



Climate Change, River Conservation, Hydropower and Public Safety: An Infrastructure Proposal for the Biden Administration and Congress

In addressing the climate crisis, increasing public safety and creating jobs, the Biden Administration and Congress have a unique opportunity to advance both the clean energy and electricity storage benefits of hydropower and the environmental, safety, and economic benefits of healthy rivers. This document makes recommendations on spending in a federal infrastructure package and related legislation in these three critical areas. The recommendations were created and endorsed by a diverse number of NGOs, companies, trade associations, and academic institutions who have agreed to come together to advance these goals¹. Collectively, the organizations commit to continue working together, as well as with the White House and Congress, toward agreement on detailed legislative language.

The spending recommendations are focused on four critical U.S. infrastructure needs:

- 1. Increase federal financial assistance to improve dam safety.**
- 2. Leverage the federal tax code to incentivize investments in dam safety, environmental improvements, grid flexibility and availability, and dam removals.**
- 3. Create a public source of climate resilience and conservation funding for removal of dams that have reached the end of their useful life.**
- 4. Invest in existing federal dams and relevant research programs to accelerate decarbonization, increase renewable power generation, enhance environmental performance, improve dam safety, and leverage innovative technologies.**

Importantly, this package of recommendations does not focus on any particular U.S. dam, river, or region. Rather, it is intended to accelerate the rehabilitation, retrofit, and removal (the “3Rs”) of the nation’s more than 90,000 dams, of which only 2,500 currently generate electricity. The areas of needed investment are tightly related to each other and are intended to be advanced as a wholistic package and

¹ The recommendations build on a [“Joint Statement of Collaboration on U.S. Hydropower: Climate Solution and Conservation Challenge”](#) reached among a number of NGOs, companies, and trade associations in October 2020, plus the contribution of other entities.

not cherry-picked in legislative or administrative proceedings. Thus, funding for environmental improvements at dams, often accompanies upgrades in dam safety or power generation. Dam removals, while advancing safety at problematic facilities, may also help restore natural systems and increase the resilience of rivers to the effects of climate change. Additional research, innovation, and analysis is also crucial to underpin these interrelated efforts. Finally, the need for the 3Rs is spread broadly across U.S. dams, independent of the type of owner of a particular facility – private, non-profit, federal, or state.

If fully enacted, this \$63.17 billion proposal for spending, over 10 years, will support or create approximately 500,000 good-paying jobs, restore over 20,000 miles of rivers enhancing their climate resilience, and secure more than 80 gigawatts of existing renewable hydropower and 23 gigawatts of electricity storage capacity by:²

- **Assessing** the state of use of America’s dams. The National Inventory of Dams (NID)³ has 90,000+ dams and there are thousands more smaller, low-head dams that are not inventoried and that also present public-safety and environmental hazards. Dams in the U.S. serve a variety of purposes, including power generation, flood control, irrigation, water storage, and/or recreation. Fewer than 3% of U.S. dams (about 2,400) are used for power generation. An assessment of dams in the U.S., led by the National Academy of Sciences, is long overdue to identify: 1) dams that continue to serve vital roles and may be priorities for rehabilitation for improved safety and environmental performance and/or retrofits to add or replace generation at powered and non-powered facilities; and 2) dams that may have been abandoned, have reached the end of their useful life, or otherwise may be candidates for removal and river restoration.
- **Funding** dam safety programs to rehabilitate more than 1,300 of the most critically deficient, non-federally regulated dams nationwide over the next 10 years and reduce the risk of dam failure for thousands of U.S. citizens, while also expanding state programs to address the thousands of other high- and significant-hazard potential dams rated in the NID as either Poor, Unsatisfactory, or Not Rated at all.
- **Incentivizing** critically needed private sector investment in dam safety, environmental improvements, and grid flexibility to help improve performance of the existing fleet of more than 80 gigawatts of hydropower and 23 gigawatts of pumped storage capacity. Maintaining and improving the performance of the existing hydropower fleet and new deployments (through capacity additions or efficiency improvements at appropriate facilities) will reduce cumulative greenhouse gas (GHG) emissions by 5.6 billion metric tons by 2050 (using a 2017 baseline) and create 195,000 jobs according to a Department of Energy (DOE) study.⁴
- **Removing** 2,000 dams, with dam owner consent, over a 10-year period, opening 20,000 miles of free-flowing rivers. This would provide meaningful climate resilience and habitat connectivity for native river fish and other species, help more segments of rivers achieve water quality standards, and provide economically valuable recreational opportunities including boating and fishing, while simultaneously resulting in 180,000 to 225,000 jobs over 10 years in construction, engineering, scientific, planning, and related positions.

² This proposal complements the provisions currently pending in the Growing Renewable Energy and Efficiency Act Now (GREEN) Act in the U.S. House of Representatives.

³ <https://nid.sec.usace.army.mil/ords/f?p=105:1:.....>

⁴ 2016 U.S. Department of Energy Hydropower Vision, Figure ES-12, at page 32 (available at <https://www.energy.gov/eere/water/downloads/hydropower-vision-report-full-report>).

- **Improving** the performance of federally-owned dams across the U.S., by funding dam safety projects, efficiency and capacity improvements within the almost 40 gigawatts of federally-owned hydropower capacity, and environmental upgrades, including fish passage facilities, habitat restoration projects, operational upgrades to improve downstream flows, and other water quality projects. Federal agencies should systematically evaluate and address disposition of all dams that they own to appropriately direct expenditures. Together, these investments will create tens of thousands of good-paying jobs manufacturing and installing turbines, generators, other power generating equipment; as well as construction jobs to implement dam safety and river restoration improvements across the federal fleet.

The Biden Administration has set major goals for infrastructure, climate, and jobs. This package of recommendations – if funded adequately and implemented aggressively – will advance these important goals and the wide-ranging safety, environmental, and economic benefits that can flow from them.

The Federal Government Should Increase Financial Assistance to Improve Dam Safety

Proposal – Reduce dam safety risk by building existing state regulatory oversight capacity, expanding funding for the rehabilitation of existing dams, mapping the potential consequences of dam failure, and reimagining the National Dam Safety Program.

Why Is It Needed?

Dams are a critical part of the nation’s infrastructure, providing a life-sustaining resource in all U.S. regions including: water supply for domestic, agricultural, industrial, and community use; flood control; recreation; and – where properly sited and appropriately mitigated – clean, renewable energy through hydropower. At the same time, dams can have a myriad of impacts including blocked sediment transport, barriers to fish migration, risk for people recreating near them, and risk of failure. There are over 90,000 dams listed in the NID and thousands of those dams have the potential to fail with tragic consequences. Dam infrastructure is aging and increased investment is required to support dam safety upgrades, facility removal, and environmental and other improvements. The federal government should provide substantial and sustained new leadership and investment to address this public safety problem.^{5 6}

What Would It Achieve?

- **Increased capacity and expertise to oversee the safety of U.S. dams.** The National Dam Safety Program (NDSP) [33 U.S. Code § 467. Subchapter VII – Dam Inspection Program], administered by the Federal Emergency Management Agency (FEMA), was established by Congress in 1996 to improve dam safety nationwide and coordinate the entities regulating dams. The NDSP authorizes FEMA to provide direct assistance grants to states to ensure proper oversight of state-regulated dams. Grants improve capacity to effectively inspect and regulate dams by strengthening state dam safety programs (states regulate almost 70% of the dams listed in the NID). Recent dam failures and incidents have shown that traditional visual inspection practices and follow-up are not always

⁵ According to the Association of State Dam Safety Officials’ (ASDSO) State Dam Safety Program Performance Reports, thousands of the most critical high-hazard potential dams in the U.S. do not meet current safety standards.

⁶ The ASDSO indicates the cost to rehabilitate the nation’s dams exceeds \$70 billion. [Read ASDSO’s Roadmap to Reducing Dam Safety Risk.](#)

sufficient to prevent dam safety incidents. Expanding NDSP assistance to states will enable additional staffing to each state for more comprehensive dam safety assessments and regulatory follow-up to ensure mitigation of potential dam failure modes for the nation's nearly 22,000 state-regulated high- and significant-hazard potential dams, as identified by the state dam safety programs. Current NDSP funding has been stagnant for 25 years at only about \$9 million annually.

- *Improved safety of unregulated dams.* Nationwide, almost 4,000 critical high- and significant-hazard potential dams fall through regulatory cracks.⁷ These dams go uninspected and may not be operated and maintained to ensure public safety. Federal law [33 U.S. Code § 467a], which authorizes the U.S. Army Corps of Engineers (USACE) to inspect these types of dams, should be funded and utilized to identify dam deficiencies and seek ways to reduce dam failure risk. This mechanism has never been implemented.
- *Rehabilitation of dams to meet current safety standards.* There are over 3,800 high- and significant-hazard potential dams rated as either Poor or Unsatisfactory in the NID.⁸ Over 8,000 more are listed as Not Rated and it is likely many of those also have safety deficiencies. Expanded funding for existing federal assistance programs – the National Rehabilitation of High Hazard Potential Dams Program (HHPD) [33 U.S. Code § 467f-2], the Watershed Rehabilitation Program [16 U.S. Code § 1012] and the Corps Water Infrastructure Financing Program (CWIFP) administered by the USACE – will enable the rehabilitation of over 1,300⁹ of the most critical deficient dams nationwide, over the next 10 years, and reduce the risk of dam failure for thousands of U.S. citizens.¹⁰
- *Access by regulators to emergency funds to fix dams when owners can't or won't.* Hundreds of dams identified as being deficient go unimproved year after year due to a lack of available financial resources for dam owners. A new federal program to fund the efforts of states to step in and rehabilitate not necessarily eligible for other federal funding assistance when dam owners cannot or will not take action is needed to help assure public safety. This new program will create an emergency fund for the rehabilitation of hundreds of high- or significant-hazard potential dams which pose an unacceptable risk to the public (similar to or as a part of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) aka Superfund). The program would be structured to seek reimbursement from dam owners, once the identified risk has been reduced.
- *Enhanced understanding of the threat to people and property.* It is estimated that approximately 34% of state-regulated high-hazard potential dams and 72% of state-regulated significant-hazard potential dams likely do not have a dam failure inundation map.¹¹ Identification of the potential consequences of dam failure by funding the National Flood Mapping Program [42 U.S. Code § 4101b] to map the dam failure inundation area downstream of all high- and significant-hazard potential dams in the U.S. will enable the development of life-saving Emergency Action Plans (EAP) for these dams. The activation of an EAP and subsequent evacuation of downstream residents during the 2020 Michigan dam failures saved lives. More specifically, there were no fatalities resulting from the Michigan dam failures even though 2,500 homes and buildings were impacted.

⁷ [National Inventory of Dams](#)

⁸ <https://crsreports.congress.gov/product/pdf/R/R45981>

⁹ ASDSO "[The Cost of Rehabilitating Our Nation's Dams \(2019\)](#)" based on an average rehabilitation cost of \$3.4 million per project.

¹⁰ The HHPD and CWIFP programs can fund the repair or removal of dams. Funding for removal is not considered in this proposal but it is included in the accompanying request for dam removal financial assistance.

¹¹ ASDSO [State Dam Safety Program Performance Reports](#) (click on an individual state for a link to that state's report).

- *Revitalized national leadership to advance dam engineering and safety.* The NDSP was established as a response to mid- to late-20th Century events and policies and, although it has made progress, it has not been updated or adapted to changes over the last 25 years, beyond the important addition of the small HHPD Dam Rehabilitation Grant program in 2018 (described above). A reimagining of a national approach to dam safety risk management is needed, including combining existing Department of Homeland Security dam risk management programs, exploring a joint national dam and levee safety program, and providing accurate and up-to-date scientific data crucial for the design and operation of dams (such as proposed in the PRECIP and FLOODS Acts¹²).

What Would It Cost?

- Total cost over 10 years = \$19.46 billion including:
 - *Dam Safety Regulation.* \$1 billion over 10 years (\$75 million annually for the National Dam Safety Program and \$25 million annually for the USACE’s inspection program¹³).
 - *Dam Rehabilitation.* \$18.15 billion in total over 10 years (\$200 million annually for the High Hazard Potential Dam Rehabilitation Grant Program, \$100 million annually for the NRCS Watershed Rehabilitation Program, \$15 million annually for the USACE’s CWIFP program,¹⁴ and \$1.5 billion annually for a new emergency rehabilitation/removal fund).
 - *Funding National Flood Mapping Program and Develop Emergency Action Plans.* \$300 million in total over 10 years.
 - *Reimagine the National Dam Safety Program and the federal role in providing up-to-date scientific data.* Total cost – estimated at \$10 million in total over 10 years.

Leveraging the Federal Tax Code to Incentivize Investments In Dam Safety, Environmental Improvements, Grid Flexibility & Availability, and Dam Removal

Proposal – Establish a 30% Tax Credit for investment at qualifying facilities¹⁵ in dam safety, environmental improvements, grid flexibility and availability, and dam removals, with a direct pay alternative.

Why Is It Needed?

- There are more than 90,000 dams in the United States. Efficient and thoughtful use of the infrastructure already in place makes economic sense and allows for the growth of hydropower capacity while also protecting or improving river health. Focus efforts on existing infrastructure by encouraging dam safety investments, improving environmental performance, expanding grid flexibility and availability, leveraging innovative technologies, and removing infrastructure as appropriate with consent of the dam owner.
- Incentivizing critically needed private sector investment in dam safety, environmental improvements, and grid flexibility would help improve the performance of the existing fleet of

¹² Read the [PRECIP Act and the FLOODS Act](#).

¹³ This program is for non-federal dams and is not duplicative of proposed spending for USACE dams.

¹⁴ This program is for non-federal dams and is not duplicative of proposed spending for USACE dams.

¹⁵ “Qualified facilities” will be defined and are required to meet all applicable environmental, licensing and regulatory requirements. Detailed definitions will be developed for dam safety, environmental improvements, grid flexibility and availability, and dam removal investments.

more than 80 gigawatts of hydropower and 23 gigawatts of pumped storage capacity, some of which is at risk of shutting down in the next decade. Maintaining and improving the existing hydropower fleet and new deployments will reduce cumulative GHG emissions by 5.6 billion metric tons by 2050 (using a 2017 baseline) and create 195,000 jobs according to a DOE study.¹⁶

- Recent events in California and Texas underscore the need for flexible resources that can respond to changing weather and electricity load.¹⁷ Reservoir hydropower and pumped storage offer the full range of reliability attributes including energy, peak capacity, voltage support, ramping, regulation, spinning and non-spinning reserves, storage, inertia, as well as black start capability.¹⁸ With these attributes, hydropower helps integrate variable solar and wind generation.
- The average age of the ~90,000 U.S. dams is close to 60 years old and work is needed to rehabilitate dams with long-term benefits or remove dams with the consent of the owner.
- A 30% ITC, or “direct pay” alternative, would encourage earlier upgrades and installation of state-of-the-art environmental systems and other innovative technologies, like aerating turbines, that otherwise may not be economically justified.
- While some powered dams are no longer economically viable, the costs associated with dam removal may prompt owners to postpone removal as long as possible, creating a need for incentives and funding to support removal.
- A 30% tax credit, with direct pay alternative, to remove powered and non-powered dams, with the consent of the dam owner, could be a useful tool in appropriate circumstances and complement direct federal spending and other public and private support for dam removal.

What Would It Achieve?

- Help improve performance of the existing fleet of 80 GW of hydropower and 23 GW of pumped storage, or 103 GW of capacity. For context, 300 existing hydropower facilities, representing roughly 30% of the non-federal fleet and 13 GW of generation, are up for relicensing by 2030.¹⁹
- Encourage much needed investments in dam safety and enhance environmental improvements and grid flexibility investments.
- Create new financial incentives to remove powered and non-powered dams, with the consent of the owner and other stakeholders.
- The tax credit creates an opportunity for qualifying facilities to accelerate dam safety investments, improve environmental performance, enhance grid flexibility, and restore ecosystems – all critical to addressing climate change.

What Would It Cost?

\$4.71 billion for dam safety, environmental improvements, and grid flexibility over ten years.²⁰ In addition, there are \$4.5 billion in eligible tax credits for dam removals, which is not included in the total

¹⁶ 2016 U.S. Department of Energy Hydropower Vision, Figure ES-12, at page 32 (available at <https://www.energy.gov/eere/water/downloads/hydropower-vision-report-full-report>).

¹⁷ Politico Article 2/21/21 [Texas and California built different power grids, but neither stood up to climate change - POLITICO](#)

¹⁸ 2021 Hydropower Market Report [U.S. Hydropower Market Report \(energy.gov\)](#) p. 117.

¹⁹ 2021 Hydropower Market Report [U.S. Hydropower Market Report \(energy.gov\)](#) p. 87-122.

²⁰ The tax credit is estimated to cost **\$9.2B** over ten years. This estimate includes several components: 1) Dam safety is estimated at \$3.3B over 10 years (according to the NID for the 2,214 non-federal dams with hydropower listed as one of the purposes, available at <https://nid.sec.usace.army.mil/>); 2) Environmental mitigation is

to avoid double counting because entities would not be eligible for tax credits if they receive federal funds for the same activity.

Create a public source of climate resilience and conservation funding to remove dams that have reached the end of their useful life

Proposal – Congress should authorize mandatory annual grant funding to remove 2,000 U.S. dams over a decade. These dam removals should be funded by an expenditure of \$15 billion in total over 10 years, leveraging additional funds through a variable cost share. Dam removals shall be at the consent of dam owners. The Administration should issue an Executive Order establishing an inter-agency and stakeholder advisory committee to coordinate agency assistance in dam removal planning and funding, harmonize agency permitting to ensure a predictable regulatory process, and serve as a forum to address programmatic challenges.

Why Is It Needed?

- *While many dams have important uses such as water supply, flood management, and hydropower, many others – both publicly and privately owned – have reached the end of their useful life.* Those dams can pose public safety risks, impact fish and other aquatic life, and can be costly liabilities to their owners. Many of those dams are abandoned, not profitable, or require costly repairs and upgrades that push dam owners to consider removal. Removing dams restores native aquatic life to rivers, increases climate resilience, and reduces the risk of aging dams failing and possibly causing catastrophic flood damages and/or loss of human life.
- *Climate resilience for rivers.* In many situations, removing dams at the end of their useful life can be an effective method for increasing climate resilience in rivers. Dam removals can improve water temperatures, increase dissolved oxygen, eliminate conditions conducive to growth of algae and toxic cyanobacteria, restore native riverine habitat, and allow fish and other aquatic species to move upstream and downstream to different habitats necessary to their life cycles.²¹ Because most waterbodies produce methane, some dam removals can also reduce potential sources of GHGs.²²

estimated at \$8.5B over 10 years (based on Oak Ridge National Lab Hydropower Market data, 2021 edition, available at <https://hydrosourc.ornl.gov/dataset/cost-mitigating-environmental-impacts-hydropower-projects>); 3) Flexibility upgrades and availability improvements are estimated at \$3.9B (based on 50% of the investments in refurbishments and upgrades to infrastructure and equipment in DOE's 2021 Hydropower Market Report (\$7.8B between 2010-2019), available at <https://www.energy.gov/eere/water/hydropower-market-report> on page 4); and 4) Dam removal is estimated at \$15B for 2,000 dams over ten years. Together, this adds up to \$30.7B of investments/activities eligible for the 30% tax credit, which results in a cost of \$9.2B over ten years.

²¹ Bednarek A.T. 2001. Undamming rivers: A review of the ecological impacts of dam removal. *Environmental Management* 27: 803-814.

²² There are areas of uncertainty around estimating possible net GHG emissions or sequestration (most importantly methane) from freshwater impoundments, lakes and rivers in the U.S. DOE, Oak Ridge National Lab and the Environmental Defense Fund are collaborating to review data from around the world and better characterize the ranges and areas of uncertainty in estimating emissions from U.S. reservoirs, lakes and rivers, only a small percentage of which are used for hydropower generation. This work is reviewing the science on pathways for reservoir emissions and also attempting to compare ranges of possible emissions from other major U.S. sources. In addition, DOE is working with the International Hydropower Association (IHA) to explore whether IHA's G-res tool for estimating potential net GHG emissions from reservoirs, both new and existing, could be useful for estimating emissions potential in the U.S. at largely existing reservoirs.

- *Climate resilience for communities.* Dams can play a role in climate resilience, such as by providing flood control, water storage and, in some situations, acting as a carbon sink. However, as many dams age and some dam owners lack the resources to continue maintaining their structures, dams can become public safety hazards.²³ In the last few years alone, dam failures or near failures have forced hundreds of thousands of people to evacuate, caused millions of dollars of property damage, and loss of life.²⁴ In addition, hundreds of drownings have occurred downstream of low-head dams because of the dangerous forces caused by flow hydraulics downstream of structures.²⁵
- *Fisheries, wildlife, and natural heritage.* Dams are a major cause of species decline in U.S. rivers, from migratory fish like salmon and herring, nonmigratory fish like trout, and other aquatic species like freshwater mussels. Removing dams is a proven approach to restoring healthy conditions for native river species, with documented results showing increases in fish and other aquatic species populations. For example, herring populations in the Northeast, smallmouth bass in the Midwest, mussels in the Southeast, and salmon in the West have all increased in response to dam removals.²⁶

What Would It Achieve?

- Federal dam removal funding that is scaled to the size of the problem would enable the removal of 2,000 U.S. dams, with dam owner consent, over a 10-year period, opening 20,000 miles of free-flowing rivers, and eliminating hazards to public safety.²⁷
- Removing 2,000 U.S. dams over a decade is an intensive infrastructure endeavor providing construction, engineering, scientific, planning, and other jobs. Dam removal projects support 12 to 15 jobs per \$1 million²⁸ invested, resulting in total job support from this proposal of 180,000 to 225,000 jobs over 10 years. This funding should include support for pre-construction phases in order to benefit a broader cross section of the economy, result in higher quality multi-benefit projects, allow projects to be completed more efficiently, and create a pipeline of future projects.
- Removing 2,000 dams would save lives and property by reducing public safety hazards caused by dam failures and drownings.

²³ Fourth National Climate Assessment, Chapter 3: <https://nca2018.globalchange.gov/chapter/3/>.

²⁴ By 2030, 70% of U.S. dams will be more than 50 years old, many of which were sized for river flows that are now outdated when considering climate-induced increases in storm intensity and frequency. As dams continue to age, development downstream of dams has also increased. According to the American Society of Civil Engineers, the number of high hazard dams (dams that could cause loss of life if they fail) has more than doubled in the last 20 years because of increased downstream development (<https://infrastructurereportcard.org/wp-content/uploads/2020/12/Dams-2021.pdf>). In addition, because dam safety offices are under-funded, this “hazard creep” due to downstream development is too often unrecognized, putting even more communities at risk. Also see the Fourth National Climate Assessment, Chapter 11 (<https://nca2018.globalchange.gov/chapter/11/>).

²⁵ <https://krcproject.groups.et.byu.net/browse.php>

²⁶ McCombs, E. 2014. *Dam Removal and Freshwater Mussels: Effective Restoration and Prioritization through Case Studies*. Paper presented at the 2014 International Conference on Engineering and Ecohydrology for Fish Passage.

²⁷ According to data from American Rivers, 1,797 dams have been removed in the U.S. since 1912. See <https://www.americanrivers.org/DamRemovalMap> and https://figshare.com/authors/American_Rivers/4057636. Over the past few years, between 69 and 99 dams have been removed each year across the country. With sufficient federal funds, the annual number could be more than doubled to 200 dam removals per year, or 2,000 dam removals over a 10-year period.

²⁸ *Massachusetts*: <https://www.mass.gov/doc/economic-benefits-from-aquatic-ecological-restoration-projects-in-massachusetts-summary-of/download>; and *Oregon*: <http://ewp.uoregon.edu/sites/ewp.uoregon.edu/files/downloads/WP24.pdf>.

- An additional 20,000 miles of free-flowing rivers would provide meaningful climate resilience and habitat connectivity for native river fish and other species that need to move to different habitats seasonally, throughout their lives, and to find refuge from floods, droughts, and heat. Some dam removals can reverse the water temperature warming effects caused by many dams, buffering the impacts from climate-induced warming. Dam removals would also help more segments of river achieve water quality standards as occurred at dam removals on the Cuyahoga River in Ohio and elsewhere.²⁹
- Long stretches of free-flowing river have the potential to provide economically valuable recreational opportunities including boating and fishing along with associated economic stimulus from travel, lodging, food, and equipment.
- In a continued effort to more equitably consider Tribal Nations' water, fishing, and cultural rights, focusing some of these incentives on dam removals where Tribal rights have been infringed allows us to begin to resolve these ecological and cultural impacts.
- Larger funding sources for dam removal would facilitate many more projects. Dam removals are most commonly funded by a mix of small grants from federal/state programs, private foundations, and other private sources deriving from ecological restoration funds rather than from public safety or infrastructure management funds.³⁰ Available funding is variable and grant applications exceed available dollars. The current uncertainty of dam removal funding is a disincentive for dam owners to decide to remove their dams.

What Would It Cost?

\$15 billion in total over 10 years, leveraging additional funds through a variable cost share.³¹

How Would It Work?

- 1) *Provide Grant Funds to Remove Public and Private Dams.* Funding should cover all dam removal and related project needs including, but not limited to engineering, scientific assessment, economic analysis, construction, project management, technical assistance, acquisition, infrastructure protection, and sediment management. Funds should be provided for both public and private dams and should be provided for much-needed planning and design, in addition to construction-ready projects. Non-federal cost share should be variable and determined by project and program need. Dam removals should be conducted voluntarily with dam owner consent, follow all applicable regulations, and include meaningful community engagement.
- 2) *Invest in Expanded or Clarified Authorities to Support Dam Removal through Existing Programs.* Funding should go to programs with experience in: managing dam removal funding; identifying projects using selection criteria; efficiently distributing grant funds within reasonable time frames; and holding grantees accountable for project completion. Examples of existing programs include the National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service

²⁹ Tuckerman, S. and Zawiski, B. 2007. Case studies of dam removal and TMDLs: Process and results. *Journal of Great Lakes Research* 33: 103-116. [https://doi.org/10.3394/0380-1330\(2007\)33\[103:CSODRA\]2.0.CO;2](https://doi.org/10.3394/0380-1330(2007)33[103:CSODRA]2.0.CO;2).

³⁰ https://media.rff.org/documents/Federal_Funding_for_Dam_Removal_in_the_United_States.pdf.

³¹ According to estimates by American Rivers, dam removal costs vary widely: the most common projects, low-head dam removals with minimal ancillary issues, cost on the order of \$500,000 including planning, engineering, and construction. Middle range projects, those that have additional management challenges, such as a need for extensive sediment management or a need to replace/stabilize surrounding infrastructure (bridges, road embankments, utility pipes, etc.) cost on the order of \$20 million. The largest dam removals, those that are essentially large public works projects, cost greater than \$100 million each.

Restoration Center, U.S. Fish and Wildlife Service National Fish Passage Program, National Fish and Wildlife Foundation, FEMA Hazard Mitigation Grant Program, and NRCS Regional Conservation Partnership Program.

- 3) *Establish a Dam Removal Advisory Council.* An inter-agency and stakeholder advisory council is needed to coordinate agency assistance in dam removal planning and funding, harmonize agency permitting to ensure a predictable regulatory process, serve as a forum to address programmatic challenges, and coordinate federal agencies to assess dams.
- 4) *Assist with Real or Perceived Environmental Liability.* Identify and assist with environmental liability sometimes associated with dam removals. Whether real or perceived, potential environmental liabilities often act as disincentives for dam owners to initiate projects. For example, sediment trapped behind dams sometimes contains pollutants that may have traveled from upstream. While those pollutants may not be the fault of the dam owner, liability for material on their property is uncertain.

Increase investment in existing federal dams and relevant research programs to accelerate decarbonization, increase renewable power generation, enhance environmental performance, improve dam safety, and leverage innovative technologies

Proposal – Provide substantial additional federal appropriations to a number of federal agencies that own, regulate, and conduct research relevant to dams in order to address: dam safety and environmental improvements; backlogged operations and maintenance activities; upgrades, efficiency, flexibility, and capacity improvements; and deployment of innovative technologies. Federal agencies should coordinate and systematically evaluate and address disposition of all dams that they own to appropriately direct expenditures.

Why Is It Needed?

- Federal dams make up roughly 50% of all U.S. hydropower generation, with USACE and Bureau of Reclamation facilities accounting for the vast majority of federal hydropower capacity.³²
- The USACE (the largest U.S. hydropower generator) and the Bureau of Reclamation (the second largest generator) have identified billions of dollars needed for O&M and capital projects.³³
- The business environment for federal fleet operations is challenged by low energy prices, constraints on water resources that fuel the system, increased integration of variable renewable energy resources into regional energy markets, and competition for funding.³⁴
- Federally-owned hydropower makes the U.S. government the single largest renewable energy provider in the country.
- Increased funding for research and innovation in historically underfunded programs at DOE, USACE, Bureau of Reclamation, NOAA, and U.S. Fish and Wildlife Service, which can have substantial benefits beyond the federal fleet as well.
- Infrastructure is aging and increased investment is required to support needed improvements. For this reason, a systematic evaluation of all federally-owned dams is important to identify

³² 2016 Hydropower Vision Report [Hydropower Vision Report \(energy.gov\)](https://www.energy.gov/hydrogenandfuelcells/hydropower-vision-report) p. 394.

³³ 2021 Hydropower Market Report [U.S. Hydropower Market Report \(energy.gov\)](https://www.energy.gov/hydrogenandfuelcells/hydropower-market-report) p. 17.

³⁴ [DOE Hydropower Market Acceleration & Deployment.](https://www.energy.gov/hydrogenandfuelcells/hydropower-market-report)

additional opportunities to accelerate decarbonization, improve environmental performance, and/or enhance dam safety.

What Would It Achieve?

- Improve the performance of the existing federal fleet consisting of almost 40 GWs of capacity.³⁵
- Support dam safety upgrades across the system.
- Support capacity additions and efficiency improvements at appropriate facilities, increasing the federal hydropower system’s contribution to the U.S. renewable energy portfolio, including helping to integrate variable solar and wind generation.³⁶
- Improve the availability of the federal hydropower assets and the grid reliability benefits they provide. In its National Hydropower Program Strategic Plan Fiscal Year (FY) 2020 – FY 2024, USACE reports that meeting the need for reliability will depend on its ability to overcome recent trends of increased forced outages, which rose from 4% in 2008 to 7% in 2018.³⁷
- Research breakthroughs and further investments in environmental improvements (e.g., fish passage facilities), habitat restoration projects, enhanced operations to improve downstream flows, and other water quality projects at federal facilities, although innovation could also benefit non-federal dams.
- Create tens of thousands of good-paying jobs manufacturing and installing turbines, generators, other power generating equipment; as well as construction jobs to implement dam safety and river restoration improvements across the federal fleet at project sites throughout the country.

What Would It Cost?

\$24 Billion in total over 10 years, a combination of \$22 Billion for dam-owning agencies and \$2 Billion for research.³⁸ Investments made for USACE and Bureau of Reclamation assets should include legislative mechanisms to avoid cost increases to federal hydropower customers (e.g., deeming the additional funding as “non-reimbursable”).

³⁵ 2021 Hydropower Market Report [U.S. Hydropower Market Report \(energy.gov\)](https://www.energy.gov) p. 34-35.

³⁶ Any capacity or efficiency improvements should ensure that any potential adverse environmental and social impacts, including potential changes to operational flows, are effectively mitigated.

³⁷ US Army Corps of Engineer Strategic Plan FY2020 – FY2024. [USACE NHP Strategic Plan FY2020 - FY2024 \(oclc.org\)](https://www.usace.army.mil/Portals/0/docs/USACE_NHP_Strategic_Plan_FY2020_-_FY2024.pdf) p. 16.

³⁸ Additional inter-agency discussions are needed to determine the precise allocation of resources between agencies that own federal dams. The \$22B estimate is based on a report indicating that the USACE estimated a backlog of \$20B for dam safety rehabilitation and repair, and Bureau of Reclamation estimated between \$1.4 and \$1.8 billion. CRS Reports – 2019 Dam Safety: Federal Programs and Authorities [Dam Safety: Federal Programs and Authorities \(congress.gov\)](https://www.congress.gov/records/2019/04/23/2019-04-23-dam-safety-federal-programs-and-authorities).

The following organizations have signed on in support of this document:

American Rivers

American Society of Civil Engineers

Association of State Dam Safety Officials

Gravity Renewables, Inc.

Great River Hydro

Hydro Reform Coalition

Hydropower Foundation

Low Impact Hydropower Institute

National Hydropower Association

Rye Development

The Nature Conservancy

Union of Concerned Scientists

World Wildlife Fund