1.9	Coastal states only; aquatic restoration; T&E species focused; not many dam removal projects
Great Lakes Restoration Initiative	\$290	~\$6 ^c	Great Lakes region only; broad restoration focus; dam removal less important than other activities
Army Corps of Engineers Ecosystem Restoration Authorities—Sections 206 & 1135	\$18 (authorized at \$117.5)	NA ^d	National; aquatic restoration focus; 1135 only for Corps-owned dams
Army Corps of Engineers Great Lakes Fishery and Ecosystem Restoration Program	\$3.5	NA ^d	Great Lakes region only; aquatic restoration but fish passage specific focus
FEMA Building Resilient Infrastructure and Communities (BRIC), formerly Pre-Hazard Mitigation Grant Program	\$500	TBD	New program; spending on dam removal likely negligible, as in the predecessor program
FEMA Rehabilitation of High Hazard Potential Dams Program	\$10 (authorized at approx. \$44.5)	TBD	Only in first year of funding; all spending on dams but up to states to decide whether to use on removal or repair; high hazard dams only
USDA-NRCS Watershed Rehabilitation Program	\$46	\$0	All spending on dams but only repairs thus far, not removal; NRCS dams only

^a Total funding based on most recent FY appropriations, typically 2020, except GLRI and NRCS Watershed Rehabilitation Program, which are averages of spending over the last 10 years and 21 years, respectively. Sources are provided in the previous sections describing each program. Corps of Engineers 206 and 1135 funding and FEMA Rehabilitation of High Hazard Potential Dams Program authorized at higher annual levels than current appropriations.

^b Michael Bailey, National Coordinator, FWS National Fish Passage Program, personal communication with the authors, November 9, 2020. Number are based on funding for 2015, 2016, 2017, and 2018.

^c Dam removal funding under GLRI includes average for projects over last 10 years for Bureau of Indian Affairs, EPA, FWS, NOAA, and Army Corps of Engineers, plus a rough estimate of Forest Service spending.

^d NA=not available. The Army Corps of Engineers does not track projects in a way that makes dam removal funding numbers easily available. Joseph Redican, Deputy Chief, Planning and Policy Division, US Army Corps of Engineers Headquarters.

TBD = to be determined.

Funding is scattered across many different federal programs and agencies. In most programs, it is directed to restoring ecosystems and aquatic habitat and dam removal is an infrequent use, as in the NOAA program, the GLRI, and the Army Corps of Engineers programs under its ERA. The FWS program has a fish passage mandate, as does the Army Corps' Great Lakes program (along with general restoration of aquatic habitat), but these programs also spend most of their money on alternative types of projects and not dam removals. Only the FEMA Rehabilitation of High Hazard Dams grant program and the NRCS Watershed Rehabilitation Program are specifically focused on dams. Although the FEMA program leaves the door open for removal, the NRCS program currently does not. The goal of the FEMA hazard mitigations programs is to invest in projects that reduce flood risks; they have only been used in a few select cases for dam removal, where flood risk reduction benefits were deemed to outweigh costs of the projects. It is unclear how dam removal projects might fare in the new BRIC program.

The Association of State Dam Safety Officials (2019) estimates the total cost of rehabilitating all known deficient dams in the United States at \$66 billion. Even if only a fraction of these are removed rather than repaired and the costs of removal are significantly less than repair, as several studies have shown, federal grant programs will not come close, in their current form, to paying for all removals. In our view, dam removal advocates should pay attention to three programs in Table 1. First, the FEMA Rehabilitation of High Hazard Potential Dams grant program could provide opportunities for funding if advocates can work with state dam safety programs to identify dams where removal makes more economic sense than repair. It will also be necessary for Congress to set appropriations closer to the authorized levels to make more headway with either repair or removal. Second, the NRCS Watershed Rehabilitation Grant program could provide significant funding if the program is revised to allow for removal as well as repair. Third, the new FEMA BRIC program could provide opportunities for dam removal in some settings where it yields flood mitigation benefits. Our reasons for highlighting this program are the comparatively generous funding levels (and thus high grant awards) and the new focus on natural infrastructure solutions.

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