

S. HRG. 117–119

WATER INFRASTRUCTURE FOR THE 21ST CENTURY: THE VIABILITY OF INCORPORATING NATURAL INFRASTRUCTURE IN BUREAU OF RECLAMATION WATER MANAGEMENT SYSTEMS

HEARING BEFORE THE SUBCOMMITTEE ON WATER AND POWER OF THE COMMITTEE ON ENERGY AND NATURAL RESOURCES UNITED STATES SENATE

ONE HUNDRED SEVENTEENTH CONGRESS

FIRST SESSION

MARCH 24, 2021



Printed for the use of the
Committee on Energy and Natural Resources

Available via the World Wide Web: <http://www.govinfo.gov>

U.S. GOVERNMENT PUBLISHING OFFICE

43–942

WASHINGTON : 2022

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WATER INFRASTRUCTURE FOR THE 21ST CENTURY: THE VIABILITY OF INCOR- PORATING NATURAL INFRASTRUCTURE IN BUREAU OF RECLAMATION WATER MAN- AGEMENT SYSTEMS

WEDNESDAY, MARCH 24, 2021

U.S. SENATE,
SUBCOMMITTEE ON WATER AND POWER,
COMMITTEE ON ENERGY AND NATURAL RESOURCES,
Washington, DC.

The Subcommittee met, pursuant to notice, at 2:30 p.m. in Room SD-366, Dirksen Senate Office Building, Hon. Ron Wyden, Chairman of the Subcommittee presiding.

OPENING STATEMENT OF HON. RON WYDEN, U.S. SENATOR FROM OREGON

Senator WYDEN. The Subcommittee will come to order and welcome to the first Water and Power Subcommittee hearing of the 117th Congress. I would like to start by acknowledging that it is taking place during World Water Week, and I am pleased to be able to welcome our new Ranking Member from Mississippi, Senator Hyde-Smith. We have been comparing notes with respect to the fact that we often walk together to votes in the Senate and we are both fast walkers. So it is great to have her.

I will tell you, Senator, that we look at the abundance of water that you have in your state and I am sure that, at least for folks that you represent, it is hard to imagine what water is like for us in the West. There is an old saying in our part of the world, the former chairman of the Committee, someone we all admired very much, Pete Domenici of New Mexico used to often say, "In the West, whiskey is for drinking. Water is for fighting over." Well, this year is going to be a doozy of a battle and one that we have to get at quickly. Across the West, towns like Sisters, Oregon, and cities like Denver are wondering if they have enough water to respond to fires. Tribes like Oregon's Warm Springs are struggling to provide clean drinking water to communities. Farmers, like those in the Klamath Basin, are making tough calls right now about whether to plant crops or to fallow their land and try again next year. As of Monday, 27 out of 36 counties in Oregon have unusually dry weather and we are seeing these numbers trend earlier and earlier each year.

Now, this water shortage has big ramifications and the fact is that Congress has to use every tool available to put together water

availability with water needs. So today I introduced legislation that instructs the Bureau of Reclamation to start expanding their toolbox because that is really what this is about, using every single tool to try to connect water availability with water needs. First, under my bill, the Bureau of Reclamation has to be creative using natural infrastructure to reduce water conflicts. Second, it would prioritize projects that provide multiple benefits: water, recreation and habitat. And the bill creates new ways for the Bureau of Reclamation to work with farmers, to plan irrigation seasons and also address issues like migratory birds and endangered fish.

So as we look to this toolbox, I think we are starting off in the right direction, talking about natural infrastructure, using nature to provide clean water, reduce flooding, store spring water for use later. For a great example of how natural infrastructure is being used, you can look at a town I am honored to represent: Tillamook, Oregon. There, farmers and local stakeholders worked together and Tillamook restored 300 acres of fish habitat in their estuary and reduced the flooding risk to the town. How? By removing manmade barriers around the Wilson River to allow the river and ocean tides to meet naturally, flood the original estuary and support native salmon and steelhead, rather than to flood the town. So I am looking forward to hearing from our panel today to discuss ways to use what nature has given us to store and conserve water.

And now, for her first opening statement, here is our Ranking Member on the Subcommittee, let me turn to my colleague from Mississippi.

**STATEMENT OF HON. CINDY HYDE-SMITH,
U.S. SENATOR FROM MISSISSIPPI**

Senator HYDE-SMITH. Thank you very much, Mr. Chairman. I really am honored to be in this position on such an important Subcommittee. It is making me thirsty just talking about this. I look forward to working with you and to address the important issues such as the one that we have before us today, the viability of incorporating natural infrastructure within the Bureau of Reclamation. Thank you to our witnesses who are joining us today. I am hopeful that through your testimony and your answers that we can gain a deeper knowledge on how to approach the best solutions to America's water supply challenges, especially in the drought-prone areas that are environmentally resilient and economically viable.

Although my state lies east of the Mississippi River, I understand the duty and the responsibilities the Bureau of Reclamation holds for the 17 Western states that it serves. Of the many notable features of the Reclamation, it is the largest wholesaler of water in the country, allowing access to water to nearly 31 million people. Reclamation is integral to our farmers, as it provides one out of five Western states' farmers with irrigation, water for ten million acres of farmland which provides 60 percent of the nation's vegetables and 25 percent of the fruits and nuts. We do not grow a lot of nuts in Mississippi, other than pecans. Reclamation is also the second largest producer of hydroelectric power in the United States, producing enough electricity to serve 3.5 million homes. I believe investment in infrastructure across the nation is important, including finding responsible solutions to Western water infrastruc-

ture needs that are in the best economic interest of American citizens.

One issue I hope to highlight during this hearing is the effectiveness of natural infrastructure and built infrastructure, or gray infrastructure, as it is referred to. Our witnesses will review the different benefits of natural and gray infrastructure and I am interested in how to accomplish greater utilization of natural infrastructure solutions without increasing production cost, extending project completion dates, and creating a backlog of unfinished projects that we get started and it just stays out there and lingers forever.

Before I close, I would like to ask for unanimous consent to submit written testimony from Dan Keppen, Executive Director of Family Farm Alliance. In summary, the Alliance believes that constructing and using natural infrastructure, while used for many decades in managing water in the West, must be done in a tightly coordinated fashion with water managers and a watershed. Natural infrastructure must be used in conjunction with existing dams and existing canals but also must not be a one-size-fits-all approach to improving water supply. It believes there must be investments in new and existing water storage and conveyance infrastructure, including rehabilitating and upgrading aging facilities that we are all way too familiar with. I ask that this be submitted by unanimous consent.

Senator WYDEN. Colleague, without objection, and we know Dan Keppen very well. He lives in Oregon and his ideas and input are always welcomed. So I thank you for raising that.

Senator HYDE-SMITH. Thank you very much.

[Written testimony from Dan Keppen follows:]

**Dan Keppen, P.E.
Executive Director
Family Farm Alliance**

**Written Testimony for the United States Senate
Committee on Energy and Natural Resources
Subcommittee on Water and Power**

Oversight Hearing

“To examine the viability of incorporating natural infrastructure in western water management and policy to support economic development, protect watershed health, and build more resilient communities”

March 24, 2021

Chairman Wyden, Ranking Member and members of the Subcommittee:

Thank you for the opportunity to submit testimony on incorporating natural infrastructure in western water management and policy. The Family Farm Alliance (Alliance) is a grassroots organization of family farmers, ranchers, irrigation districts, and allied industries in 16 Western states. We are committed to the fundamental proposition that Western irrigated agriculture must be preserved and protected for a host of economic, sociological, environmental and national security reasons – many of which are often overlooked in the context of other national policy decisions. The American food consumer nationwide has access to fruits, vegetables, nuts, grains and beef throughout the year largely because of Western irrigated agriculture and the projects that provide water to these farmers and ranchers.

THE ROLE OF NATURAL INFRASTRUCTURE IN WATER MANAGEMENT

Natural infrastructure has always been a central part of water management in the western United States. Mountain snowpack and groundwater aquifers are critical natural sources of water storage. Many Bureau of Reclamation (Reclamation) projects were designed, and are still operated, to conjunctively use these non-structural features along with human-built dams, canals and other facilities to provide reliable water supply.

Healthy National Forests are another component of natural infrastructure important to water management. These lands are overwhelmingly the largest, single source of water in the U.S. and, in most regions of the West, contribute nearly all the water that supplies our farms and cities. Healthy forests temporarily store winter snow and rain, slow down the pace of runoff to increase the effectiveness of existing water infrastructure, and naturally filter water resources. The long-known benefits of forested watersheds and the desire to protect water resources is a primary reason many forest lands have been federally reserved since the early 1900s through the National Forest System.

Unfortunately, we are now seeing firsthand that unhealthy forests and associated catastrophic wildfires have the opposite effect. The destructive Western wildfires we have seen in recent years can directly reduce the capacity of existing water supply reservoirs due to increased soil and debris runoff and related sedimentation. In some cases, expensive new water treatment is required to address increased toxins and contaminants. Wildfires also cause serious delayed impacts through post-fire flash flooding and debris flows which can severely damage or render useless our already fragile water infrastructure.

It is important to also highlight that the ability of natural infrastructure to increase water security and drought resilience depends upon adequate and well-functioning traditional infrastructure. In other words, nature-based features can be an important tool to boost the overall water supply reliability of Western water systems when developed the right way. However, natural infrastructure should not be seen as a replacement for significant investments in new and existing man-made infrastructure, including surface storage and conveyance facilities.

The Alliance continues to advocate for and believe that investments in water conservation, water recycling, watershed management, conveyance, desalination, water transfers, groundwater storage, and surface water storage are all needed for a diversified, resilient, and successful water management portfolio. This includes reinvesting in our existing aging water assets to ensure they are able to continue to operate in a safe, efficient and reliable manner.

IMPROVING AND EXPANDING USE OF NATURAL INFRASTRUCTURE

Forest Management and Watershed Health

The number of acres burned by wildfire in the U.S. last year broke a modern-day record, according to data published by the National Interagency Fire Center, as extreme heat and dryness fueled major conflagrations across many populated areas in the West. Wildfire burned over 10.3 million acres in 2020, breaking the calendar-year record of 10.1 million acres, set in 2015. More than 40% of the wildfires in 2020 burned in California. This marks the third year that wildfire has burned more than 10 million acres in the U.S., according to fire center records going back to 1983. All three of those years have been since 2015.

Increasingly fierce Western wildfire disasters are becoming an annual occurrence and underscore the importance of improving on-the-ground management actions that can lead to improved forest health. Improving the condition of our nation's forested lands is of primary importance to water providers. The Alliance believes a responsible level of continuous fuels reduction includes a combination of robust mechanical thinning and prescribed fire. These management tools can be employed to significantly reduce evapotranspiration, tree stress, disease, and pest infestation, preserve health forest conditions, and protect species and habitats. Failure to employ this approach will continue the accelerating, downward spiral in forest health due to fuel accumulation, drought,

disease, and invasive insects. This will lead, inevitably, to additional high-intensity fire events in the future.

Watershed health and catastrophic wildfires must be addressed in order to restore the ability of forests to function as natural infrastructure and protect existing traditional water supply infrastructure. This can only improve the reliability, volume, and quality of water for tens of millions of Americans, along with the wildlife, recreational, and multi-purpose values of these lands.

Aquifer Recharge

Aquifers have long been a proven and important type of natural water storage reservoirs. Water managers across the West are advancing groundwater storage projects to enhance needed storage at a large scale. While aquifer recharge uses natural processes to infiltrate and store water supply, expanding the use of groundwater storage often requires significant investments in features like conveyance and spreading basins. Federal investment and streamlining of approvals would aid in increasing the use of these natural and cost-effective projects.

Floodplain Reintegration

In many areas, floodplains have historically supported robust fish and wildlife populations. Now, towns, cities and productive agricultural lands occupy many of these areas, and levees and dams have been built, in part, to protect these areas and residents from catastrophic floods. Floodplains that support productive agriculture also often have characteristics favorable to aquifer recharge. Using modern scientific knowledge of how rivers work, natural infrastructure projects are currently being pursued that reactivate traditional floodplains. These projects can successfully improve water supply and flood control management that benefits fish, birds, wildlife, farms, and cities. This type of managed floodplain reintegration essentially spreads out flood flows, slowing down the flow of water across the landscape to mimic natural flows. Multiple benefits are being realized by these projects, including groundwater recharge, fish and wildlife habitat creation and restoration, and agricultural production.

Northern California Water Association Case Study

In October 2019, the Alliance prepared extensive written testimony for this Subcommittee's oversight hearing on Western water innovation and technology. That document described multiple real-life examples of multi-benefit projects aimed at resolving some of the water conflicts of the West. One example cited in our testimony focused on the efforts of the Northern California Water Association (NCWA) in the Sacramento Valley. NCWA is part of a diverse coalition of conservation organizations, farmers, local governments, water suppliers and academic institutions that have come together to advance a new model for water management, fish and wildlife habitat restoration and land use that seeks to reactivate historic floodplains in the Central Valley. This

innovative, sweeping program is intended to upgrade California's aging water and flood infrastructure while simultaneously enhancing the function of river ecosystems for the benefit of fish and wildlife populations. This innovative strategy implements and improves dynamic conservation strategies designed to create, retain and enhance habitat in temporary and adaptable ways. This project could ultimately reinforce the value of floodplains and help struggling fish and wildlife species thrive in a changing world. Developing and deploying dynamic conservation strategies is especially important for migratory species— both birds and salmon - and will also become increasingly important for biodiversity conservation.

Technology Integration

In much of the West, farms and cities rely on water that is stored for much of the year as snowpack. But patterns of snow accumulation and melt are changing; temperatures are higher in the “shoulder season,” more precipitation is falling as rain instead of snow, and our snowpack storage is diminishing. Throughout the Western U.S., water users are working to adapt to these changing conditions while maintaining secure, reliable supplies of water. While adapting to the loss of snowpack will ultimately require new storage, integrating technology can lead to operational improvements to better utilize existing water storage facilities.

One technology that improves the ability coordinate water stored as snowpack and existing water management infrastructure is Airborne Snow Observatory (ASO). It uses plane-mounted cameras and laser technology to measure snow depth and reflectivity on multiple points in every square meter of a watershed multiple times during months of snow accumulation and melt. The measurements and aerial imagery that are collected can be used to estimate the amount of water supply stored in the snowpack and assess flood risk and other on-the-ground conditions, such as forest health. This data is also used to generate predictions of runoff into rivers, streams, lakes, and reservoirs that have shown to be 96%-98% accurate, far better than more traditional forecasting techniques.

Forecast Informed Reservoir Operations (FIRO) is another emerging technology that uses more accurate weather forecasting to manage releases from reservoirs in real time to maximize their water storage and flood control values.

California Central Valley Example

Since 2013, water districts in California, including those in one of our member districts, the Friant Division of the Central Valley Project (CVP), have worked together with NASA, the California Department of Water Resources, Reclamation, the USDA's Agricultural Research Service (USDA-ARS) and NRCS National Weather and Climate Center to operate the ASO program. ASO operators conduct the flights and collect measurements; the USDA-ARS produces runoff forecasts; and local, state, and federal agencies use the information to manage water for multiple uses, including irrigation, flood protection, and groundwater recharge.

The ASO program began with the 460 square-mile upper Tuolumne River basin and by 2019 USDA-ARS had produced runoff forecasts for almost all the southern Sierra Nevada (nearly 21,000 square miles) representing approximately one-third of California's agricultural water supply. In 2018, Turlock Irrigation District used ASO-derived information to save more than 150,000 acre-feet of water at Don Pedro Reservoir that would otherwise have been released by flood managers to make flood space available. As this example proves, ASO-derived data and runoff forecasts can allow for increased water supply storage in existing reservoirs without the need for new permits or construction. The Friant Water Authority estimates that, once fully implemented, the ASO program could improve deliveries by as much as 100,000 acre-feet in a given year through more effectively managed runoff using existing infrastructure. Additionally, Reclamation has used ASO-informed runoff forecasts to help refine CVP water supply estimates and improve operations for the restoration of salmon below Friant Dam.

IMPORTANCE OF TRADITIONAL INFRASTRUCTURE

As referenced earlier, the “viability of incorporating natural infrastructure in Western water management” is directly linked to having adequate traditional infrastructure, and it is critical that our country invest in new Western water supply infrastructure, along with rehabilitating and modernizing our aging existing facilities, to meet current and future demands for water.

As hydrological conditions in the West continue to change and populations expand, failure to address water security has become increasingly critical. Ignoring the need to improve our aging water infrastructure and develop new sources of usable water supply will inevitably result in additional conflict as pressure grows to ‘solve’ urban and environmental water shortages. Moving water away from Western irrigated agriculture to meet these other growing needs will surely contribute to the decline of rural communities dependent on farming, as well as negatively impact our Nation's food security.

Earlier this year, the Alliance and a national coalition of over 200 agricultural organizations and urban and rural water districts, collectively representing \$120 billion in agricultural production and tens of millions of urban and rural water users, urged then President-elect Joe Biden and congressional leadership to address new and aging Western water infrastructure in any potential infrastructure or economic recovery package. The coalition encouraged the federal government to invest in a diversified water management portfolio, including funding and support for water conservation, water recycling, reuse, and desalination projects, new surface and groundwater storage, watershed management, fish passage and recovery, and habitat restoration, among other things. Beyond financial support, the coalition also called on the federal government to ensure the timely construction of water projects by improving the efficiency and timeliness of federal regulation and permitting processes.

Incorporating natural infrastructure and building more resilient communities also requires supporting the dams, canals and other facilities that serve as the backbone of our existing water

system, and it is important that investments in this traditional infrastructure are included in this conversation.

PARTNERSHIP AND COLLABORATION

The Alliance is seen by many water resource stakeholders across the West and in Washington, D.C. as an important player in the context of Western water resource management and how this important function is impacted by implementation of federal laws and regulations.

The Alliance has worked diligently in the creation of the Western Agriculture and Conservation Coalition (WACC), a collaborative effort to improve the environment, protect Western irrigated agriculture, and keep farmers and ranchers in business. Members of the WACC include Trout Unlimited, Audubon, The Nature Conservancy, California Farm Bureau, Environmental Defense Fund, Public Lands Council, Western Growers Association, Wyoming Stockgrowers, and the California Agricultural Irrigation Association, to name a representative few. We actively seek opportunities to partner with these collaborative, solution-oriented organizations, and shun those organizations that use dueling science, litigation, and negative press to assign blame to family farmers for various regional and global environmental impacts.

Both the threats and the solutions to a viable and sustainable rural West are numerous, complex, and varied. The Alliance and the farmers and organizations we work with are dedicated to the pragmatic implementation of actions that sustainably balance environmental protection and economic prosperity.

This type of collaboration and stakeholder involvement is especially important when developing natural infrastructure projects that will complement and operate in conjunction with existing water systems. When developed in close partnership with water managers, non-structural nature-based water infrastructure components can contribute meaningfully to a portfolio approach of increasing water supply that benefits the system as a whole. However, projects that are considered in isolation without input from local stakeholders and analysis of impacts to existing water management can have unintended consequences that reduce the effectiveness of and even cause harm to existing systems.

In some instances, there has been a recent tendency to favor projects using non-structural approaches over other alternatives. Policy and practices that give preference to nature-based solutions, intentional or not, can limit the full consideration of a suite of alternatives and lead to decision making based on an incomplete analysis of a watershed or the preclusion of other possible infrastructure solutions that are both realistic and cost-effective.

Given the water security challenges we face in the West, we must quickly advance infrastructure projects, natural or otherwise, that can increase water supply and add resilience to Western basins.

This can only be accomplished through collaboration, and we look forward to working with this Subcommittee and our partners in the West to advance these on-the-ground solutions.

POLICY RECOMMENDATIONS

The Western water provisions included in the 2021 Omnibus Appropriations bill enacted in the 116th Congress takes the type of comprehensive approach needed to address our current water challenges. It addressed traditional infrastructure by establishing an aging infrastructure account in Treasury to fund and finance extraordinary maintenance projects to improve our aging federally owned water infrastructure; and also addressed natural infrastructure through the Aquifer Recharge Flexibility Act that will allow greater use of Reclamation facilities for aquifer recharge. It also advanced the use of ASO programs to provide more accurate data about predicted snowmelt runoff and improve water system operations, and it reauthorized the Cooperative Watershed Management Program to promote healthy headwaters.

These were important steps in the right direction, but more is needed to increase the water security and drought resilience our Western irrigated farms and communities need. The Alliance urges Congress to further support both traditional and natural infrastructure solutions to increase water security by:

- **Protecting Irrigated Agriculture** – Competition for water supplies, among other things, could drive more Western farmers off the land at a time when American food production in general should be increased. This rapid fragmentation of agricultural wildlife habitat, as well as crop conversions and changing irrigation practices, have implications that reverberate beyond agriculture and begin to impact local water availability for people and wildlife. Integrating agriculture, science, technology, and ecology can lead to improved understanding of key linkages related to the importance of agricultural irrigation and the need to invest in modernizing irrigation infrastructure. Such investments also have collateral benefits for landscape resiliency including groundwater recharge, habitat enhancement, and conservation of fish and wildlife.
- **Investing in New Infrastructure** – The Alliance supports reauthorization and funding of programs that allow federal partnership in new federal and non-federal storage and groundwater recharge projects, including extending provisions in the WIIN Act of 2016 – P.L. 114-322.
- **Accelerating the Pace and Scale of Forest Restoration** - It appears that there is growing recognition that improved funding and agency cooperation are needed to tackle the critical problem of unhealthy forest conditions and the resulting wildfires. However, this policy recognition is not necessarily translating to action in Western forests. Bold legislative and administrative action is needed to fund and accelerate proposed and pending projects. This type of active forest management will increase water yield, improve water quality, provide for jobs, and reduce the cost of firefighting, while increasing and protecting forest health and resiliency.

- Funding the Bureau of Reclamation Aging Infrastructure Account created last Congress to fund and finance the rebuilding of our aging federally owned water management infrastructure.
- Support Improved Environmental Regulations - We are hearing calls from some to modify or revoke some of the federal environmental rulemaking actions taken by the previous Administration. In our view, many of the changes made to decades-old federal environmental laws, including the Endangered Species Act (ESA), the National Environmental Policy Act (NEPA) and the Clean Water Act, helped bring them into the modern era. They did so by focusing on important process improvements that allows for more efficient, informed, and transparent regulatory and infrastructure permitting decisions without impacting the effectiveness of environmental or species protection measures.

CONCLUSIONS

The Family Farm Alliance' long-term goal is to find lasting solutions to Western water conflicts that can protect our farms and ranches and the rural communities they help support, our Nation's ability to feed ourselves and export food to others and continue to lead the world in agricultural production. At the same time, we must find ways to accommodate the water supply needs of growing urban areas, energy development, recreation, and environmental preservation. Fair, balanced, and long-lasting solutions will not come easily – they never have. Such solutions require visionary leadership and a firm commitment to sensible, workable policies. They will also certainly require both natural and traditional infrastructure and avoiding the tendency, at both the federal and local watershed levels, to favor one type of solution over another without considering all factors and conditions in a watershed.

The Alliance looks forward to working with your Subcommittee to address these critical infrastructure issues. We will continue our efforts to ensure irrigated agriculture is able to successfully continue to play a vital role in feeding our Nation while keeping our rural communities and our environment healthy.

Senator HYDE-SMITH. I look forward to discussing how the Bureau of Reclamation can further meet the water demands and managements of the West, while also protecting the public investment in projects that also promote economic development, watershed health and protection, and communities that are more resilient.

Thank you, Mr. Chairman.

Senator WYDEN. Thank you very much, colleague.

Now let me, kind of, give folks a little bit of a sense of where we are. Oh, very good.

Senator Kelly, who will run the hearing in a bit when I have to go to the Floor, now will introduce one of our witnesses, Dr. Holly Richter, and I am going to have him do that here momentarily. Then the order of our witnesses will be Dr. Bobby Cochran, with Oregon's Willamette Partnership, Mr. Larson and then we will have Dr. Richter and Mr. Stern. I believe that is the order of the witnesses.

Senator Kelly, would you like to introduce Dr. Holly Richter?

**STATEMENT OF HON. MARK KELLY,
U.S. SENATOR FROM ARIZONA**

Senator KELLY. Yes, Mr. Chairman, thank you. Thank you for holding today's hearing on natural infrastructure. I would like to take one minute to very briefly introduce one of our witnesses who will be testifying shortly, Dr. Holly Richter, as you said, is from the Arizona Chapter of The Nature Conservancy in Tucson. Over the past 20 years, Dr. Richter has worked with elected officials, local stakeholders and the U.S. Army base commanders at Fort Huachuca to reduce groundwater pumping that is depleting the surface flows of the San Pedro River, one of the last free-flowing rivers in the Southwest.

She is a founding member of the Upper San Pedro River Partnership, a clearinghouse of scientific and technical information that was used to inform local decision-makers on how best to conserve water at the Fort and in the nearby city of Sierra Vista. Fort Huachuca is a critical intelligence and cybersecurity center for the Army. Dr. Richter's work is important to the service branches, the 16,000 soldiers and civilian contractors stationed there and the long-term economic prosperity for Cochise County.

I look forward to listening to her testimony and thank you, Chairman Wyden.

Senator WYDEN. Thank you, Senator Kelly, and thank you for also allowing us to keep this going as I have to go to the Floor in a bit.

All right. Let's go to our witnesses.

Dr. Bobby Cochran, with Oregon's Willamette Partnership, is testifying from the beautiful State of Oregon, as I understand it.

Dr. COCHRAN.

**STATEMENT OF DR. BOBBY COCHRAN, PARTNER, COMMUNITY
RESILIENCE & INNOVATION, WILLAMETTE PARTNERSHIP**

Dr. COCHRAN. Senator Wyden, Senator Hyde-Smith and distinguished members of the Subcommittee and all the other panelists, it's a real good honor to be here. My name is Bobby Cochran. I'm our Partner for Community Resilience & Innovation at Willamette

Partnership and the Partnership is based in Oregon, as you said, Senator, but we support communities all over the Western United States in finding solutions that improve the environment, improve health, and create a more inclusive economy. In particular, we implement solutions for natural infrastructure that save money and get better outcomes.

So for us, natural infrastructure is an approach that uses any process of nature to provide a key service to communities, so that could be filtering drinking water, reducing flood risk, increasing the ability to store snow and groundwater for later in the summer when we need it to grow food and drive industry. And right now a lot of towns, especially our small, low-income places, are trying to find new ways to do more with less and provide the kinds of opportunities for their kids to thrive, take over the farm, get good jobs and grow up to raise their families and towns. And so, we need infrastructure investment to do multiple things at once and natural infrastructure is one of those key things in the toolbox and I'll give a couple of examples.

You know, first off, we can think of our forests as reservoirs. Oregon's seeing a lot less snowpack which is our significant storage resource for a lot of the state and that dynamic is true all over the West. Most of the water infrastructure, particularly the federal water infrastructure in Oregon, was built more than 50 years ago, so back when like Phil Knight was making shoes on a waffle iron. We can do better than that. And here's some examples of where we're thinking of upgrades. So some research out of the North Platte River in Colorado is identifying opportunities for improved forest management that could actually increase water yields in the North Platte River by 55,000 acre-feet a year. The cities of Denver and Santa Fe are already investing in forest restoration upstream of their reservoirs to prevent catastrophic fire that lets a huge dose of sediment fill up those reservoirs. And so, it really is a role for Reclamation in partnering with upstream land managers to protect existing storage capacity and kind of lean in to that opportunity for natural groundwater storage. There's also a really good upside for investment in natural infrastructure that every \$1 million we invest in natural infrastructure, we see about 15 to 24 jobs created and a lot of those jobs are local jobs. So basically, \$0.90 of every \$1.00 spent on natural infrastructure stays in the local community and we've found instances in natural infrastructure that actually created a restoration economy that you had off-season forest workers and others being able to stay closer to home and closer to family.

Restored streams are another really good example of natural infrastructure providing cool, clean, affordable water. One example to point to is in Southern Oregon for the cities of Medford and Ashland. They had a choice. We all take hot showers in the morning. That water coming out of the edge of the wastewater treatment plant was too warm for fish. We could have spent \$16 million on a mechanical chiller—100 percent sure to cool the water in terms of the end of the pipe but it did nothing relative to the broader habitat needs and broader community investment. So instead, Medford and Ashland invested in natural infrastructure, restoring streams in the Rogue River and they did that at more than half

of the cost, so basically, \$6–\$8 million. And the upside of a lot of that stream restoration is, when the Alameda Fire ripped through this Labor Day, the restored stream actually acted as firebreak, preventing the fire from burning as intensely and burning as quickly and prevented the loss of some key homes along the riparian corridor.

So in general, we really need to think about how we can put natural infrastructure on an even playing field and there's some things that Congress can help do to help establish that even playing field. One of the things is just make natural infrastructure eligible. The Water Resource Development Act of 2020 did that with a lot of the WRDA investments. FEMA has done that with a lot of its natural hazard mitigation approaches. So just making it eligible is simple and then prioritizing infrastructure investments that create multiple benefits. So, not only thinking about water storage, but thinking about benefits to habitat, affordability for ratepayers, particularly low-income ratepayers, and then also thinking about flood protection and fire protection as well. And then, I think, just thinking about bigger than shovel ready. So as Congress thinks about infrastructure investments or the role of Federal Government, shovel ready doesn't invest in the types of broad solutions that we think are important. So thinking about coordinated permitting, monies to solve planning, money for technical assistance, particularly for rural communities, and making sure that infrastructure needs to create resilient inclusive economies as well as the broader benefits.

Thank you again for the opportunity to share some of our thoughts. Happy to answer any questions. Happy to be in conversation over time with you. Senators, thank you all for your service for the country and everything that you do and thank you very much.

[The prepared statement of Dr. Cochran follows:]



WILLAMETTE PARTNERSHIP

WRITTEN TESTIMONY OF DR. BOBBY COCHRAN

COMMUNITY RESILIENCE & INNOVATION, WILLAMETTE PARTNERSHIP

PREPARED FOR THE US SENATE SUBCOMMITTEE ON WATER AND POWER, COMMITTEE ON
ENVIRONMENT AND NATURAL RESOURCES

March 24, 2021

RE: Hearing Natural Infrastructure

Senator Wyden, Senator Hyde-Smith, and distinguished members of the Subcommittee:

Thank you for the opportunity to be here with you today. My name is Bobby Cochran, and I'm our Partner for Community Resilience & Innovation at Willamette Partnership.¹ The Partnership is based in Oregon, and supports communities across the West in finding solutions that improve the environment, improve health, and create more inclusive economies. In particular, we implement solutions for natural infrastructure that saves \$ and gets better outcomes. We think the choice between the environment and the economy is a false choice, and natural infrastructure is an important part of any economic recovery and growth strategy.

Natural infrastructure is any approach that uses the processes of nature to provide a key service to communities—Things like filtering drinking water; Reducing flood risk; and increasing the ability to store snow and groundwater for later in the summer when we need it to grow food and drive industry.

A lot of towns, especially small and low income places, are trying to find new ways to do more with less and provide the kinds of opportunities for their kids to thrive, take over the farm, get good jobs, and grow up to raise their families in town. We need infrastructure investments that do multiple things at once. Most of the federal water infrastructure in Oregon was built more than 50 years ago—back before Phil Knight and Nike were making shoes in a waffle iron. We can do better than that. Here are some examples.

EXAMPLES OF NATURAL INFRASTRUCTURE

OUR FORESTS AS RESERVOIRS: NORTH PLATTE RIVER & SIERRA NEVADAS

Oregon is seeing less snowpack—a significant storage resource for much of the state. The Colorado River Basin is seeing snowpack declines across 90% of its monitoring sites, and that snow accounts for two-thirds of the inflow into major storage reservoirs in the Basin². Attention to natural

¹ <https://willamettepartnership.org/>

² Mote, P.W., Li, S., Lettenmaier, D.P., Xiao, M., and Engel, R. (2018). Dramatic declines in snowpack in the Western US. *Climate and Atmospheric Science*, Vol 1 (1): 2; Knowles, J.F., Harpold, A.A., Cowie, R., Zeliff, M., Barnard, H.R., Burns, S.P., Blanken, P.D., Morse, J.F., and Williams, M.W. (2015). The relative contributions of alpine and subalpine ecosystems to the water balance of the mountainous, headwater catchment.

infrastructure can also increase groundwater recharge and increase water availability in the West's dry summers and fall. In Colorado's North Platte River, research is showing how restored forests that have the right mix of stand densities and canopy cover ensure rain gets into groundwater and snowpack stays shaded.³ It is estimated that water yields from National Forests in the North Platte have decreased 11-13% and improved forest management could increase yields by 55,000 acre-feet. Similar research in California's Sierra Nevada forests estimate that improved forest management could increase water yields by 16% and delay snowmelt by days or weeks on the Tahoe National Forest.⁴ Further, restoring forests can reduce fire upstream of existing reservoirs and irrigation/municipal diversions. Denver and Santa Fe have both invested in restoration of upstream federal forest lands, so fire doesn't expose masses of sediment that erode and fill those reservoirs up.

We don't always need a dam and a reservoir to store water. But natural infrastructure isn't magic either. It requires active management and investment, just like built infrastructure does. There is a role for Reclamation in partnering with upstream land managers to protect existing storage capacity and lean into the opportunity for natural groundwater storage.

And investment in natural infrastructure is especially good for the rural economy. Every \$1 million invested in natural infrastructure creates 15-24 jobs, and \$0.90 of every dollar actually stays in the local economy (i.e., local people can do the local work).⁵

OUR STREAMS AS FILTERS: MEDFORD AND ASHLAND

The cities of Medford and Ashland in Southern Oregon (the cities at the center of Reclamation's Rogue River Project) each had a challenge. We all take hot showers in the morning, and that warm water flowing through and out of the wastewater treatment plant was too warm to support salmon—a critical fish for us—culturally and economically. The cities had a choice. They could have spent \$16 million each building mechanical chillers. Those chillers would have cooled the water, but they also would have used a ton of energy. Instead, Willamette Partnership with groups like the state and The Freshwater Trust to restore several miles of local streams.⁶ The natural infrastructure, streamside forests in this case, were planted at half the cost and 2 times the cooling

Hydrological Processes, vol 29(22):4794-4808. Available at <https://onlinelibrary.wiley.com/doi/abs/10.1002/hyp.10526>.

³ MacDonald, L.H. and Stednick, J.D. 2003. Forests and Water: A State-of-the-Art Review for Colorado. CWRRI Completion Report No. 196. Fort Collins, CO: Colorado State. Available at <https://www.fs.usda.gov/treearch/pubs/59257>.

⁴ Bales, R.C., Battles, J.J., Chen, Y., Conklin, M.H., Holst, E., O'Hara, K.L., Saksa, P., and Stewart, W. (2011). Forests and Water in the Sierra Nevada: Sierra Nevada Watershed Ecosystem Enhancement Project. Available at <https://ucanr.edu/sites/cff/files/146199.pdf>.

⁵ <https://www.oregon.gov/oweb/data-reporting/Pages/economic-impacts.aspx>.

⁶ <https://www.thefreshwatertrust.org/case-study/medford-water-quality-trading-program/#:~:text=What%20is%20water%20quality%20trading,environmental%20benefits%20for%20compliance%20purposes>.

benefit of those chillers. Reclamation also invested in adjacent stream restoration as a cost-effective way to meet its Endangered Species Act mitigation obligations. But that's not all. This September, the Alameda Fire ripped through the Bear Creek Valley. But those restored streamside forests acted as fire breaks, preventing the fire from destroying more affordable homes and saving millions in local and federal disaster relief costs. Even more, the replanting has created new businesses—nurseries to grow plants and good-paying jobs for off-season fire and forestry crews.

Cities all over the West are using similar natural treatment. Boise, OR is paying a farmer for a sediment basin that removes that last nutrients from its wastewater. Prineville, OR uses a treatment wetland that doubles as a city park that helped them significantly reduce the fees they charge businesses.

OUR PARKS AS FLOOD CONTROL: LOS ANGELES, DENVER, AND OKLAHOMA CITY

And finally, natural infrastructure can improve health while it protects us from floods. In Los Angeles, Sun Valley Park got new baseball and soccer fields and trees in 2006. It is a place to relax or run around most days. We know that time in nature can measurably improve mental and physical health. Just 2 hours outside⁷ a week or simply greening a vacant lot in town showed measurable health improvements.⁸ But when a really rainy comes, the park gathers, treats, and infiltrates stormwater from 21 acres of homes and businesses—reducing flooding and adding 30 acre feet of water back in the aquifer for later use. The project cost \$7 million to build.

The National Recreation and Park Association is supporting Environmental Learning for Kids⁹ to improve aging gray stormwater infrastructure through the Montbello Open Space project, located in the far northeast section of the city and county of Denver, Colorado. The project involves the restoration of 5 acres in Montbello, one of the city's largest neighborhoods, and development of a new park that is designed specifically to mimic the native Colorado prairie ecosystem; employ green infrastructure techniques to improve stormwater flow; accommodate frequent storms; withstand a 100-year flood event; improve water and environmental quality; and improve wildlife habitat in this arid landscape. To allow for additional infiltration, water will collect on the park site prior to releasing the flows into a detention pond on the health clinic site, thereby capturing and filtering all water that flows into the public storm sewer. This project will collectively manage over 2 million gallons of stormwater per year and will be complete in 2021.

Oklahoma City is reorienting roads to include more natural infrastructure in ways that helped manage stormwater, but it also had the effect of slowing traffic, and increasing downtown business because more people stopped and shopped, and stayed longer.¹⁰

⁷ <https://www.newscientist.com/article/2206249-two-hours-a-week-spent-outdoors-in-nature-linked-with-better-health/>.

⁸ <https://whyv.org/articles/greening-vacant-lots-improves-mental-health-in-philly-communities/>.

⁹ <http://www.elkkids.org/>.

¹⁰ <https://www.okc.gov/home/showdocument?id=11814>.

PUT NATURAL INFRASTRUCTURE ON AN EVEN PLAYING FIELD

Natural infrastructure solutions are compatible with community needs and can serve a vital role in solving community infrastructure challenges. The federal government uses 240 separate programs to fund water infrastructure, research, data, and conservation.¹¹ However, most of those programs don't explicitly authorize and encourage natural infrastructure. We need to put natural infrastructure on an even playing field. That the small and low income communities I work with most would love a natural infrastructure option to consider if it saves money, increases water security, and builds a foundation for a strong economy. Floyd Dominy made Reclamation famous for its big projects, like Lake Powell, that helped feed the world and allowed more people to move West. But our challenge now is how to sustain communities, especially rural communities. Natural infrastructure can cost less, create better more local jobs, and improve health.

1. WE CAN CLARIFY THAT NATURAL INFRASTRUCTURE IS ELIGIBLE IN THE COUNTRY'S FEDERAL INFRASTRUCTURE PROGRAMS

Natural infrastructure was explicitly authorized, even prioritized, in the 2020 Water Resources Development Act (WRDA) that passed as part of the omnibus bill at the end of the 116th Congress. We can do that with every program (e.g., Bureau of Reclamation, USDA Rural Development, Clean Water and State Drinking Water Revolving Funds, and how we manage our nation's forests and streams). Federal funding can also clarify that the community engagement, planning, and stewardship of natural infrastructure are eligible costs.¹²

Congress can also state its interpretation that natural infrastructure is a capital asset—just like a road or pump station. That designation allows local governments to capitalize the costs of restoring and caring for the streams, wetlands, and forests that serve their towns. And that in turn lets them issue the bonds, and partner with the private sector, to finance that work.

2. PRIORITIZE INFRASTRUCTURE THAT HAS MULTIPLE BENEFITS, ESPECIALLY EFFICIENCY AND REUSE

No investment should solve for one problem anymore. For example, in Central Oregon, irrigation districts are upgrading leaky canals on several Reclamation projects into pressurized pipe. They're laying down broadband for rural towns and microhydropower in those same conduits. That rural broadband is then connected to real-time water gauging which allows for better water budgeting and moving water between farm, municipal, and habitat uses as needed during the year.

Bureau of Reclamation's WaterSMART and Cooperative Watershed Management programs can push these kinds of innovations further. USDA programs, like the Regional Conservation

¹¹ <https://willamettepartnership.org/water-investment-ready-oregon/>.

¹² <https://www.nrpap.org/contentassets/0aa1178a2d944cbc8cb6fbc5ce31b266/greener-parks-for-health-policy-action-framework-web.pdf>

Partnership Program (RCPP), provide the space for farms and cities to come up with collaborative, good solutions that incorporate both built and natural infrastructure solutions.

3. DON'T JUST THINK ABOUT "SHOVEL READY"

The 2009 American Recovery and Reinvestment Act (ARRA) worked for some places, and left others behind. In Oregon, higher capacity towns could quickly put together project designs, permits, and applications. Rural Oregon didn't have that same capacity. Unemployment remained high, and still today lags behind our brothers and sisters in Portland.

As Congress thinks about its next 150-year approach to infrastructure investment we need to move beyond shovel ready in some key ways:

- Invest in the technical assistance and capacity building for rural and low income places to access federal aid (e.g., rural circuit riders and environmental finance centers)—but make sure there is also technical assistance for natural infrastructure solutions;
- Invest in the foundational information, such as groundwater basin studies, needed to do more accurate water budgeting and demand management—the same kinds of real-time management the electric sector is able to do;
- Plan and solve regionally—we need to look across city and state boundaries with coordinated approaches (e.g., for the Colorado, Columbia, or Mississippi);
- Give communities 1-3 years from the date of project application to spend 4
- Coordinate permitting so restoring streams and protecting forests doesn't take so much time or cost so much to get permits;
- Make sure it's clear that infrastructure needs to create resilient, inclusive economies and opportunities for all people to thrive in all places—no exceptions. Infrastructure tied just to increases in job numbers and export-led production won't create the kinds of economic liberty rural and urban places across the West are asking for.

Thank you again for the opportunity to share some of our thoughts on natural infrastructure. We are happy to continue the dialogue and support Congress' conversations however we can. Thank you for your service, and all the work you do and will do for this country.

Sincerely,



Bobby Cochran, PhD
Willamette Partnership

Senator WYDEN. Dr. Cochran, thank you very much.

I also want to welcome Senator Marshall, our new colleague from Kansas. I was born in Wichita, because my dad worked at The Wichita Eagle. We look forward to having you here on the Subcommittee.

Senator MARSHALL. Thank you. Glad to be here.

Senator WYDEN. Very good.

Our next witness will be Mr. Troy Larson, Executive Director of the Lewis & Clark Regional Water System, also from home.

Mr. Larson, you are also with us.

**STATEMENT OF TROY LARSON, EXECUTIVE DIRECTOR,
LEWIS & CLARK REGIONAL WATER SYSTEM**

Mr. LARSON. Yes, good afternoon. I'm Troy Larson, Executive Director of the Lewis & Clark Regional Water System. Thank you, Mr. Chairman and Madam Ranking Member, for allowing me to testify.

Lewis & Clark is a drinking water project that covers southeast South Dakota, northwest Iowa and southwest Minnesota. It involves a partnership with the Federal Government, 3 states, 15 cities and 5 rural water systems. The Bureau of Reclamation provides construction and regulatory oversight and has been an important partner since Lewis & Clark was incorporated in 1990 and later authorized by Congress in 2000. Construction began in 2004 and we are about 86 percent complete. At current federal funding levels, we unfortunately still have about ten years to go. I've been the Executive Director for 18 years. Reclamation is involved with every level of construction to ensure projects are constructed in the most efficient and cost-effective manner possible, as well as ensuring all environmental regulations are followed. Reclamation staff in Pierre, Bismarck and Billings have been invaluable partners. The 3 states and 20 local members have fulfilled their financial obligations to Lewis & Clark, a combined \$154 million. A timeline to complete construction depends entirely on annual appropriations as the Federal Government works toward fulfilling its financial commitment. Our goal of connecting the remaining communities is within reach, but this assumes construction requirements do not change in ways that would add more money or time.

I appreciate the goals of the Chairman in terms of exploring the viability of incorporating natural infrastructure into Reclamation's mission. I have three concerns about this proposal; however, I caveat my concerns with the statement that I'm not aware of the full scope of the policy changes under consideration. So I raise concerns in an effort to bring issues to the Subcommittee's attention. First, I'm concerned new requirements could increase the cost of construction as well as delay completion of projects. Second, I am concerned about a one-size-fits-all change because not all Reclamation projects are alike. And third, I'm concerned funding natural infrastructure may take precedent over completing projects currently underway. I will discuss each in turn.

In terms of the financial effects, an example from 2008 is particularly important for the Subcommittee to consider. Our source of water is a series of wells adjacent to the Missouri River. To protect the wells from erosion, we needed to construct bank stabilization.

At the request of the National Park Service and the Army Corps of Engineers, we used an approach they deemed to be more environmentally friendly, even though our approach would have accomplished the exact same goal. The bank stabilization was completed in 2008 at a cost of \$5.25 million. Our engineers conservatively estimate this approach added at least \$1 million to the cost, roughly a 20 percent increase. We could've used the \$1 million to construct more pipeline.

Second, I'm concerned Reclamation may be required to apply natural infrastructure provisions to all projects. Land forms and topography vary greatly, what might work in the Western states may not work for us on the Plains.

Finally, I'm very concerned if Congress adds a new scope to Reclamation's mission, it could mean longstanding projects like ours will take a back seat for funding to natural infrastructure projects. We originally thought it would take ten years to complete our project. Here we are 20 years after authorization and we still have about 10 years to go. If Reclamation is required to satisfy Congress' desire to have the agency focus on natural infrastructure, what does that mean for projects like ours in terms of Reclamation's funding priorities? Lewis & Clark would strongly oppose giving a higher funding priority to natural infrastructure projects.

I close by reiterating that changes in Reclamation's mission could adversely affect the cost and timeline for the completion of projects like Lewis & Clark. My thanks to the Chairman for holding this hearing and the Ranking Member for inviting me to testify. I stand ready to be a resource to the Subcommittee as you explore what natural infrastructure requirements might mean to projects like ours. Thank you.

[The prepared statement of Mr. Larson follows:]

Senate Committee on Energy and Natural Resources
Subcommittee on Water and Power

Water Infrastructure for the 21st Century:
The viability of incorporating Natural Infrastructure in Bureau of Reclamation Water
Management Systems
March 24, 2021 at 2:30 PM

Witness Testimony of Troy Larson
Executive Director
Lewis & Clark Regional Water System

Good afternoon. I am Troy Larson, Executive Director of the Lewis & Clark Regional Water System (Lewis & Clark). Thank you, Mister Chairman and Madam Ranking Member, for allowing me to testify before the Committee today.

Lewis & Clark is a tristate drinking water project that when completed will benefit over 350,000 individuals in southeast South Dakota, northwest Iowa, and southwest Minnesota. This water project involves the partnership of the federal government, three states, 15 cities, and five rural water systems. I appreciate the interest of the Committee in examining the Bureau of Reclamation and how their current programs guide the building of important infrastructure projects like the Lewis & Clark Regional Water System.

The Bureau of Reclamation (Reclamation) provides construction oversight for our project and has been an important partner since the project was incorporated in 1990 and later authorized by Congress in 2000. Construction began in 2004, and we are approximately 86% complete. In today's dollars, the estimated cost of the project is \$618 million. At current funding levels, we unfortunately still have about 10 years to go.

I have served as the Executive Director of the Lewis & Clark Regional Water System for 18 years. Over the past 18 years, I have seen the critical oversight role Reclamation fills with our project. Their engineers are involved in every level of construction to ensure projects are being constructed in the most efficient and cost-effective manner possible, as well as ensuring all existing environmental rules and regulations are being followed. For example, they have held Value-Engineering studies of certain larger aspects of our project, such as the water treatment plant. They have also hosted Inter-Agency Environmental Review Teams to get input from various federal and state agencies, as well as tribal officials, with regard to planned construction. Reclamation staff in Pierre, Bismarck, and Billings have been invaluable partners from a design, construction, environmental, and oversight standpoint.

Our project and four other projects are funded by Reclamation's Rural Water Program, and at this point the primary barrier to project completion for us is federal funding. The states and municipalities have fulfilled their financial obligations to the projects.

With construction roughly 86% complete, the goal of connecting all awaiting communities and rural water systems is within reach; however, this assumes that the construction requirements for our project from Reclamation do not significantly change in ways that would require spending financial resources to satisfy those new requirements.

I appreciate the goals that the Chairman has in exploring the viability of incorporating natural infrastructure in water management and policy. I have three concerns about this proposal to discuss today. However, I caveat my concerns with the statement that I am not aware of the full scope of the policy changes under consideration, so I raise concerns in an effort to bring issues to the attention of the Committee for your consideration as you continue to contemplate changes to how Reclamation operates.

First, I am concerned about the financial effects these new requirements could have and that they will delay completion of projects and require additional scarce funds to satisfy these goals. Second, I am concerned about one-size-fits all changes because not every Reclamation funded project is alike; and third, I am concerned that funding new natural infrastructure will take precedent over completing the Reclamation projects that are currently in process. I will discuss each in turn.

First, for projects like ours, the sooner our project is complete, the less of a burden we are to the federal government because once complete, Lewis & Clark is fully self-sustaining with water rates covering all operation and management expenses. We are grateful for what Congress appropriates every year, and we hold fast to our goal of being self-sufficient, but that cannot occur until we have received the funds necessary to complete construction. Adding new requirements that might make our project more expensive only further delays our ability to become self-sufficient, which was the vision Congress laid out for our project when we were authorized over 20 years ago.

In the course of my 18 years and our close partnership with the Reclamation, there have been countless times when we have had to ensure compliance with various environmental parameters. One example from 2008 is particularly important to consider as you weigh the impact of changes the Committee is discussing today.

Our source of water is a series of wells adjacent to the Missouri River. To protect the wells from erosion we need to construct bank stabilization. Our original plan was to bury large rocks a short distance inland, and when natural erosion affected the shore and reach the buried rocks, the rocks would eventually tumble down the river bank. This would stabilize the riverbank from further erosion. At the request of the National Park Service and the Army Corps of Engineers, we instead used a "modified stone toe revetment with root wads." I would be happy to further provide an explanation of what this entailed, but to keep this short I will just say that it was deemed a more environmentally friendly and natural looking approach to bank stabilization even though the other approach would have also accomplished the exact same goal. We were forewarned it has been used on smaller streams, but not on one as large as the Missouri River. The bank stabilization project was completed in August 2008, and the total cost was \$5.25

million. Our engineers conservatively estimate this approach added at least \$1 million to the contract of the project; roughly a 20% increase. That is \$1 million we could have used to put more pipeline in the ground and closer to completing the entire water system.

This additional cost for natural shoreline infrastructure did not necessarily come out of the pocket of the federal government, and it is possible that future requirements for natural infrastructure will not come out of the pocket of the federal government. That because of the hard cap of our federal funding ceiling, Reclamation knows that there is a maximum amount the federal government will pay for our project, so new additional costs, even if they are a result of policy directives coming from the federal level, will likely be borne by the municipalities and rural water systems in our project.

Second, should Congress consider natural infrastructure mandates, I am concerned that mandates on Reclamation to create one-size-fits natural infrastructure requirements may also have unintended consequences and result in inadvertent oversights. Lewis & Clark is unique in that Reclamation only operates in the 17 most western states, so this is the first time Iowa and Minnesota have benefited from a Reclamation project.

Landforms and topography vary significantly between our project on the plains and those of other Reclamation projects in more mountainous, arid, or rocky regions of the country. I am concerned that smaller projects like ours will simply be overlooked if the agency has to meet new mandates on natural infrastructure because what might work for natural infrastructure in Colorado, Utah, or other states in the west likely will not work for us on the plains. Further, with only 14% left in our project, depending how the new requirements are drafted and implemented, resources might have to be spent on engineering and compliance with any new natural infrastructure requirements, only further pushing out expected our completion date.

Finally, I am concerned that if Congress adds a new scope to Reclamation's mission, it will mean that long-standing projects like ours will take a back seat to funding for new natural infrastructure projects. For us, we originally thought it would take about 10 years to complete the water project. But here we are, 20 years after we were authorized, and we still are not complete, and at current funding levels, we anticipate another decade of work before we are complete. If Reclamation is suddenly trying to satisfy Congress' desire to have the agency focus on the new idea of natural infrastructure, what does that mean for projects like ours in terms of the commitment of the scarce resources that Reclamation is appropriated every year? I fear it means it will take even more years than we expect to complete our project.

I close by reiterating that changes in the mission or scope of Reclamation and their expectations for how we complete our infrastructure project have the potential to significantly affect timelines for completion by reducing the amount of federal funds required for Reclamation-funded projects; one-size-fits-all natural infrastructure mandates won't work for all Reclamation projects; and an expansion of Reclamation's mission could mean existing projects are no longer prioritized for completion.

I want to thank the Chairman for holding this hearing today and the Ranking Member for inviting me to testify. I stand ready to continue to be a resource to the Committee as you explore what natural infrastructure requirements might mean to projects like ours.

Senator WYDEN. Thank you very much, Mr. Larson.

Just a quick comment while it is fresh in everybody's mind. I want all my colleagues and others who are following this debate to know that as we envision it and as the bill has been written, this is one option in the toolkit. It was something, as I indicated in my statement, that was chosen in Tillamook by farmers and conservationists and others as fitting the area. So I only want to make clear, this is an option. It would not be given a higher priority or anything of that nature. And just while it is fresh in everybody's mind, I just wanted the record to make it clear that those of us who are looking in the West—and this is before you came, Senator Kelly—we kind of need all of the above. We need lots of tools because we are short of water. We are going to look at this, and we are going to look at that, and over here and over there.

So I very much appreciate the chance to just make that point for the record.

Let's now have Dr. Holly Richter.

**STATEMENT OF DR. HOLLY RICHTER, ARIZONA WATER
PROJECTS DIRECTOR, THE NATURE CONSERVANCY**

Dr. RICHTER. Chairman Wyden, Ranking Member Hyde-Smith and members of the Subcommittee, thank you for inviting me to testify today on incorporating natural infrastructure in Western water management. It's an appropriate topic during this week of World Water Day. I appreciate the Committee's focus on solutions that support economic development, protect watershed health and build more resilient communities.

I'm Holly Richter, the Arizona Water Projects Director for The Nature Conservancy, and where I live and work groundwater is the only source of water for people and nature. Fort Huachuca, the U.S. Army's premier intelligence and communications testing facility, depends on the same limited groundwater resources as does the U.S. Bureau of Land Management's San Pedro Riparian National Conservation Area located several miles away. The small towns and cities in the area do as well. When I first moved to Arizona, legal battles related to the limited groundwater supplies had started to emerge. And in response, The Nature Conservancy was a founding member of the collaborative group of 21 different stakeholders, the Upper San Pedro Partnership, to build consensus for hydrologic science that could help inform decision-making. Over the years, we worked with the U.S. Geological Survey to develop a predictive groundwater model to evaluate a wide range of alternatives. And what we learned together was that there were some significant ways to optimize groundwater for the various water needs of humans and nature. The Partnership later joined forces with the U.S. Bureau of Reclamation to conduct an appraisal level study of water management alternatives that was completed in 2007.

Today, we have much more clarity about the most effective options to replenish groundwater and to assure a vibrant economy, the operability of missions of Fort Huachuca, the health of the San Pedro River and water security for local communities. The conversations over the years weren't always easy ones, but the co-development of the information to inform our decisions brought increased clarity and understanding. The vision for regional water

management included replenishment of the groundwater aquifer at just the right places and amounts, using treated wastewater effluent and stormwater. We identified where too much stormwater was problematic. For example, where there was increased runoff from urbanized areas and we flipped that problem into a water source asset. We looked at the demand side of the equation as well and retired high-volume pumping and/or precluded it in the future at the locations where our science told us it had the worst impacts to water supplies.

The U.S. Army has been a critical partner for projects to support our regional water vision. The Army's Compatible Use Buffer program which is part of DoD's Readiness and Environmental Protection Integration program, or REPI, has leveraged the efforts of this conservation partnership to address water security for all water users in the region. REPI funded us and allowed for the development of projects that could combat encroachment on military training, testing and operations and enhance military installation resilience, while also increasing water security for the entire region. And today, only three more recharge projects, totaling \$21 million, now remain to be constructed by our consortium of project partners, called the Cochise Conservation and Recharge Network. One of the remaining projects blends traditional and natural infrastructure approaches. Stormwater runoff from the largest urban area in the watershed will be diverted into a constructed basin to retain accelerated flood peaks in a way that slowly releases them back into the natural channel at a rate that will increase channel infiltration and groundwater recharge. The project will restore a more natural flood regime. It'll reduce sedimentation, increase water quality and result in enhanced groundwater storage.

I want to thank you for Congress' attention to water resources legislation. I hope that as Congress debates investments in infrastructure, that you will make Western water supply infrastructure a priority. To increase water security in the West, we will need additional resources and funding for projects capable of leveraging natural systems as well as traditional infrastructure to convey and store water supplies. The example project I described today is illustrative of how traditional and natural infrastructure can be blended into one single project, but the inclusion of both types of projects within a given watershed can also leverage the benefits of one with another. As the primary federal water managers for the West, the Bureau of Reclamation should look at these types of innovation and solutions more often and implement them in collaboration with other agencies where appropriate to build a resilient and multi-benefit Western water infrastructure for the future.

I appreciate the Committee's attention to Western water issues and I thank you once again for the opportunity to testify today.

[The prepared statement of Dr. Richter follows:]

Testimony of Dr. Holly Richter, Arizona Water Projects Director, The Nature Conservancy
Before the US Senate Energy and Natural Resources Subcommittee on Water and Power
March 24, 2021

Introduction: The Western Water Challenge

Chairman Wyden, Ranking Member Hyde-Smith, and members of the Subcommittee, thank you for inviting me to testify today. The topic of today's hearing-- incorporating natural infrastructure in western water management—during this week of World Water Day. The western United States is suffering through an extended period of drought and persistent water supply challenges, as are many other places around the globe. I appreciate the committee's focus on solutions that support economic development, protect watershed health and build more resilient communities.

I am Holly Richter, Arizona Water Projects Director for The Nature Conservancy (TNC). Founded in 1951, TNC is a global environmental nonprofit working to create a world where people and nature can thrive. Thanks to more than a million members and the dedicated efforts of our diverse staff and more than 400 scientists, we work in all 50 U.S. states and impact conservation in 72 countries across six continents.

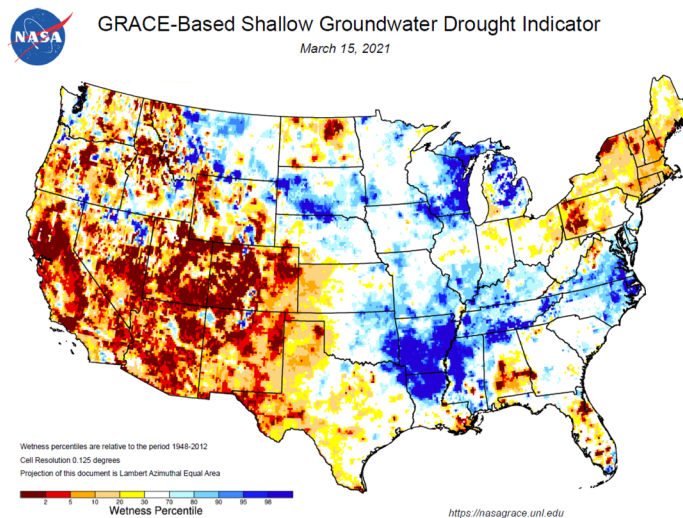
Water is the lifeblood of the arid West. Over the past 20 years we have endured widespread drought conditions, and climate change is producing higher temperatures and drier conditions throughout the Western states. According to the U.S. Drought Monitor, 55.4% of the country was experiencing severe, extreme, or even exceptional drought at the beginning of 2021. The news for the desert Southwest is even more alarming- more than half of Arizona and New Mexico are experiencing "exceptional drought" conditions (Pugh, 2021).

How much water we have at any given time or location is a simple equation, and essentially depends on two factors: how much we extract and consume (demand) and how much water enters the system and is subsequently stored (supply). Historically, our western water storage portfolio has revolved primarily around surface water reservoirs, which until recent decades, were adequate to meet the combination of municipal, industrial and agricultural demands. Now, in the Colorado River Basin, demand exceeds supply and surface water storage levels have been going down (U.S. Bureau of Reclamation, 2012).

We have all seen the photographs of Lake Powell and Lake Mead with telltale bathtub rings that reflect declining water levels under our ongoing and extended drought conditions. But what is harder to see is the similar decline in groundwater storage beneath our feet across the West. In the United States, groundwater is the source of drinking water for about half the total population and nearly all of the rural population, and over 40 percent of irrigation water is groundwater (USGS, Water Science School: Groundwater Use United States). Groundwater depletion in the United States from 1900-2008 is estimated to be 1,000 cubic kilometers of water, one quarter of which was extracted between 2000-2008 alone (Konikow, 2013).

To bridge the gap between supply and demand we have increasingly relied on groundwater resources. However, groundwater pumping remains largely unregulated in most western states, and due to the cumulative losses of groundwater storage, our fall-back and safeguard for water supplies, has itself diminished over the past century. Groundwater overdraft has many negative consequences such as land subsidence that is damaging public infrastructure – including as bridges and canals, seawater intrusion, water quality deterioration, and depleted surface water (Matsumoto et. al, 2019). Groundwater is also a critical resource not only for human communities but also for many riparian and aquatic ecosystems and species. Unfortunately, groundwater management priorities seldom address the water needs of natural systems, and as a result, many of them have been degraded or eliminated, especially in arid regions (Saito, et.al, 2021).

Chronic water shortages and more frequent and intense droughts, combined with population growth and aging water infrastructure, are not only increasing the potential for conflict over water resources, but also reducing water security. These urgent drivers, informed by the development of new science and technical tools, now encourage innovation and new approaches to our water management practices, policies and projects as well as additional investments in western water infrastructure. These investments can be most effectively leveraged by the incorporation of natural infrastructure approaches either alone or in combination with traditional approaches. Natural systems can convey and store water at the right times, and in the right places, to meet our needs.



This Groundwater Drought Indicator Map is a result of gravity variations detected by NASA's GRACE satellites to determine groundwater storage on land masses. By comparing recent data to an average over time, scientists have generated this map illustrating where groundwater storage has been depleted or increased. Rust colored areas show areas where ground water has decreased, and areas in blue are where groundwater levels have increased (NASA: <https://gracefo.jpl.nasa.gov/science/water-storage/>). This map represents conditions as of March 15, 2021.

Natural Infrastructure Storage Solutions

The use of natural infrastructure has increased in recent years in response to the growing need to protect people and property in a changing climate, and to increase resilience in the face of extreme weather. Put simply, natural infrastructure involves a natural system that is intentionally managed to provide multiple benefits for the environment and human well-being. Natural infrastructure storage solutions more specifically increase water storage through aquifer recharge, floodplain storage, or the alteration of the timing of runoff. These solutions mimic natural riverine, wetland, ecosystem, or hydrologic processes, which in many cases also provide added benefits to the environment and recreation. Methods for the economic evaluation of natural infrastructure for aquifer recharge have been developed to weigh costs and benefits, and return on investment (Morales, et.al, 2019).

Replenishing groundwater storage can be accomplished in a surprising number of ways, through use of traditional and natural infrastructure, or better yet, a combination of both. Different types of landscapes offer different opportunities for replenishing groundwater aquifers. How we manage our watersheds above ground—the conditions of woodlands, forests, grasslands and deserts—can affect how rainfall enters and moves through natural systems, ultimately determining how much natural runoff, and streamflow occur.

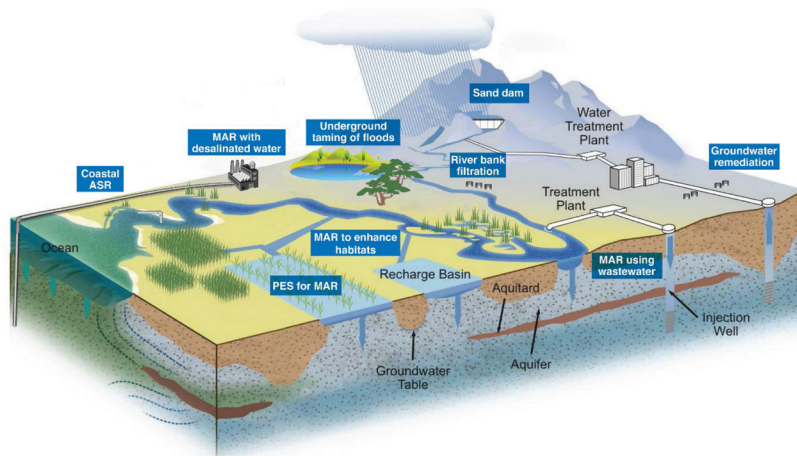
There are many forest thinning hydrologic studies, assessing the use of forest thinning as a management tool to reverse the adverse impacts of decades of fire suppression in the western United States. Research into the impacts of forest thinning on surface water, soil, and vegetation re-growth have occurred concurrently with the growing popularity of forest thinning; however, its potential impact on groundwater recharge has largely been ignored until recently and there are few studies that focus on groundwater resources. Of 35 studies reviewed, there is little consensus among them, other than a general positive trend of increased groundwater recharge in response to forest thinning, as compared to clear cut forests (Shenk et al., 2020).

While groundwater recharge for a particular aquifer, soil type, or geologic setting can vary greatly, in general, the protection and restoration of rivers, streams, wetlands and natural floodplains enables flood flows to recharge alluvial aquifers, as well as for natural sediment transport processes. In most Western landscapes, it is these features where the highest natural groundwater recharge rates typically occur (Levick et. al, 2008).

But what if natural recharge isn't enough to satisfy our water demands in the 21st century? What if even our previously reliable groundwater supplies, that serve as our critical reserves when drought creates surfacewater shortages, is also dwindling? While groundwater storage is harder to measure, understand and manage, advancements in predictive models and monitoring techniques allow water managers to make better decisions across the drought-stricken West, and as a result, innovations in water management techniques are also starting to emerge. Managed aquifer recharge (MAR) projects that enhance supply are becoming more commonly implemented, and are more cost-effective than many other supply enhancement projects, such as surface water storage and ocean desalinization (Perrone and Rohde 2016).

The following examples provide a sense of the variety of approaches that have been undertaken to advance innovation in natural storage solutions so far, from the Colorado River headwaters to the Central Valley in California, and undoubtedly many other examples exist. Some of the best solutions

come from the local level where customized solutions are developed according to context and need. What is most frequently missing to develop, advance, and take full advantage of these innovations is adequate funding, from sources and programs that encourage innovation.



This illustrates human approaches or interventions that intentionally utilize and manage groundwater and subsurface systems and processes in order to increase water storage, retention, and water quality for the overall benefit of water security, human resilience, and environmental conditions. These approaches can range from managed aquifer recharge (MAR), to floodplain restoration, and even irrigation methods that enhance recharge. Aquifer storage can be more sustainable and cost-effective than traditional gray infrastructure alone, such as dams. (Groundwater Solutions Initiative for Policy and Practice-<https://gripp.iwmi.org/natural-infrastructure/overview-on-groundwater-based-natural-infrastructure/>)

Case study: Restoration of Headwater Systems

Starting in the headwaters of the Colorado River Basin, in high elevation meadows where tributary streams cross meadows and irrigated pastures, even seemingly small structures like beaver dams can help to slow flows and increase the amount of water recharged back into the streambanks and floodplains of upper watersheds. The reintroduction of beaver and/or the replication of the types of structures they historically built can increase groundwater storage in these locations.

Within the Upper Green River Basin, the New Fork River flows out of the Wind River Range, and the installation of 35 beaver dam analogs and 125 low-profile, hand-built structures of rock or wood is underway to accelerate recovery of incised streams and riparian and wet meadow habitats by reducing water velocities, increasing sediment deposition and aggradation, enhancing floodplain connectivity,

raising groundwater tables, and increasing habitat complexity. Over the long term, the desired outcome is to restore the natural processes that self-sustain riparian and wet meadow habitats, as well as water supplies. TNC's role is to develop and implement a measurement and monitoring program, and assist with project installation. The project is a cost share between TNC, a private landowner, federal partners (U.S. Fish & Wildlife, National Fish and Wildlife Federation, and the Natural Resource Conservation Service), one State agency (Wyoming Game and Fish Department), and a local agency, the Sublette County Conservation District.

These projects have the potential to build adaptive capacity in ecosystems and ranching operations to deal with ongoing climate shifts. They improve watershed resilience, support floodplain functions, regulate stream hydrographs, provide habitat, minimize erosion and sedimentation, and support recovery from extreme events (e.g., droughts, floods, and fires) (Fairfax, 2020). In addition, while streams restored through beaver dams and beaver dam analogs will likely flow longer during drought over the long term, additional groundwater can also be stored for irrigation purposes. The implementation of various analogs to beaver-related restoration tactics have shown promise as a means by which to re-establish naturally distributed storage at the watershed scale which has been previously lost.

Case Study: Municipal Recharge of Regional Aquifers

In the arid valleys of the Lower Colorado River Basin in Arizona, where I live and work, groundwater is the only source of water for people and nature. Fort Huachuca, the U.S. Army's premier intelligence and communications testing facility, depends on the same limited groundwater resources as does the U.S. Bureau of Land Management's San Pedro Riparian National Conservation Area, located several miles from it, and ranches, rural landowners, and small towns and cities located in the same area.

Over twenty years ago, legal battles and litigation related to the limited groundwater supplies in the region started to emerge. In response, a collaborative group of 21 local, state and federal entities formed to build consensus and serve as an honest broker for developing hydrologic science that could help to inform decision-making, the Upper San Pedro Partnership (upper-san-pedro-partnership.org). This group worked closely with the U.S. Geological Survey to develop a predictive groundwater model to compare and evaluate a wide range of options and alternatives (Pool, et.al, 2007). What we learned, together, was that there was a way to optimize groundwater for the various water needs of humans and nature, including for flows in the San Pedro River itself.

The Partnership also joined forces with the U.S. Bureau of Reclamation to conduct an Appraisal Level Study of regional water management alternatives (U.S. Bureau of Reclamation, 2007) that was completed in 2007. Of the 15 alternatives assessed in the study, four were recommended for further study. This planning process also helped to inform the regional water management vision. Today, we have much more clarity about how to replenish groundwater to ensure a vibrant economy, the operability of missions at Fort Huachuca, the health of the San Pedro River, and water security for local communities. The conversations and discussions over the years weren't always easy ones, but the co-development of the information brought clarity and understanding.

The vision for regional management included replenishment of the groundwater aquifer at just the right places and amounts, using treated wastewater effluent and stormwater. We identified where too much stormwater was problematic—for example, where there was increased runoff from urbanized areas—and flipped that problem into a water source asset. We looked at the demand side of the equation as well, and either retired high volume pumping, and/or precluded it in the future, at the very specific locations where our science told us it had the worst impacts to water supplies.

Today, eight groundwater protection and recharge projects are underway in the region, by a relatively small consortium of five project implementation partners called the Cochise Conservation and Recharge Network (ccrnsanpedro.org). The Conservancy partnered with the cities of Sierra Vista and Bisbee, Cochise County, and the Hereford Natural Resource Conservation District to form the Network, under a voluntary Memorandum of Understanding “to implement regional water management projects to meet the long-term water needs of the Sierra Vista Subwatershed by preserving the baseflows of the San Pedro River and ensuring the long-term economic viability of local communities by promoting and implementing recharge and conservation efforts”. The Conservancy’s main role has been to provide facilitation, science and technical support for the group, and assistance with land acquisition. The water benefits of the groundwater projects between 2015-2019 were over 26,400 acre-feet, over half of which was a result of aquifer recharge, and the remainder from the retirement of historic pumping or areas where future pumping had been precluded (<https://ccrnsanpedro.org/about/>). Only three projects remain to be constructed. While we’re not done yet, and funding for infrastructure construction remains challenging, we also could have never come this far without the engagement and support of many players at all levels of government.

One of these three remaining projects was originally intended to be a managed aquifer recharge project, whose conceptualization came out of the 2007 BOR Appraisal Study, but has since been adapted to a natural infrastructure solution approach. Storm runoff from the largest urban area in the watershed, that currently enters a natural tributary to the San Pedro, will be diverted into an adjacent basin, to detain accelerated flood peaks in a way that slowly releases them back into the natural channel at a rate that will increase channel infiltration, and groundwater recharge. The project is anticipated to restore a more natural flood regime, reduce sedimentation, increase water quality, and result in enhanced groundwater storage.

Today the members of the Partnership are also working together on a WaterSMART Applied Science Grant, to create a state of the art web portal that will make the extensive hydrologic data sets for the region available to the public in a manner that is useful and accessible.

The U.S. Army has also been a critical partner for all of these projects. It facilitated essential land acquisition in key locations along 25 miles of river that were necessary to make the regional water vision a reality. The Army’s Compatible Use Buffer Program, which is part of the Department of Defense Readiness and Environmental Protection Integration (REPI) Program, was established to combat encroachment on military training, testing and operations. Here, the flexibility of the REPI funding program to not only accomplish its own specific programmatic objectives, but to also leverage the efforts of its conservation partners and address water security for all water users in the region, has made a big difference for our area. REPI enabled partnerships between DoD, state and local governments, and conservation NGO’s, to develop and co-fund projects to combat encroachment on

military training, testing and operations and enhance military installation resilience, while also increasing water security for the region.

The Army has been an important partner for our groundwater recharge efforts in southern Arizona, but the military is grappling with water supply challenges across the nation. In January 2019, DoD sent Congress a list of 79 bases vulnerable to one or more impacts of climate change (U.S. DoD, 2019). In 45 of those 79 installations, drought was listed as a concern or vulnerability. In FY 2021 two military installations in the West asked for REPI funding for drought-related projects – Fort Huachuca asked for \$4.37 million in REPI funding for groundwater recharge work, and Cannon Air Force Base in New Mexico requested REPI funding to address drought, erosion, soil quality/quantity, and water quality/quantity. Earlier this year, Fort Bliss and El Paso secured a \$4.5 million grant from the Texas Military Preparedness Commission to invest in aquifer storage and recharge supporting both the city's and installation's water supplies there (El Paso Herald-Post, 2021). At the Mountain Home Air Force Base in Idaho, the groundwater aquifer which supplies the base is nearly depleted, and a large pipeline project from the Snake River has been proposed with a new water treatment facility to pipe surface water and keep the base in place and operational (SPF Water Engineering, 2016).

Case Study: Agricultural Recharge of Regional Aquifers

Continuing West in our case studies, to the agricultural San Joaquin Valley of California, the overdraft of groundwater there is estimated at 1.8 million acre-feet per year. It's important to remember that the impacts of pumping an aquifer are cumulative over time. Every year that cumulative deficit increases, lowering the water table, year after year. The combination of population growth and climate change in California has resulted in reduced snowpack, increased frequency of droughts, and altered surface water availability (Diftenbaugh et al. 2015; Swain et al. 2018; Grantham et al. 2018). Groundwater supplies have never been more important there than they are now, given that groundwater withdrawals for irrigation in California increased 60% from 2010 to 2015, a period of protracted drought; surface water withdrawals for irrigation decreased 64% during the same period (Dieter et al. 2018).

In the fall of 2019, TNC began a managed aquifer recharge effort developed in partnership with the Colusa Groundwater Authority (CGA) and the California Department of Water Resources (DWR). CGA and TNC identified areas where overdraft issues were of most concern, and through an innovative partnership between farmers, water managers and conservation interests, an on-farm, multi-benefit demonstration project began recharging groundwater while also providing wetland habitat for migratory birds. Through these and other practices that create habitat on farms, TNC estimates that we've recharged 0.66 AF/acre on low end, and measured recharge up to 1.8 AF/acre, for a total estimate of 41,000-51,000 AF of recharge since 2014.

The Colusa County grower agreed to prepare and flood agricultural fields to provide temporary or "pop-up" wetland habitat for shorebirds in early fall, during the peak of migration along the Pacific Flyway. These practices created habitat appropriate for shorebirds, as well as shallow flooding, and maintained water depths of no higher than four inches throughout the four-week enrollment. These seasonal recharge projects are very inexpensive, leveraging existing land and irrigation conveyance infrastructure, while benefitting migratory birds.

Recommendations to Enhance Natural Storage Solutions

I want to thank you for Congress's attention to water resources legislation. The consolidated appropriations bill passed by Congress in December 2020 contained provisions to respond to many needs of tribal communities, western states' water supply, and the environment. The bill will promote a more balanced approach to providing 21st century western water infrastructure, water supply security, and ecological resiliency in the face of shifts in water availability and the changing climate. But much more needs to be done. I hope that as Congress debates investments in infrastructure that you will make western water supply infrastructure a priority. To increase water security in the West, we will need additional resources and funding for projects capable of leveraging natural systems to convey and store water supplies.

The Bureau of Reclamation has supported natural infrastructure solutions primarily through grants issued through the WaterSMART Program. Congress made changes to these grants last year that should make them more amenable to the types of multi-benefit natural infrastructure projects described in my testimony. Those grants can be funded and further targeted to promote water conservation and reduced consumptive use while restoring ecosystems and boosting the resilience of western communities to drought and water shortages.

The Bureau of Reclamation needs to support natural solutions outside of the WaterSMART Program as well. We recognize the need for additional water storage and support an expanded portfolio of infrastructure projects at the Bureau of Reclamation that takes full advantage of groundwater recharge benefits as well as natural storage solutions that improve watershed conditions overall. The examples described in my testimony show how these types of projects are already providing water supply benefits to local communities and nature. As the primary federal water manager for the West, the Bureau of Reclamation should look to these solutions more often and implement them where appropriate to build a resilient and multi-benefit western water infrastructure for the future.

I appreciate the committee's attention to western water issues, and I thank you again for the opportunity to testify today.

References

- Dieter, C.A., M.A. Maupin, R.R. Caldwell, M.A. Harris, T.I. Ivahnenko, J.K. Lovelace, N.L. Barber, and K.S. Linsey. 2018. *Estimated Use of Water in the United States in 2015*. U.S. Geological Survey Circular 1441. Reston, Virginia: U.S. Geological Survey. 65 p. <https://doi.org/10.3133/cir1441>.
- Diffenbaugh, N, D. Swain, and D. Touma. 2015. *Anthropogenic warming has increased drought risk in California*. Proceedings of the National Academy of Sciences of the United States of America. 112:(13), 3931-3936.
- El Paso Herald Post. 2021. *City Awarded \$4.5M military grant for water infrastructure project*. January 26, 2021.
- Fairfax, Emily, and Andrew Whittle. 2020. *Smokey the Beaver: beaver dammed riparian corridors stay green during wildfire throughout the western United States*. Ecological Society of America, Ecological Applications: 30(8). <https://doi.org/10.1002/eap.2225> (Accessed March 21, 2021).
- Grantham, T. E., Carlisle, D. M., McCabe, G. J. & Howard, J. K. 2018. *Sensitivity of streamflow to climate change in California*. Climatic Change 149:427-441.
- Konikow, L. 2013. *Groundwater depletion in the United States (1900-2008)*. U.S. Geological Survey Scientific Investigations Report 2013-5079. <https://doi.org/10.3133/sir20135079> (Accessed March 21, 2021).
- Levick, L., J. Fonseca, D. Goodrich, M. Hernandez, D. Semmens, J. Stromberg, R. Leidy, M. Scianni, D. P. Guertin, M. Tluczek, and W. Kepner. 2008. *The Ecological and Hydrological Significance of Ephemeral and Intermittent Streams in the Arid and Semi-arid American Southwest*. U.S. Environmental Protection Agency and USDA/ARS Southwest Watershed Research Center, EPA/600/R-08/134, ARS/233046.
- Matsumoto, S., Melissa Rohde, Sarah Heard. 2019. *Policy Note: Economic Tools to Achieve Groundwater Sustainability for Nature: Two Experimental Case Studies from California*. Water Economics and Policy, Vol. 5, No. 4 (2019) 1971002. <https://doi.org/10.1142/S2382624X19710024> (Accessed March 21, 2021).
- Morales, A. G., S. Ozment, and E. Gray. 2019. *Natural Infrastructure for Aquifer Recharge Financial Calculator: Method, Data, and Assumptions*. World Resources Institute: Technical note and Excel-based tool available online at: www.wri.org/publication/natural-infrastructure-financial-calculator.
- NASA, GRACE Tellus Gravity Recovery and Climate Experiment, Jet Propulsion Laboratory, California Institute of Technology News-March 2020. NASA, University of Nebraska release *Global Groundwater Maps and U.S. Drought Forecasts*. <https://grace.jpl.nasa.gov/news/110/nasa-university-of-nebraska-release-new-global-groundwater-maps-and-us-drought-forecasts/> (Accessed March 21, 2021).
- Perrone, D. and M. Rohde. 2016. *Benefits and economic costs of managed recharge in California*. University of California-Davis, San Francisco Estuary and Watershed Science: 14:(2).

Pool, D.R., and J.E. Dickinson. 2007. *Ground-water flow model of the Sierra Vista Subwatershed and Sonoran portions of the Upper San Pedro Basin, southeastern Arizona, United States, and northern Sonora, Mexico*. U.S. Geological Survey Scientific Investigations Report 2006-5228.

Pugh, B. 2021. Climate Prediction Center, National Oceanic and Atmospheric Administration. U.S. *Drought Monitor-U.S. States and Puerto Rico*. https://droughtmonitor.unl.edu/data/pdf/20210316/20210316_total_trd.pdf (Accessed March 21, 2021).

Saito, L. B. Christian, J. Diffley, H. Richter, M. Rohde, and S. Morrison. 2021. *Managing Groundwater to Ensure Ecosystem Function*. Groundwater-Issue paper: ngwa.onlinelibrary.wiley.com, published February 19, 2021.

Schenk, E. Frances O'Donnell, Abraham E. Springer, Lawrence E. Stevens. 2020. *The impacts of tree stand thinning on groundwater recharge in aridland forests*. *Ecological Engineering* 145 (2020) 105701. <https://doi.org/10.1016/j.ecoleng.2019.105701> (Accessed March 21, 2021).

SPF Water Engineering. 2016. *Water supply planning report-Mountain Home Air Force Base, Snake River surface water supply*. Prepared for the Idaho Water Resource Board, Contract 011110.

Swain, D., B. Langenbrunner, J. Neelin, and A. Hall. 2018. *Increasing precipitation volatility in twenty-first-century California*. *Nature Climate Change* 8:427-433. <https://doi.org/10.1038/s41558-018-0140-y>

U. S. Bureau of Reclamation. 2007. *Augmentation Alternatives for the Sierra Vista Sub-watershed, Arizona*, Appraisal Report, Lower Colorado Region.

U.S. Bureau of Reclamation. 2012. *Colorado River Basin Water Supply and Demand Study*.

U. S. Geological Survey. Water Science School: *Groundwater decline and depletion*. https://www.usgs.gov/special-topic/water-science-school/science/groundwater-decline-and-depletion?qt-science_center_objects=0#qt-science_center_objects (Accessed March 21, 2021).

U.S. Geological Survey. Water Science School: *Groundwater use United States*. https://www.usgs.gov/special-topic/water-science-school/science/groundwater-use-united-states?qt-science_center_objects=0#qt-science_center_objects (Accessed March 21, 2021).

U.S. Department of Defense, Office of the Under Secretary of Defense for Acquisition and Sustainment. 2019. *Report on Effects of a Changing Climate to the Department of Defense*. https://climateandsecurity.org/wp-content/uploads/2019/01/sec_335_ndaa-report_effects_of_a_changing_climate_to_dod.pdf (Accessed March 21, 2021).

Senator WYDEN. Thank you very much.

We will wrap up now with Charlie Stern, Specialist in Natural Resources at the Congressional Research Service.

STATEMENT OF CHARLES V. STERN, SPECIALIST IN NATURAL RESOURCES POLICY, CONGRESSIONAL RESEARCH SERVICE

Mr. STERN. Thank you, Chairman Wyden, Ranking Member Hyde-Smith and members of the Subcommittee. My name is Charles Stern. I'm a specialist in Natural Resources Policy at the Congressional Research Service, or CRS. Thank you for inviting CRS to testify. The Committee has asked CRS to provide general context on natural infrastructure and how these concepts fit into the Bureau of Reclamation's authorities. In serving the U.S. Congress, CRS takes no position on the issues I will discuss today.

Observers have used a variety of terms to describe both natural features and combinations of traditional hard or gray features with natural components that are used to restore or mimic natural processes. In this testimony I will use the term natural infrastructure to collectively represent these features, the others may use different terms. Natural infrastructure can provide a range of beneficial functions. In the water availability context, natural infrastructure primarily addresses water supply rather than demand. Relevant efforts may include restoring forests, reconnecting rivers to floodplains, creating spaces for bioretention and infiltration and combining one or more of these features with managed aquifer recharge. These projects may reduce flash flooding, increase stored groundwater and improve late season flows, among other things.

Some federal agencies have received explicit Congressional guidance and definitions as to what constitutes natural infrastructure. For example, in 2016 Congress enacted definitions of natural feature and nature-based feature for the civil works authorities of the U.S. Army Corps of Engineers. Congress also directed the Corps to consider these features in its project planning. Congress has also defined green infrastructure, a similar but not always synonymous term for EPA authorities under the Clean Water Act. The differences in these definitions are delineated further in my written testimony. Other agencies construct or support work on natural infrastructure under broad authorities. For example, NOAA has supported the use of natural infrastructure features to fulfill the agency's mandates, but Congress has not explicitly defined natural infrastructure in statute for NOAA activities.

The Bureau of Reclamation has constructed more than 180 federally-authorized water resource projects throughout the 17 Western Reclamation states. Over the last 50 years, Reclamation has constructed fewer new federal projects, but has expanded support for non-federally led projects, including those for water reuse and recycling, desalination and water and energy efficiency modernization, among other things. The primary opportunities to incorporate natural infrastructure features into Reclamation activities involve efforts to improve natural water storage. Most prominently, this might involve new managed aquifer recharge projects or additional efforts to restore rivers and ecosystems, headwaters and floodplains to a more natural state. In regard to groundwater recharge, generally, Reclamation does not manage significant aquifer recharge

programs or facilities. However, the Bureau has experience with aquifer recharge activities in some locations and Congress has authorized federal financial support for some geographically specific, non-federal recharge projects. Additionally, several of Reclamation's programmatic authorities can be used to provide financial support for groundwater storage. These include grants through the Bureau's WaterSMART and Title 16 programs as well as support for water storage projects under the 2016 Water Infrastructure Improvements for the Nation Act. Reclamation and water users have utilized some of these programmatic authorities for natural infrastructure more than others and I outline the statistics of this usage in my written testimony.

In regard to ecosystem restoration, Reclamation has typically aligned its ecosystem restoration activities with the authorized purposes of the Bureau's water resource projects, as well as with other relevant federal laws, such as the Endangered Species Act. Projects under these authorities may support river protection and enhancement, activities that, in some cases, may have the potential to improve water supply related ecosystem services. The 116th Congress approved several changes related to natural infrastructure in the FY 2021 Appropriations Act. Congress added definitions for natural feature and nature-based feature for Reclamation's WaterSMART grants program, notably, these were the first such statutory definitions for Reclamation. It also explicitly made these types of projects eligible for WaterSMART grant support. Congress also approved broad authority for Reclamation to assist non-federal entities with aquatic ecosystem restoration efforts in Reclamation states. Depending on funding and implementation decisions, some future non-federal projects under this authority could support natural infrastructure efforts.

In discussing the future of natural infrastructure in Reclamation's activities, Congress may weigh the extent to which natural infrastructure might merit a set-aside or other consideration in Reclamation programs, including in WaterSMART or in proposed extensions of the WIIN Act, Section 4007, Storage Authority. Congress could also consider enacting guidance directing how Reclamation should incorporate natural infrastructure in its activities as it has done for the Corps. In doing so, how or if Congress defines natural infrastructure may be an important component in framing Reclamation's approach.

This concludes my statement. I would be happy to answer any questions you may have at the appropriate time.

[The prepared statement of Mr. Stern follows:]



Statement of

Charles V. Stern

Specialist in Natural Resources Policy

Before

Committee on Energy and Natural Resources

Subcommittee on Water and Power

U.S. Senate

Hearing on

**“Water Infrastructure for the 21st Century:
The viability of incorporating Natural
Infrastructure in Bureau of Reclamation Water
Management Systems”**

March 24, 2021

Congressional Research Service

7-5700

www.crs.gov

Chairman Wyden, ranking member Hyde-Smith, and members of the subcommittee, my name is Charles Stern. I am a Specialist in Natural Resources Policy at the Congressional Research Service (CRS). Thank you for inviting CRS to testify. This CRS statement focuses on the authorities of the U.S. Bureau of Reclamation (Reclamation) and provides relevant general context on natural and nature-based infrastructure.¹

In serving Congress on a nonpartisan and objective basis, CRS takes no position on legislation and makes no recommendations. CRS remains available to assist the subcommittee in its development and consideration of water resource and other legislation.

I will start by providing context for federal efforts on natural infrastructure. I will then discuss the Bureau of Reclamation's authorities and potential opportunities for the incorporation of natural infrastructure in its activities, including questions for policy makers.

Background on Natural Infrastructure

Historically, researchers, practitioners, and decisionmakers have used a variety of terms to describe natural features and combinations of traditional hard or gray features with natural components that are used to restore or mimic natural processes. These features may be implemented to achieve certain objectives for humans and wildlife. Some of the most common terms used to describe these features include natural infrastructure, nature-based infrastructure, green infrastructure, natural features, and nature-based features, among others.² I will use the term "natural infrastructure" in this testimony, but others stakeholders may use different terms.

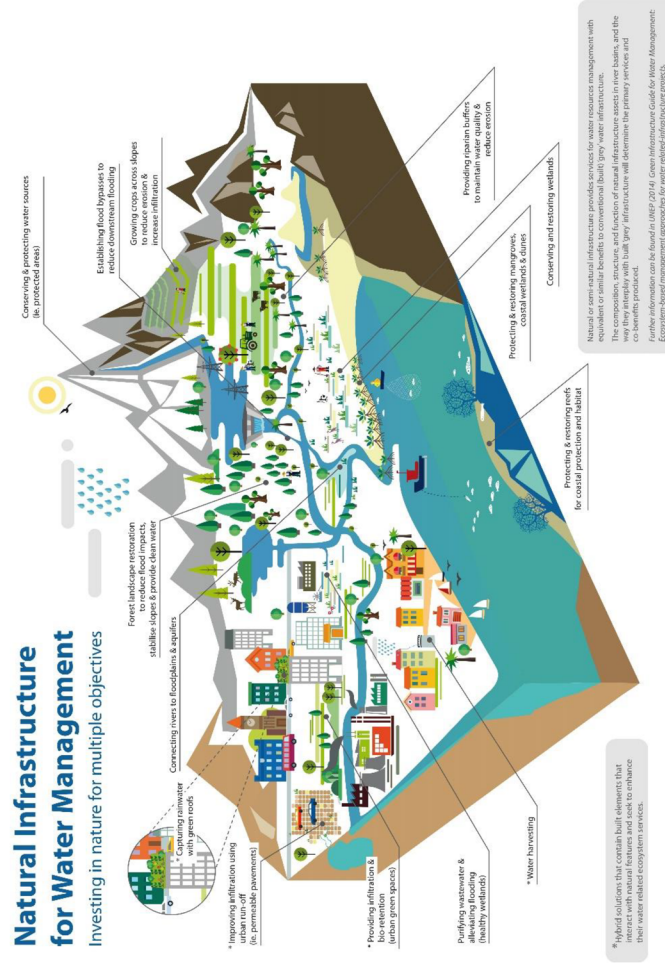
Natural infrastructure sits on a continuum from natural areas, such as forested lands, to combinations of natural "green" components and engineered or "gray" (e.g., rock, steel, and concrete) components. The benefits of using natural infrastructure include a range of functions, or ecosystem services, such as evaporation, infiltration into the ground, water storage (i.e., within soils, groundwater, and wetlands), erosion and sediment regulation, flood and drought protection, natural resource provisioning (e.g., fisheries, agricultural products, and hydropower), carbon sequestration, and aesthetic and recreation value, among others.³ Examples of various types of natural infrastructure are depicted below in **Figure 1**.

¹ Eva Lipiec, Analyst in Natural Resources Policy, assisted in preparing this written testimony, particularly the portions that focus on background information related to natural infrastructure.

² The specific features included within a term's definition vary depending on the environmental context, project goals, and supporting entity in question. Other terms include nature-based solutions and hybrid infrastructure, among others. For more information about these terms and others, see United Nations World Water Assessment Programme/UN-Water, *The United Nations World Water Development Report 2018: Nature-Based Solutions for Water*, 2018, p. 23. Hereinafter referred to as *UN NBS For Water*, 2018.

³ *UN NBS For Water*, 2018, p. 42.

Figure 1. Illustration of natural infrastructure for water management



Source: IJC/N Water Programme, "Natural Infrastructure for Water Management – Investing in nature for multiple objectives," at <https://www.ijcn.org/themes/water/resources/infographics>.

Selected Federal Agency Definitions and Applications of Natural Infrastructure

Some federal agencies have supported natural infrastructure under existing statutory authorities. For example, the National Oceanic and Atmospheric Administration (NOAA) has supported the use of natural infrastructure features to fulfill the agency's mandate to research, restore, and conserve natural resources.⁴ However, Congress has not defined natural infrastructure in statutes related to NOAA activities.⁵ Where Congress has been involved, interest in natural infrastructure has evolved over time. While interest may have been initially in the environmental and social benefits of natural infrastructure, especially as part of restoration efforts, interest in the economic benefits of these features has grown.⁶

In recent years, Congress has begun to explicitly define natural infrastructure, as well as nature-based and green infrastructure, in statute for some federal agencies. Congress has directed selected agencies to consider and use natural infrastructure in specific ways. For example, as part of the Water Infrastructure Improvements for the Nation Act of 2016 (P.L. 114-322), Congress defined a natural feature as a feature "created through the action of physical, geological, biological, and chemical processes over time,"⁷ and a nature-based feature as "a feature that is created by human design, engineering, and construction to provide risk reduction by acting in concert with natural processes."⁸ Congress enacted these definitions in the context of the water resource authorities of the U.S. Army Corps of Engineers (USACE). USACE refers to these features collectively as natural and nature-based features (NNBFs). In the same legislation, Congress directed USACE to consider NNBFs in its planning of flood risk management, hurricane and storm damage reduction, and ecosystem restoration projects.⁹ As discussed later in this testimony, Congress also provided similar definitions in amendments to the Reclamation WaterSMART program authorized in the Western Water and Indian Affairs title of P.L. 116-260.

Congress has also defined green infrastructure, a similar but not always synonymous term, in the context of the U.S. Environmental Protection Agency's (EPA's) authorities under the Clean Water Act (CWA). Under the 2019 Water Infrastructure Improvement Act (P.L. 115-436), green infrastructure is defined as "the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters."¹⁰ The act also directed EPA to promote the use of green infrastructure in CWA permitting and enforcement, planning efforts, research, technical assistance, and funding guidance.

Other agencies may have their own working definitions that were developed administratively. For example, NOAA defines natural infrastructure as "healthy ecosystems, including forests, wetlands, floodplains, dune systems, and reefs, which provide multiple benefits to communities, including storm

⁴ See National Oceanic and Atmospheric Administration, *NOAA National Habitat Policy*, NAO 216-17, June 30, 2015, Section 4, at <https://www.noaa.gov/organization/administration/nao-216-17-noaa-national-habitat-policy#References>.

⁵ For more information, see CRS Report R46145, *Nature-Based Infrastructure: NOAA's Role*, by Eva Lipiec.

⁶ For example, the National Oceanic and Atmospheric Administration (NOAA) highlights several studies regarding the economic benefits of certain coastal natural infrastructure at NOAA Office of Coastal Management, "Fast Facts: Natural Infrastructure," at <https://coast.noaa.gov/states/fast-facts/natural-infrastructure.html>.

⁷ P.L. 114-322, Section 1184; 33 U.S.C. §2289a(a)(1).

⁸ P.L. 114-322, Section 1184; 33 U.S.C. §2289a(a)(2).

⁹ For more information, see CRS Report R46328, *Flood Risk Reduction from Natural and Nature-Based Features: Army Corps of Engineers Authorities*, by Nicole T. Carter and Eva Lipiec.

¹⁰ P.L. 115-436, Section 5; 33 U.S.C. §1362(27).

protection through wave attenuation or flood storage capacity and enhanced water services and security.”¹¹ NOAA describes nature-based infrastructure as “engineered systems where natural features are combined with more hard or structural engineering approaches to create a hybrid system.”¹²

Natural Infrastructure in the Context of Water Availability

In the water availability context, natural infrastructure primarily addresses water supply, rather than demand, through managing water storage, infiltration, and conveyance.¹³ These efforts may include conserving and restoring forests, reconnecting rivers to floodplains, creating spaces for bioretention and infiltration,¹⁴ and combining one or more of these features with managed aquifer recharge.¹⁵ Some of the benefits of these actions may include reducing flash flooding, increasing groundwater storage, and improving late season runoff, among other things. There are a variety of options to support the implementation of these features, including direct financial support, technical assistance, grants, loans, tax incentives, and payments for ecosystem services, among other things.¹⁶

Multiple federal agencies provide support for natural infrastructure that improves water availability; this support is typically provided to meet various objectives and mission areas. For example, the Department of the Interior (DOI; including Reclamation), EPA, and the U.S. Department of Agriculture (USDA) all have broad authorities to provide financial assistance for aquifer recharge. At the same time, USACE, NOAA, USDA, and multiple bureaus within DOI, among others, all have authorities that support the use of natural infrastructure to restore portions of ecosystems at various scales.¹⁷

¹¹ NOAA, “NOAA Administrative Order 216-117, Section 3. Definitions” at <https://www.noaa.gov/organization/administration/nao-216-17-noaa-national-habitat-policy#section3>.

¹² NOAA, “NOAA Administrative Order 216-117, Section 3. Definitions” at <https://www.noaa.gov/organization/administration/nao-216-17-noaa-national-habitat-policy#section3>.

¹³ *UN NBS For Water*, 2018, p. 38.

¹⁴ For example, bioretention structures are “typically pits filled backfilled with soil, mulch, and vegetation used to retain runoff for infiltration through the filter bed components, with reliance on biological and biochemical reactions within the soil matrix and around the root zones of the plants” (*UN NBS For Water*, 2018, p. 56).

¹⁵ *UN NBS For Water*, 2018, pp. 32 and 76. Managed aquifer recharge generally refers to purposeful recharge of water to aquifers for subsequent recovery or for environmental benefit. It may involve purposefully injecting water into an aquifer through an aquifer storage and recovery well, or allowing water to recharge from a space dedicated to bioretention or infiltration (e.g., a spreading basin). For more information on groundwater supply, see CRS Report R45259, *The Federal Role in Groundwater Supply*, by Peter Folger et al.

¹⁶ For examples of financial support mechanisms, see Browder, et al., *Integrating Green and Gray: Creating Next Generation Infrastructure*, 2019, World Bank and World Resources Institute, at <https://openknowledge.worldbank.org/handle/10986/31430>, and Colgan, C.S., M.W. Beck, and S. Narayan, *Financing Natural Infrastructure for Coastal Flood Damage Reduction*, 2017, at https://www.middlebury.edu/institute/sites/www.middlebury.edu.institute/files/2018-07/6.13.17.LL.YODS.Financing%20Natural%20Infrastructure%201JUN_2017_Lo%20Res.pdf.

¹⁷ For example, §306 of the Water Resources Development Act of 1990 (P.L. 101-640; 33 U.S.C. §2316) directed the Secretary of the Army to include environmental protection (now commonly referred to as ecosystem restoration or environmental restoration) as one of the primary missions of USACE in planning, designing, constructing, operating, and maintaining water resources projects. Since that authority, Congress has authorized and funded USACE to study and construct projects under project specific authorities and under programmatic authorities, such as Section 206, 1135, and Section 204 Continuing Authorities Programs.

Incorporating Natural Infrastructure into Bureau of Reclamation Authorities

Background¹⁸

Congress created the Reclamation Service (the precursor to the Bureau of Reclamation) in 1902. Since that time, Reclamation has constructed more than 180 congressionally authorized projects throughout the 17 arid and semiarid Reclamation states.¹⁹ Most of these “reclamation projects” consist of some combination of dams, surface storage reservoirs, and water conveyance infrastructure. Many of these projects continue to be operated by Reclamation to provide water supplies for agricultural irrigation and municipal and industrial uses, to generate hydropower, and to benefit the environment, among other purposes.

Over the last 50 years, Reclamation has shifted its focus, first from project construction to operations and maintenance of existing projects. Then, in the early 1990’s Congress began directing Reclamation to expand its support for nonfederally led projects, including those for water reuse and recycling, water and energy efficiency modernization efforts, and desalination. Congress added further to these efforts in 2009 under P.L. 111-11. As a result, Reclamation’s current activities can be broadly characterized as a split between (1) operation and oversight of “traditional” reclamation projects (i.e., federally-owned water supply projects that provide low-cost water to agricultural and municipal contractors) and (2) financial and technical support for nonfederal efforts to conserve or create water supplies in the West, including grants for water efficiency and authorized projects for water recycling, desalination, and rural water supply, among other efforts.²⁰ While the first category continues to account for the majority of congressionally appropriated funding for Reclamation, the latter category has grown in recent years.²¹

Current Authorities: Support for Groundwater Storage and Restoration Projects

Based on Reclamation’s mission and activities, the primary opportunities for Reclamation to incorporate natural infrastructure solutions into its activities may involve efforts to improve natural water storage, in particular storage available in groundwater aquifers. These efforts can involve managed aquifer recharge as well as restoration of riverine ecosystems and floodplains to a more natural state that allow for surface waters to replenish groundwater supplies.

Groundwater Storage

Historically, Reclamation has not managed or administered significant aquifer recharge programs or facilities, but has had experience with aquifer recharge activities in some locations. In the Lower Colorado River Basin, the bureau is authorized to enter into agreements to store Colorado River water off-stream (including in groundwater storage) for future use. Some projects, such as the Central Arizona

¹⁸ For more information on Reclamation, see CRS Report R46303, *Bureau of Reclamation: History, Authorities, and Issues for Congress*, by Charles V. Stern and Anna E. Normand.

¹⁹ 43 U.S.C. §391. The 17 states are Arizona, California, Colorado, Idaho, Kansas, Montana, Nebraska, Nevada, New Mexico, North Dakota, Oklahoma, Oregon, South Dakota, Texas, Utah, Washington, and Wyoming. Congress also added the territories to Reclamation’s authorized service area.

²⁰ For more information on Reclamation’s rural water projects, see CRS Report R46308, *Bureau of Reclamation Rural Water Projects*, by Anna E. Normand.

²¹ In FY2021 enacted appropriations, Reclamation’s WaterSMART and Rural Water Programs received appropriations of \$276 million of Reclamation’s \$1.61 billion appropriation (approximately 17 percent). For more information, see CRS In Focus IF11465, *Bureau of Reclamation: FY2021 Appropriations*, by Charles V. Stern.

Project (which conveys Colorado River waters), convey water that is used in extensive groundwater banking operations that store excess or recycled supplies. Part of another Reclamation project—the Friant Division of Reclamation’s Central Valley Project in California—was designed and is operated as a conjunctive use project, with groundwater and surface water facilities managed jointly.

Congress has also authorized financial support for several specific groundwater storage projects as part of a broader legal settlement and restoration effort. As part of the San Joaquin River Restoration Settlement Act authorized in P.L. 111-11, Congress approved financial assistance to local agencies within the Central Valley Project for the purposes of designing and constructing groundwater recharge/banking facilities that offset water supply impacts to water contractors. The act provided a total of \$50 million of cost-shared funding to assist agencies in constructing these groundwater recharge facilities. To date, two of the four facilities have been completed.²²

Congress has also approved broader programmatic authorities that Reclamation may use to support groundwater storage projects, among other things. These include:

- Title IX, Subtitle F (Secure Water), Section 9504 of the Omnibus Public Land Management Act of 2009 (P.L. 111-11) authorizes Reclamation to provide financial assistance (i.e., grants) through the WaterSMART program for groundwater projects.²³
- Reclamation’s Title XVI program (Title XVI of the Reclamation Projects Authorization and Adjustment Act of 1992, P.L. 102-575, as amended) provides Reclamation with the authority to implement water recycling and reuse projects, which may include projects that recycle and reuse impaired groundwater.
- Title III, Section 4007(c) of the Water Infrastructure Improvements for the Nation Act (WIIN Act; P.L. 114-322) authorizes Reclamation to participate in state-led water storage projects, which are defined to include groundwater storage facilities, among other facility types.

Reclamation and local water users have utilized some of these programmatic authorities for natural infrastructure more than others. For example, from 2012-2019, the WaterSMART Water and Energy Efficiency Grant program authorized in P.L. 111-11 funded at least 19 nonfederal projects with groundwater storage or recharge components. Eleven of these projects were in California, with other projects in Idaho, Colorado, Washington, Oregon, and Arizona. Similarly, Reclamation recently reported that since 2017, it has funded 15 Title XVI projects with major groundwater storage or aquifer replenishment aims.²⁴

Among WIIN Act Section 4007 storage projects, as of early 2021 Reclamation had allocated funding for 12 water storage projects costing \$306 million, but only one of these projects (the Sacramento Regional Water Bank) is for groundwater storage. The project has received less than \$1 million to date.²⁵

²² For more information, see San Joaquin River Settlement Program, “Groundwater Banking Projects,” at <https://www.restoresjr.net/projects/water-management-goal/groundwater-banking-projects/>.

²³ For more information on the WaterSMART program, see U.S. Bureau of Reclamation, “WaterSMART (Sustain and Manage America’s Resources for Tomorrow),” at <https://www.usbr.gov/watersmart/>.

²⁴ CRS Correspondence with Bureau of Reclamation, March 19, 2021. For example, Reclamation approved and provided funding for the Aquifer Storage and Recovery Using Reclaimed Water Project in El Paso, Texas. This project will treat impaired surface water for groundwater infiltration at the Hueco Bolson Aquifer. More project descriptions are available at <https://www.usbr.gov/watersmart/title/index.html>.

²⁵ For more information, see Regional Water Authority, “Sacramento Regional Water Bank,” at <https://rwah2o.org/sacramento-regional-water-bank/>.

Ecosystem Restoration

In regard to ecosystem restoration, in the past, Reclamation has typically aligned its ecosystem restoration and fish and wildlife “enhancement” activities with project purposes, as well as with other relevant laws such as the Endangered Species Act.²⁶ Congress has included or added fish and wildlife benefits to the authorized purposes for some Reclamation projects.²⁷ In other cases, Congress has authorized standalone Reclamation restoration programs and activities,²⁸ or has authorized Reclamation to conduct efforts to respond to endangered species concerns.²⁹ Projects undertaken with these authorities often support activities, such as river and stream-bank protection and enhancement, which may benefit natural watershed services and functions.

Recent Changes

The 116th Congress considered and enacted several changes related to natural infrastructure in the Western Water and Indian Affairs title of P.L. 116-260 (Title XI of Division FF) in December 2020.³⁰ In Section 1105 of the title, Congress directed that reclamation project infrastructure could be used to convey non-project water for the purposes of aquifer recharge (subject to the applicable rates and requirements), and that reclamation project water contractors could use and/or contract for recharge activities involving project water. While recharge activities were reportedly occurring to some extent in prior years, this was the first formal, reclamation-wide guidance from Congress on this subject.

In Section 1106 of the title, Congress added specific definitions for “natural feature” and “nature-based feature” in the context of WaterSMART grants and research agreements as authorized in P.L. 111-11,³¹ and formally recognized these as eligible project types for grants. The same section also provided for additional federal cost-share coverage (i.e., raising the cost-share ceiling from 50 percent to 75 percent) for certain projects developed by watershed groups or multiple users; this could apply to projects with natural and nature-based features that meet this criteria.³²

Section 1109 of the title authorized \$15 million for Reclamation to provide assistance to states, state-based entities, tribes, and non-profits, among others, for the design, study, and construction of aquatic ecosystem restoration and protection projects for the benefit of fish and wildlife. These projects, which have yet to be funded, may in some cases provide Reclamation the opportunity to support additional ecosystem services.

²⁶ 16 U.S.C. §§1531-1544. For more information on the Endangered Species Act, see CRS Report R46677, *The Endangered Species Act: Overview and Implementation*, by Pervaze A. Sheikh, Erin H. Ward, and R. Eliot Crafton.

²⁷ For instance, in P.L. 102-575 Congress added fish and wildlife as an authorized purpose of Reclamation’s largest project, the California Central Valley Project.

²⁸ For example, the Glen Canyon Dam Adaptive Management Program was established in 1997 in response to a directive from Congress under the Grand Canyon Protection Act of 1992 (P.L. 102-575) to operate Glen Canyon Dam “in such a manner as to protect, mitigate adverse impacts to, and improve the values for which Grand Canyon National Park and Glen Canyon National Recreation Area were established.”

²⁹ DOI and its implementing partners established the Upper Colorado Endangered Fish Recovery Program in 1988 to assist in the recovery of four species of endangered fish in the Upper Colorado River Basin. Congress formally authorized Reclamation to carry out this program in 2000 under P.L. 106-392.

³⁰ Title XI of Division FF of P.L. 116-260.

³¹ Similar to the USACE definitions in Water Infrastructure Improvements for the Nation Act of 2016, “natural feature” was defined as “a feature that is created through the action of physical, geological, biological, and chemical processes over time,” while “nature-based feature” was defined as “a feature that is created by human design, engineering, and construction to provide a means to reduce water supply and demand imbalances or drought or flood risk by acting in concert with natural processes.”

³² Funding for WaterSMART grants from FY2017-FY2021 averaged \$40 million.

Potential Issues for the 117th Congress

In the 117th Congress, some stakeholders may propose further prioritizing natural infrastructure in Reclamation activities; some of this attention may be enhanced by regional drought concerns and flood events. Other stakeholders may raise concerns that efforts to have increased Reclamation participation in natural infrastructure activities may hamper or compete with the agency's efforts to operate and maintain existing, aging infrastructure.

Congress may debate the extent to which "natural water storage projects" might merit a set-aside or other priority in certain Reclamation programs, such as for WaterSMART grants or in any proposed extensions of the WIIN Act's Section 4007 storage authority (which expires in December 2021). Congress could also consider agency-specific guidance for how Reclamation should incorporate natural infrastructure into other projects and programs, as it has done for USACE. Some support congressional approval of new Reclamation financing authorities that could leverage funding for natural infrastructure projects, among other things. Most prominently, this includes the "Reclamation Water Infrastructure Financing and Innovation Act (RIFIA)," a proposed loan authority which would operate similarly to existing water financing authorities of EPA and USACE.³³

When considering whether and how to make available additional authorities and funding to Reclamation for natural water infrastructure, Congress may wish to consider several questions:

- What is known and what research is underway to understand the efficiency and efficacy of natural infrastructure for enhancing water availability?
- How do natural infrastructure options compare to other alternatives in terms of life-cycle costs, reliability, and environmental and social impacts?
- What are the primary impediments to incorporating more natural infrastructure into Reclamation's water management activities?
- What is the demand for the natural water storage projects, and how would increased federal funding support for these projects be likely to affect this demand?
- Which states stand to benefit the most from support for natural infrastructure by Reclamation? How accommodating are various state water rights systems to natural infrastructure?
- What is the preferred federal role in supporting natural infrastructure? Is Reclamation the agency best suited to support these projects? What other federal agencies (if any) support the type of nature-based projects that Reclamation is most likely to target?

This concludes my prepared remarks. Thank you for the opportunity to testify, and I look forward to answering any questions you may have. If additional research and analysis related to this issue would be helpful, my colleagues and I at CRS stand ready to assist the subcommittee.

³³ Congress authorized WIFIA to support a range of water infrastructure projects, including projects for aquifer recharge, development of alternative water supplies to reduce aquifer depletion, as well as environmental restoration. However, these authorities are nationwide in scope, whereas proposals for a Reclamation-centered program have largely been limited to western states. For more information on these authorities, see CRS Report R43315, *Water Infrastructure Financing: The Water Infrastructure Finance and Innovation Act (WIFIA) Program*, by Jonathan L. Ramseur, Mary Tiemann, and Elena H. Humphreys and CRS Insight IN11577, *U.S. Army Corps of Engineers Civil Works Infrastructure Financing Program (CWIFP): Status and Issues*, by Anna E. Normand and Elena H. Humphreys.

Appendix.

Statutory Definitions of Selected Natural Infrastructure-Related Terms

Citation	Term	Agency	Definition in Statute
Water Infrastructure Improvements for the Nation Act, P.L. 114-322, §1184; 33 U.S.C. §2289a(a)(1)	Natural feature	USACE	“The term ‘natural feature’ means a feature that is created through the action of physical, geological, biological, and chemical processes over time.”
Water Infrastructure Improvements for the Nation Act of 2016, P.L. 114-322, §1184; 33 U.S.C. §2289a(a)(2)	Nature-based feature	USACE	“The term ‘nature-based feature’ means a feature that is created by human design, engineering, and construction to provide risk reduction by acting in concert with natural processes.”
Water Infrastructure Improvement Act, P.L. 115-436, §5; 33 U.S.C. §1362(27)	Green infrastructure	EPA	“The term ‘green infrastructure’ means the range of measures that use plant or soil systems, permeable pavement or other permeable surfaces or substrates, stormwater harvest and reuse, or landscaping to store, infiltrate, or evapotranspire stormwater and reduce flows to sewer systems or to surface waters.”
Consolidated Appropriations Act, 2021, P.L. 116-260, Division FF, Title XI, §1106; not yet included in the U.S. Code	Natural feature	BOR	“The term ‘natural feature’ means a feature that is created through the action of physical, geological, biological, and chemical processes over time.”
Consolidated Appropriations Act, 2021, P.L. 116-260, Division FF, Title XI, §1106; not yet included in the U.S. Code	Nature-based feature	BOR	“The term ‘nature-based feature’ means a feature that is created by human design, engineering, and construction to provide a means to reduce water supply and demand imbalances or drought or flood risk by acting in concert with natural processes.”

Source: CRS from Congress.gov and Office of the Law Revision Counsel, United States Code.

Notes: USACE=U.S. Army Corps of Engineers; EPA=Environmental Protection Agency; BOR=Bureau of Reclamation

Senator WYDEN. Thank you very much, Mr. Stern.

Let me start with you, Dr. Cochran. There you are. So I mentioned Tillamook, Oregon, a beautiful community, and I am having virtual town meetings and getting out on the Oregon coast here starting in a day or two. For my colleagues, Tillamook is dairy country. You probably have some Tillamook products in your refrigerator, cheeses and things like that. And in the community, the farmers and the stakeholders, as I indicated, produced the win-win. They dealt with supply issues. They restored habitat, not because it was something that government mandated or this kind of thing, they said this is the best option for us, a natural option for us.

So my question to you, to begin, Dr. Cochran, why wouldn't it make sense, apropos of the toolkit for dealing with water, to create options—and I underline that, options, no mandates—to do more of what Tillamook showed is a win-win? What are your thoughts on that?

Dr. COCHRAN. Yeah, thank you for the question, Senator, and I really do hope we are able to get to the point where we can share that virtual ice cream or real, in person, ice cream at some point from Tillamook. The folks, the stuff they're doing there is great.

You know, I think, to the question of how we think about options, that is the point really, that it's the choice between gray or natural infrastructure is a bit of a false choice. It's never an either/or. Another example is from Central Oregon which is also a Reclamation project, where you have irrigation districts that are investing in piping canals that right now are leaking a lot of water and also taking the opportunity to lay in hydropower in those pipes, as well as lay down rural broadband so that folks have access to broadband internet for their kids to go to school and all that good stuff. Right alongside that, the land trust and the irrigation district are working on floodplain restoration that's adding more water back into the stream and improving habitat.

So when communities are getting together, where farms and towns and environmental groups and tribes and others are cooperating, you're seeing these really innovative solutions come together and what we find is it's more of an issue of hey, you all are the government. We don't care so much whether you're Reclamation or Forest Service or whichever agency, we're looking for support in the entire suite of solutions that we've just come to. So that solution in Central Oregon is going to be a little bit different than the one in Tillamook, a little bit different than the one in New Mexico, a little bit different than the one in Idaho. That's cool. Let's just figure out how to provide options and flexibility so communities can track their—

Senator WYDEN. Dr. Cochran, you said it better than I could because I think this really is a false choice. Washington, DC, does lots of false choices, always looking for pitting somebody against somebody else. So that isn't going to happen as long as I am Chair of the Subcommittee, and I am going to be working with Senator Hyde-Smith and Senator Kelly, Dr. Marshall and everybody to create more options. I think you said it very well, Dr. Cochran.

One question for you if I might, Mr. Stern, and then we will go to my colleague from Mississippi, and Senator Kelly will chair.

Mr. Stern, I gather that the Bureau of Rec has some authorities to use natural infrastructure to support groundwater storage and restoration work. Why don't you, because we don't get you into politics and all that kind of stuff, what are the limits in terms of what you can do and you have heard me say that I just want there to be more options, but I think it would be helpful to get a sense of what you think the limits are because you said Bureau of Reclamation has some authorities to use natural infrastructure which makes me think that something is being limited. Go ahead.

Mr. STERN. Thank you for the question, Senator.

Yeah, as I had mentioned in my written testimony, Reclamation has some authorities to use natural infrastructure, some of which were recently added. There are some who support additional authorities for Reclamation in regards to natural infrastructure and one potential option in that world would be actually doing some sort of a set-aside or additional prioritization for natural infrastructure. Another option might be just adding natural infrastructure as a more explicit authorized purpose, for example, under Section 4007 of the WIIN Act where groundwater storage projects are authorized, but other sorts of natural storage projects are not currently authorized.

Senator WYDEN. I am over my time, but the second one you described sounds to me like, again, something that might just be seen as, hey, look this is one of the options. We are not saying go do this or go do that, but this is one of the options. Is that what you are trying to convey in something resembling understandable language?

Mr. STERN. That would certainly be an option, yes.

Senator WYDEN. Great, okay.

We are going to go to my colleague from Mississippi and I very much appreciate our new member, Senator Kelly, taking over. Thanks to our friend from Oregon, Dr. Cochran. I look forward to working with all my colleagues on these issues. I don't think anybody has mentioned one party or another here. We have a lot of interesting work to do, and I look forward to pursuing it with my colleagues.

We will now go to Senator Hyde-Smith and Senator Kelly will run the hearing.

Senator HYDE-SMITH. Thank you, Mr. Chairman. I also look forward to working with you. We all have to have water. As they say, water is life.

Mr. Larson—

Mr. LARSON. Yes.

Senator HYDE-SMITH. —when it comes to funding the Bureau of Reclamation infrastructure projects, in your opinion, what projects do you believe should be given the highest priority?

Mr. LARSON. Thank you very much, Senator, for the question.

We would certainly advocate that projects that are given the highest priority are the ones currently underway that are already on the Federal Government's plate as opposed to adding new projects where you're adding an additional financial need for the Bureau of Reclamation. So we would strongly advocate making sure that projects already on the Federal Government's plate are prioritized, and we appreciate that the Chairman indicated this

will not be a mandate. What we have seen in the history of Reclamation funding is when it comes time for budget cuts, rural water projects get cut the most. We are at the bottom rung when it comes to the priorities of Bureau of Reclamation. That's not to say they're not supported. It's just when it comes to funding, we're at the bottom. And the concern is adding more projects, regardless of what they're called, will put us further down the list.

And so yes, our concern is getting pushed further back. So we would certainly advocate making sure that projects already underway are completed first.

Senator HYDE-SMITH. And if the drinking water projects, like Lewis & Clark's, are not completed in a timely manner, what are the potential economic ripple effects of those delays?

Mr. LARSON. Thank you, Senator, for that question as well.

There's a double whammy to the taxpayers. The longer it takes to complete projects like Lewis & Clark, which still has a federal commitment of roughly \$160 million, the more expensive it becomes due to inflation indexing. Every year the remaining federal cost share is indexed for inflation. So that's one impact to the taxpayers.

The second impact to the taxpayers is the longer it takes for our cities and rural water systems to realize the economic benefits of being connected to Lewis & Clark and having the water. So the taxpayers are hurt on one side by having increasing costs due to inflation and number two, not having economic development opportunities as a result of the delay in getting water to them.

Senator HYDE-SMITH. Now, that has always been one of my frustrations.

And also, in your testimony you mentioned that there are five projects funded by the Reclamation Rural Water Program.

Mr. LARSON. Correct.

Senator HYDE-SMITH. And that the states and municipalities have fulfilled their financial obligations to these projects. What steps have the states and local members had to take in response to the slow pace of federal funding?

Mr. LARSON. Another really good question.

Two things have had to happen because of the delays. Number one is the 20 cities in the rural water systems have had to spend an additional \$17 million to make temporary fixes to address their water needs. So this is money on top of the \$154 million that was paid by the states and the members. So they've had to spend more money than they expected because of the delays. And number two, because of the delays, we've turned to the three states for what we call, federal funding advances, which get this, zero interest, unsecured loans that will be paid back at an unknown point in time with future federal funding. Try going to a bank and get those terms. And the reason the states have agreed to do that, to the tune of \$55 million. The three states have put in an additional \$55 million of these federal funding advances because they know how critically important Lewis & Clark is to the tri-state region in terms of quality of life and economic development.

So because of the slow pace of federal funding, this is \$55 million of additional money that the three states put up, again, as federal funding advances, at zero interest, unsecured loans that will be

paid back at an unknown point in time with future federal funds. So it's really important we get these projects completed as soon as possible.

Senator HYDE-SMITH. Yes.

Thank you so much. I yield back my 20 seconds. I do not have enough time for another question at this moment.

Mr. LARSON. Thank you, Senator.

Senator KELLY [presiding]. Thank you, Senator Hyde-Smith.

So Dr. Richter, in Arizona, Phoenix and Tucson receive water from the Central Arizona Project and the Salt River Project. Both are federal Reclamation, hard infrastructure projects. Cochise County needs water to grow too, but pumping groundwater from the San Pedro Aquifer is unquestionably affecting the river and, as a result, Fort Huachuca as well. So in your testimony you described projects in Cochise County that capture stormwater runoff that can be used to recharge groundwater supplies. Now, if you had more help from the Bureau of Reclamation, how quickly could natural infrastructure projects be completed in Cochise County compared to some of the hard infrastructure projects that have been suggested?

Dr. RICHTER. Thanks for that question.

The three remaining groundwater recharge projects that we are proposing blend, as I mentioned, traditional infrastructure with natural infrastructure, but they're local in nature and it's reasonable that any one of them could be implemented in a two-to-five-year timeframe. Other alternatives that augment supplies from much farther away, like the importation of water from the Colorado River that have been proposed by others in the past, would take much, much longer to implement.

Senator KELLY. Yes, I imagine getting Colorado River water all the way into Cochise County would be a huge undertaking.

Second question for you, Dr. Richter. What has been the role of the Department of Army in your work and should the Bureau of Reclamation prioritize projects that promote military readiness?

Dr. RICHTER. Yes, Fort Huachuca has been a leader in both water conservation and reuse as well as an incredible partner to the region. In the 15 years between 1995 and 2010, Fort Huachuca reduced their groundwater pumping by 60 percent through water conservation and reuse projects. But they also worked with the 20 stakeholders of the Upper San Pedro Partnership on collaborative efforts to conserve regional water supplies and the partners have collectively reduced the regional overdraft of the aquifer from 13,500 acre-feet that was projected back in 2010 to only 4,600 acre-feet. That's a dramatic improvement.

Senator KELLY. So the use from the aquifer now is 4,600 acre-feet?

Dr. RICHTER. That was our last estimate back in 2010 and, unfortunately, funding has not been available in recent years to calculate that annual regional groundwater budget, as additional projects have come online since then.

Senator KELLY. Well, we have seen, you know, across Arizona communities like Fort Huachuca that have reduced their water consumption, 60 percent is significant.

Dr. Richter, I want to switch to another part of our state, Northern Arizona. Northern Arizona does not, well, Arizona does not depend on the Colorado River alone for its water supply, as you stated earlier. The Verde and Salt Rivers also transport snowmelt, rainwater and groundwater from our national forests into hard infrastructure reservoirs. Over the past two decades more than 2.9 million acres of forests in the Verde and Salt Watersheds have been ravaged by wildfires and our watersheds still have not fully recovered. Elevated levels of sediment from our forest are draining into Horseshoe Dam and Roosevelt Dam which has reduced their storage capacity. Should the definition of natural infrastructure apply to our national forests at the Bureau of Reclamation?

Dr. RICHTER. Yes, and again, it's that combination of both traditional infrastructure and natural infrastructure that's really needed to address water security in Western watersheds like the Verde and the Salt. The health of not only our national forests but the entire watershed will dictate how much water moves through the system and how much is generated for human uses downstream. Yet, in addition to storage of adequate water supplies for large metropolitan areas with substantial water demands like Phoenix, will also require continued hard infrastructure approaches for storage.

So in the long run the two are very intertwined and if we drop the ball and manage our natural infrastructure poorly, we'll have negative consequences to our traditional infrastructure investments, like surface water reservoirs.

Senator KELLY. Well, thank you, Dr. Richter.

Now from the great State of Colorado, we have Senator Hickenlooper.

Senator HICKENLOOPER. Sorry about that, I was just shutting my door to be able to turn my mute off.

Thank you for your public service. I appreciate all that you do.

As snowfall decreases and snowmelt occurs earlier in the season, we need to find ways to retain water at higher elevations throughout the West to make sure that we get runoff for the summer season, the growing season, when we need it most. Arguably, the best way to do this is not with large dams, but with many small ponds, catchments. Currently, there's a tangled web of regulations and studies that need to be navigated to build wildlife water catchment structures on BLM or Forest Service land. The cost of equipment necessary to build these small catchments would be low. The risk resulting from a breach would also be low and many small and very small ponds and catchments would ensure that streams and rivers could deliver water for agriculture, for fisheries, for recreation, throughout the season.

How can we prioritize projects improving water holding on our public lands and how can we ensure that the research involves grazing and recreational lease holders, both, some of who have been on these lands for generations?

Senator KELLY. I believe that question was for Dr. Richter?

Senator HICKENLOOPER. Yes, I'm sorry.

Senator KELLY. And I think you are muted, Dr. Richter.

Dr. RICHTER. There we go. That should be better.

Senator KELLY. All right.

Dr. RICHTER. Yeah, again, natural storage solutions can really enhance, not only those high elevation areas like the headwaters up in the Rockies that have impacts downstream throughout the watersheds of the Colorado River Basin, but also for those producers that work up in those communities that require adequate groundwater for the irrigation of pastures and the production of forage, in addition to quality habitat. So the diversity of locations from those very high headwaters in the Rockies all the way down through the lower Colorado River Basin, to the delta, there's such an array of different settings where we can distribute natural storage and make it available for local communities and water users in the agricultural sector, in the industrial sector and municipalities, but that disperse nature of storage is very important to have access at all those different settings, including the wonderful headwaters of the Colorado.

Senator HICKENLOOPER. Yes, we always like to call Colorado the Headwater State because, aside from one very small corner of the state, all the rivers in Colorado start in Colorado and fall out of Colorado.

Let me go a little bit on the rising temperature issue. I think it is a real and meaningful threat to cold water fisheries and a lot of the recreation economies that depend on those fisheries. In the drought year of 2018 which was historic, a group of Western Colorado users, including the Roaring Fork River, the Colorado River District, the Exxon Mobil Corporation, the City of Aspen, they all came together to save the Gold Medal Fishery on the Roaring Fork River. They coordinated a release of about 15,000 acre-feet of reservoir water to boost flows and therefore reduce temperatures. It is a great success story on reflecting on unusual collaboration.

How else can we look at addressing some of the issues of temperature and their importance in terms of recreational uses?

Again, and I would ask that same question of you.

Senator KELLY. And you are muted.

Dr. RICHTER. There we go.

The mitigation of temperature as well as water supplies will be incredibly important for recreation as well as all of our other industries. And obviously, temperatures can be moderated by vegetation management and that's a really important aspect of making recreation enjoyable throughout our river systems, but it also affects water temperature and the habitats and availability of water for different uses. So, there's a lot of complexity to a changing climate and I appreciate your acknowledgement of temperature being a very important aspect that we need to work with, in addition to water availability and those two things do go hand in hand in many, many different situations.

Senator HICKENLOOPER. Got it. Well, thank you very much. Thank you, all of you, for your time on this. I yield my time—I have no time, so I yield back.

Senator KELLY. Senator Hyde-Smith, do you have an additional question?

Senator HYDE-SMITH. I do. Thank you very much.

One of the things—and this is for all the members of the panel today—in my State of Mississippi, we have just recently seen too many rural communities and families suffer as a result of flooding

from major storms and hurricanes that we have been having, a tremendous amount of storms. In my experience with working to find solutions that can withstand damage caused by natural disasters, natural infrastructures alone simply cannot replace physical infrastructure and adequately protect communities from these catastrophic events such as the 100-year Mississippi River flood events or powerful storm surges that accompany major hurricanes.

Given that natural disasters from wildfires, extreme heat and drought, and landslides continue to devastate our Western states, do you believe funding should be prioritized for natural infrastructure to replace built infrastructure as a priority solution that can withstand the destruction that is caused by these natural disasters?

We will start with Dr. Cochran on that.

Dr. COCHRAN. Thank you for the question, Senator Hyde-Smith.

You know, for me, it's less of a question of, kind of, natural infrastructure or built infrastructure prioritization, it's just the fact that it was 1950 when most of the Reclamation projects were built and 1970 when a lot of the clean water infrastructure was built and we're just way overdue for a major water investment, writ large, across the board. And as we're thinking about how we build our cities, how we manage farms, thinking about that role that nature plays right alongside things like seawalls and conveyance pipes and wastewater treatment plants, all of that is part of a system and a matrix that communities haven't really had the freedom to choose which types of solutions they've wanted relative to water infrastructure for a long time.

So a big part of what's needed is really prioritizing the outcomes that Congress and communities want which is, for us, improved economic inclusion, improved human health and improved environmental resilience.

Senator HYDE-SMITH. And Tony Larson.

Mr. LARSON. All right. What we have seen with the Bureau of Reclamation is what I would consider unintended consequences. And so, it may be the stated goal that prioritizing or, excuse me, natural infrastructure should not be prioritized. Inevitably, if this is becoming, if this becomes part of Reclamation's mission, it very well likely could adversely impact the projects you're talking about, Senator, projects that are brick and mortar, gray construction. And so, again, our concern is to make sure that if this goes forward, that it's very clear to the Bureau of Reclamation and everyone else that natural infrastructure projects are in no way prioritized above other projects that are very important as well.

And you stated, Senator, very well, why those brick and mortar, gray projects are very important to Mississippi and other states. So we just would be very cautionary about adding a mission to Reclamation's plate and think that it's not going to impact how they prioritize the limited funding that they're given.

Thank you, Senator.

Senator HYDE-SMITH. And Mr. Stern.

Mr. STERN. Thank you for the question, Senator.

You know, CRS doesn't make any sort of recommendations on an issue such as this, but it's a complex question and I think we'd be glad to get back to you, for the record, with any sort of additional

analysis that you would find helpful in this question of prioritization of natural infrastructure projects over built infrastructure.

Senator HYDE-SMITH. Thank you.

I think my time is up again, unless you will let me continue.

Senator KELLY. You can continue.

Senator HYDE-SMITH. I just have one more and I guess we can direct this to Tony Larson.

Do you agree that the public, including state and local municipalities, deserve to understand the cost benefits and scientific rationale behind federal disaster mitigation strategies that we have some transparency there of how we came about this?

Mr. LARSON. Well, absolutely, Senator. The more transparency, the better, and in terms of cost benefit analysis, that's really the gist of what we're talking about. We're in no way saying natural infrastructure is not a good thing. It's just that you have to look at the costs that's added, that gets added to projects, impact to timelines and construction and make an informed decision. So yes, the more transparency, the better to ensure that the best decisions possible are being made.

So thank you for the question, Senator.

Senator HYDE-SMITH. Yes, I have had that discussion with many agencies that they would like that.

Thank you.

Senator KELLY. Thank you, Senator Hyde-Smith.

I believe there are no other members wishing to speak, so this concludes our hearing.

Dr. Cochran, Mr. Larson, Dr. Richter, Mr. Stern, thank you all for your testimony.

The Subcommittee's hearing record will remain open for two weeks. Members have until Thursday at 6:00 p.m. to submit additional questions for the record.

Thank you, everybody.

And the Subcommittee stands adjourned.

[Whereupon, at 3:33 p.m. the hearing was adjourned.]

APPENDIX MATERIAL SUBMITTED

U.S. Senate Committee on Energy and Natural Resources
 Subcommittee on Water and Power
 March 24, 2021 Hearing: *Water Infrastructure for the 21st Century: The Viability of
 Incorporating Natural Infrastructure in Bureau of Reclamation Water Management Systems*
 Question for the Record Submitted to Dr. Bobby Cochran

Question from Senator John Hoeven

Question: Would you agree that natural infrastructure and features are vastly different across the different states, and that any new programs encouraging natural infrastructure must consider geographical diversity?

Answer: Thank you for the question. In general, infrastructure works best when it is designed to meet the specific needs in different communities—for both built and natural infrastructure. Wetlands restoration can be just as effective in recharging groundwater in the Dakotas as in Nevada. But those wetlands will look different and have different features. The Las Vegas Wash in Nevada treats more than 150 million gallons of stormwater each day¹ returning clean water to Lake Mead to be used again for crops and residents. Outside the City of Sioux Falls, SD 97.6% of water pumped into a restored wetland made it into groundwater for later use.²

Those two wetlands have different plants and different sources of water. But they share really important features too—they were sited in areas with porous soils, they use native vegetation to manage flows and clean water, and are actively managed by communities to maintain their infrastructure function. Similarly, a new off-channel dam and surface reservoir is going to be customized to fit topography, soils, and water sources—but a dam and reservoir also share common features.

I would encourage Congress to focus on the outcomes important to communities—things like family wage jobs, resiliency, clean water, and delivering the best value for the American people. We can be agnostic about the types of infrastructure that achieve those outcomes. And we can still hold both natural and built infrastructure to standards that ensure high quality projects. Willamette Partnership, has set standards for natural infrastructure and verifies the effectiveness of that infrastructure for cities across Oregon.³ There are a range of examples where natural infrastructure meets community needs.⁴

In closing, any infrastructure funding program should provide flexibility for communities to build and sustain the kinds of high quality infrastructure that matches their vision for their future. Infrastructure that meets multiple needs, cost-effectively, and allows communities to thrive is possible anywhere—using natural infrastructure, built infrastructure, or a combination of both.

Sincerely,

Bobby Cochran
 Partner, Community Resilience and Innovation
 Willamette Partnership

¹ https://www.lvwash.org/html/important_index.html

² <https://pubs.er.usgs.gov/publication/wri024133>

³ <https://willamettepartnership.org/resources/market-tools-rules/>

⁴ Willamette Partnership and Oregon Environmental Council. (2021). Natural Infrastructure in Oregon. Available May 12, 2021 at <https://willamettepartnership.org/resources/>.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Water and Power
March 24, 2021 Hearing: *Water Infrastructure for the 21st Century: The Viability of
Incorporating Natural Infrastructure in Bureau of Reclamation Water Management Systems*
Question for the Record Submitted to Mr. Troy Larson

Question from Senator John Hoeven

Question: Would new mandates requiring the incorporation of natural infrastructure in Reclamation projects impact your project?

Reply: I believe making natural infrastructure a part of the Bureau of Reclamation's mission very likely will adversely impact gray projects already underway like the Lewis & Clark Regional Water System. Because it will be part of their mission, Reclamation I believe will inevitably need to prioritize limited funding resources to natural infrastructure projects. This very likely will mean less funding for other projects like Lewis & Clark, which in turn will cause further delays in completing construction.

U.S. Senate Committee on Energy and Natural Resources
Subcommittee on Water and Power
March 24, 2021 Hearing: *Water Infrastructure for the 21st Century: The Viability of*
Incorporating Natural Infrastructure in Bureau of Reclamation Water Management Systems
Question for the Record Submitted to Dr. Holly Richter

Question from Senator Mark Kelly

Question: What is your response to those who suggest that prioritizing natural infrastructure means neglecting built infrastructure as the West seeks to mitigate against natural events such as wildfires, drought, extreme heat, floods, and landslides?

Response: It is the combination of built infrastructure in conjunction with natural storage solutions that provide the most options and flexibility for water management, especially for the arid West where water supplies are the most limited. In most cases, the consideration and incorporation of natural systems into water storage and supply projects can help to reduce both initial project construction costs, as well as the long-term operation and maintenance expenses. In addition, full cost accounting that considers not only direct project costs, as well as those associated with unintended consequences over the long term, is the most pragmatic and realistic approach for prioritizing water infrastructure approaches.

In my written testimony I provided an example from Arizona where a natural ephemeral stream channel was being used for the infiltration and recharge of excess stormwater runoff from an urban area to replenish a groundwater aquifer. This approach, while still paired with the use of a constructed detention basin, will reduce costs as compared to the sole use of constructed recharge facilities such as dry wells or infiltration trenches to infiltrate water into the ground. Constructed dry wells and infiltration trenches can be costly to repeatedly maintain over time, while natural channels with high infiltration rates require no long-term maintenance, and have the capacity to serve as a more efficient means of increasing aquifer recharge.

The same may be said for the importance of maintaining watershed health, including healthy forests, to avoid excessive fuel loads that result in extreme wildfires, and subsequent flooding and sedimentation to downstream reservoirs. Sedimentation within reservoirs is a costly issue to address, and the problem can be minimized through sound watershed management practices.

In the end, natural systems can complement and enhance built infrastructure projects when thoughtfully considered, or conversely, negatively impact or even destroy built infrastructure projects if not well managed. In either case, the inclusion of natural system functions into the planning, design, and implementation of water infrastructure projects will likely become increasingly important in the future as our water supply challenges grow given climate change, increasing demands, and decreasing supplies.



MEMORANDUM

April 27, 2021

To: Senate Committee on Energy and Natural Resources, Subcommittee on Water and Power
Attention: Darla Heath; Melanie Thornton; Brian Clifford

From: Charles V. Stern, Coordinator, Specialist in Natural Resources Policy, csstern@crs.loc.gov, 7-7786
Eva Lipiec, Analyst in Natural Resources Policy, elipiec@crs.loc.gov, 7-1815
Linda Luther, Analyst in Environmental Policy, lluther@crs.loc.gov, 7-6852
Laura Gatz, Analyst in Environmental Policy, lgatz@crs.loc.gov, 7-2646

Subject: **CRS Responses to Questions for the Record: 3/24/21 Hearing: Water Infrastructure for the 21st Century— The viability of incorporating Natural Infrastructure in Bureau of Reclamation Water Management Systems**

Members of the Senate Energy and Natural Resources Committee requested that the Congressional Research Service respond to questions for the record from the March 24, 2021, Senate Energy and Natural Resources Committee, Subcommittee on Water and Power hearing titled “Water Infrastructure for the 21st Century: The viability of incorporating Natural Infrastructure in Bureau of Reclamation Water Management Systems.” CRS has provided responses to the questions below. In accordance with its statutory mission, CRS does not make recommendations. CRS has addressed questions asking for recommendations or opinions by providing relevant information and identifying recommendations made by other entities, if available.

These responses refer to terminology and definitions used in CRS’s testimony in the March 24, 2021 hearing.¹ For additional information on these responses, please contact Charlie Stern at 7-7786.

Questions from Senator Hyde-Smith

In my state of Mississippi, we have recently seen too many rural communities and families suffer as a result of flooding from major storms and hurricanes. In my experience with working to find solutions that can withstand damage caused by natural disasters, natural infrastructure alone simply cannot replace physical infrastructure, and adequately protect communities from catastrophic events such as 100-year Mississippi River flood events or powerful storm surges that accompany major hurricanes. Given that natural disasters from wildfires, extreme heat and drought, and landslides continue to devastate our Western states, do you believe funding should be

¹ For more information, see CRS Testimony TE10061, *Water Infrastructure for the 21st Century: The Viability of Incorporating Natural Infrastructure in Bureau of Reclamation Water Management Systems*, by Charles V. Stern.

prioritized for natural infrastructure to replace built infrastructure as a primary solution that can withstand the destruction that is caused by these natural disasters?

CRS takes no position on funding prioritization questions and related issues before Congress, but can provide additional information and background related to this question. CRS researched recent congresses and found no proposals that would directly prioritize funding or implementation of natural infrastructure over built infrastructure, or that would replace built infrastructure with natural infrastructure. However, some proposals might indirectly prioritize natural infrastructure over built infrastructure. For example, in discussing the potential reauthorization of Section 4007 of the Water Infrastructure Improvements for the Nation Act (WIIN Act, P.L. 114-322) during the 116th Congress,² some stakeholders advocated for capping Section 4007 authority for different types of project funding, including separate funding categories for natural and built infrastructure.³ Such a “set aside” would in effect avoid direct competition between these project types. Some may view this as a way of providing unwarranted prioritization for natural infrastructure projects that are otherwise unlikely to be selected for funding, and argue that all projects should be required to compete for the same funding based on a common set of metrics.⁴ On the other hand, those arguing for an approach employing these categorical caps argue that a separate pool of funding for natural infrastructure projects will do more to encourage western water managers to “pivot” to new storage approaches.⁵

Questions from Senator Hoeven

Question 1: In terms of federal permitting and costs, what are some of the advantages and disadvantages of natural infrastructure versus “engineered” infrastructure?

Natural infrastructure sits on a continuum from natural areas, such as forested lands, to combinations of natural “green” and “engineered” or “gray” (e.g., rock, steel, and concrete) components of infrastructure.⁶ This makes it difficult to make any broad, unequivocal statements about natural infrastructure costs and permitting impacts. Cost comparisons between natural infrastructure and traditional engineered infrastructure, or between natural infrastructure features, depend on a variety of factors including the location of the proposed project, location conditions, the type of feature under consideration, and the overall goal of the project.

Costs and benefits of a project structure, whether natural or engineered, may be measured using both monetary and non-monetary methods. In some cases, natural infrastructure projects may have lower construction, labor, and/or operations and maintenance costs compared to engineered infrastructure.⁷

² Currently this authority only authorizes funding for surface and groundwater storage projects (i.e., there is no specific authority for natural infrastructure). For more information, see CRS In Focus IF10626, *Reclamation Water Storage Projects: Section 4007 of the Water Infrastructure Improvements for the Nation Act*, by Charles V. Stern.

³ See for example, Statement of Melinda Kassen, Senior Counsel, Theodore Roosevelt Conservation Partnership, U.S. Congress, Senate Committee on Energy and Natural Resources, Subcommittee on Water and Power, *Hearing on Pending Legislation: S. 1570, S. 1932, S. 2044*, 116th Cong., 1st sess., July 18, 2019. Hereinafter Kassen, 2019.

⁴ For example, see testimony submitted for the record for this hearing by Dan Keppen, Family Farm Alliance.

⁵ Kassen, 2019, p. 4.

⁶ Natural infrastructure typically goes through a design and engineering process which may be similar to the process for “engineered” gray infrastructure. In this response, CRS refers to infrastructure without natural components as “engineered” infrastructure.

⁷ United Nations World Water Assessment Programme, *The United Nations World Water Development Report 2018: Nature-Based Solutions for Water*, and World Business Council for Sustainable Development, *The Business Case for Natural Infrastructure*, December 2015, at https://www.naturalinfrastructureforbusiness.org/wp-content/uploads/2016/02/WBCSD_BusinessCase_jan2016.pdf.

Benefits derived from these projects may also be relevant considerations in assessing a project's costs. For instance, in some cases, both natural and engineered infrastructure may meet a project's objectives, however, the natural feature may result in greater additional ecological and social benefits than the engineered structure would have provided.⁸

In other cases, natural infrastructure may not be as effective in achieving project objectives or may cost more to do so under some circumstances. Other disadvantages of using natural infrastructure in certain cases may include unresolved questions about the effectiveness of some features to achieve certain project goals and additional land requirements (and related costs). Project developers also may consider the expected lifespan of natural or engineered features, and potential maintenance requirements and costs. Finally, natural infrastructure that includes ecological and landscape features may take longer to establish and provide full benefits than engineered infrastructure, a consideration if achieving project objectives within a certain time limit is a factor.⁹

Congress has directed certain federal agencies to consider the use of natural infrastructure in their project planning and design. For example, Congress directed the U.S. Army Corps of Engineers (USACE) to evaluate the use of "natural features" and "nature-based features," among other features, in flood risk reduction projects.¹⁰ Several USACE flood risk reduction project reports include estimates of potential costs of natural infrastructure features and comparisons between natural and engineered features.¹¹ USACE has also released a report on levee setbacks, a potential type of natural infrastructure, and their cost and benefit considerations in certain locations.¹²

While some stakeholders have noted differences between the permitting processes for natural versus engineered infrastructure, as well as perceived barriers to using natural infrastructure in permitting processes, some also have outlined strategies to overcome these challenges.¹³ At the federal level, Congress has shown interest in encouraging the use of green infrastructure in permitting. For example,

⁸ For example, a feature designed to reduce flood risk may also provide other ecosystem services, such as enhanced evaporation, greater water storage (i.e., within soils, groundwater, and wetlands), erosion and sediment control regulation, drought protection, natural resource provisioning (e.g., fisheries, agricultural products, and hydropower), carbon sequestration, and improvements to aesthetic and recreation value, among others.

⁹ For more information about outstanding questions regarding the design, construction, and maintenance of certain natural infrastructure features and their costs and benefits in the context of the U.S. Army Corps of Engineers (USACE), see Government Accountability Office, *Army Corps of Engineers: Consideration of Project Costs and Benefits in Using Natural Coastal Infrastructure and Associated Challenges*, GAO-19-319, March 2019; and U.S. Army Systems Approach to Geomorphic Engineering (SAGE), *Natural and Structural Measures for Shoreline Stabilization*, 2017, at <https://coast.noaa.gov/data/digitalcoast/pdf/living-shoreline.pdf>.

¹⁰ 33 U.S.C. 2289a. For more information on U.S. Army Corps of Engineer authorities related to natural infrastructure, see CRS Report R46328, *Flood Risk Reduction from Natural and Nature-Based Features: Army Corps of Engineers Authorities*, by Nicole T. Carter and Eva Lipiec.

¹¹ For example, see USACE, *Revised Final Report Integrated Hurricane Sandy General Reevaluation Report and Environmental Impact Statement, Atlantic Coast of New York, East Rockaway Inlet to Rockaway Inlet and Jamaica Bay*, July 2019, at <https://www.nan.usace.army.mil/Portals/37/docs/civilworks/projects/ny/coast/Rockaway/2020%20Update%20Report/Rock%20Jama%20Bay%20Final%20Report.pdf?ver=2020-06-01-154654-773> and USACE, *Final Integrated City of Norfolk Coastal Storm Risk Management Feasibility Study/Environmental Impact Statement*, September 2018, at <https://usace.contentdm.oclc.org/utis/getfile/collection/p16021coll7/id/8557>.

¹² U.S. Army Engineer Research and Development Center, *Levee Setbacks: An Innovative, Cost-Effective, and Sustainable Solution for Improved Flood Risk Management*, ERDC/EL SR-17-3, June 2017, at <https://usace.contentdm.oclc.org/digital/collection/p266001coll1/id/4239/>.

¹³ World Business Council for Sustainable Development, *Incentives for Natural Infrastructure: Review of existing policies, incentives barriers related to permitting, finance and insurance of natural infrastructure*, May 2017, p. 16, at https://docs.wbcsd.org/2017/05/Incentives_for_Natural_Infrastructure.pdf; and U.S. Environmental Protection Agency (EPA), *Overcoming Barriers to Green Infrastructure*, at <https://www.epa.gov/green-infrastructure/overcoming-barriers-green-infrastructure>.

Congress directed the U.S. Environmental Protection Agency (EPA) to promote the use of green infrastructure and coordinate integration of green infrastructure into Clean Water Act permitting and enforcement, planning efforts, research, technical assistance, and EPA funding guidance.¹⁴ EPA has supported the use of green infrastructure and its integration into permitting for over a decade, issuing a number of policy memos on various aspects of using green infrastructure in permitting and enforcement.¹⁵ USACE has also integrated natural infrastructure into some of its permitting. For example, one of the USACE's nationwide permits (NWP) allows discharges of dredged or fill material into waters of the United States to construct and maintain living shorelines to stabilize banks and shores in coastal waters under certain conditions (NWP-54).¹⁶ Another NWP allows discharges of dredged or fill material for construction of stormwater management facilities, including construction of pollutant reduction green infrastructure features (NWP-43).¹⁷

Question 2: Would the incorporation of natural infrastructure initiate new environmental review considerations, including reviews required under the National Environmental Policy Act?

Given the focus of the March 24 hearing, CRS interprets the reference to initiating “new environmental review considerations” to mean the potential for new environmental review procedures to apply if Congress explicitly authorizes Reclamation to consider using natural infrastructure features for proposed water supply projects. Specifically, CRS considered a scenario in which Reclamation would be explicitly *allowed*, but not directly required, to consider the use of natural infrastructure in a given proposal. Additionally, our response assumes that agency actions subject to review under the National Environmental Policy Act (NEPA)¹⁸ would primarily involve a site-specific water supply project planned and undertaken by Reclamation or a project eligible to receive financial assistance from a Reclamation-administered program (i.e., a proposal undertaken by a non-federal entity).

Among other directives, NEPA requires federal agencies to assess the environmental impacts of their proposals and any reasonable alternatives to that proposal.¹⁹ Broadly speaking, “reasonable” alternatives include those that would also meet the proposal’s purpose and need.²⁰ It is unlikely that *allowing* Reclamation to consider the use of natural infrastructure features will appreciably affect the NEPA process carried out for future project proposals undertaken or approved by Reclamation. However, it cannot be determined in advance whether or the degree to which the use of such natural infrastructure features would be included in the range of reasonable alternatives that may be considered for future projects.

¹⁴ 33 U.S.C. §1377a, P.L. 115-436.

¹⁵ U.S. EPA, “Green Infrastructure: Policy Memos,” at <https://www.epa.gov/green-infrastructure/policy-memos>.

¹⁶ USACE, “Issuance and Reissuance of Nationwide Permits,” 82 *Federal Register* 1860, January 16, 2017.

¹⁷ USACE, “Reissuance and Modification of Nationwide Permits,” 86 *Federal Register* 2744, January 13, 2021.

¹⁸ 42 U.S.C. §4321, et seq.

¹⁹ See 42 U.S.C. §4332(2)(C)(i) and (iii). These provisions explicitly require an agency to identify impacts of a proposed action and alternatives to a proposed action expected to “significantly affect the quality of the human environment” (§4332(2)(C)). Under §4332(2)(E), NEPA also requires federal agencies to “study, develop, and describe appropriate alternatives to recommended courses of action in any proposal which involves unresolved conflicts concerning alternative uses of available resources.” This directive applies to any federal agency action, not specifically those likely to result in significant impacts.

²⁰ For additional information, see the U.S. Department of the Interior, Bureau of Reclamation’s “Reclamation Managing Water in the West: Reclamation’s NEPA Handbook,” February 2012, available online at https://www.usbr.gov/nepa/docs/NEPA_Handbook2012.pdf. See specifically the discussion of the agency’s obligation to identify and assess the impacts of reasonable alternatives on pp. 4-17 to 4-18, 6-5 to 6-7, 8-5 to 8-13.



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Joe Whitworth
President/CEO
The Freshwater Trust

**Written Testimony for the United States Senate
Committee on Energy and Natural Resources
Subcommittee on Water and Power**

Oversight Hearing

"To examine the viability of incorporating natural infrastructure in western water management and policy to support economic development, protect watershed health, and build more resilient communities."

March 24, 2021

Chairman Wyden, Ranking Member Hyde-Smith, and members of the Subcommittee:

Thank you for the opportunity to submit testimony on incorporating natural infrastructure in water management and policy to restore watersheds, build jobs, and protect communities. The Freshwater Trust (TFT) is a nonprofit that develops and uses advanced watershed analytics to chop thorny water challenges down to a solvable size. With more than 37 years of technology-driven, watershed-scale restoration expertise, TFT has a proven track record of working collaboratively with the Bureau of Reclamation (Reclamation), other federal agencies, landowners, regulated entities, state and local governments, and private businesses to build, optimize, quantify, and track restoration solutions that solve water problems.

TFT's growing portfolio of work spans the states of Oregon, Idaho, California, Washington, and Colorado, and ranges from on-the-ground natural infrastructure projects, such as planting streamside vegetation to protect water quality, to developing watershed restoration technology. Over the past decade, TFT has used technology to generate and sell tens of millions of dollars of water quality credits for Clean Water Act compliance; design and implement approximately \$650 million in new environmental solutions; prioritize and deliver irrigation upgrades that benefit farmers and fish; and support agencies and clients on watershed restoration programs, such as Reclamation, Microsoft, and the Idaho Power Company.

**ADVANCED ANALYTICS IS THE KEY FOR VIABILITY AND EFFECTIVENESS OF
NATURAL INFRASTRUCTURE INVESTMENTS**

The federal government should harness the power of advanced watershed analytics to guide cost-effective investments in solutions that overcome water quality and quantity challenges. Specifically, advanced watershed analytics should be used in every basin to prioritize natural

infrastructure investments, coordinate and expedite deployment of funds to on-the-ground work, and measure progress by quantifying outcomes. Such outcomes should be measuring the millions of pounds of nutrient runoff reduced by installing irrigation upgrades in the right place, instead of the hours spent installing center pivots with no prioritization or quantified environmental benefits measured. The federal government can serve as a critical catalyst in the transition from purchasing watershed outcomes rather than watershed action, but changes are necessary in how WaterSMART and other federal funding sources use analytics to prioritize investments.

Agencies should also procure outcomes in a way that rewards results instead of reimbursing for effort. Using a “Pay-for-Success” model built from robust analytics, federal funders could knowledgeably set a price that they will pay for an achieved environmental benefit—signaling to local, regional, and national groups that top-priority projects will generate returns on investment and stimulating the deployment of private labor and capital in a cohesive and impactful manner.

CASE STUDY: CROOKED RIVER — REDUCING MILLIONS OF POUNDS OF POLLUTION WHILE SAVING MILLIONS OF DOLLARS

Our analysis of the opportunity to restore water quality to the Crooked River (Oregon) demonstrates the contrast between federal government ineffectively and inefficiently spending \$133 million without the use of analytics, compared to efficiently yielding similar results but only spending \$50 million to significantly improve river water quality by integrating technology into natural infrastructure funding decisions.

TFT analyzed ongoing agricultural operations on 4,000 irrigated fields in the Crooked River watershed for opportunities to reduce nutrient runoff by modeling the benefits of pressurized irrigation upgrades, livestock exclusion fencing, and riparian buffer restoration—along with ongoing investigations into wetlands restoration, tailwater recovery, and other actions—across the 4,000 fields. Of the 4,000 modeled fields, 1,561 were found to have a conservation action that would be cost-effective at reducing runoff, for a total projected cost of \$133 million to implement all projects. However, through application of TFT’s analytics capabilities, 79% of the potential nitrogen reductions and 73% of the potential phosphorus reductions were achievable by implementing activities on fewer than 500 fields, or roughly 30% of the modeled actions, for a projected cost of just under \$50 million.

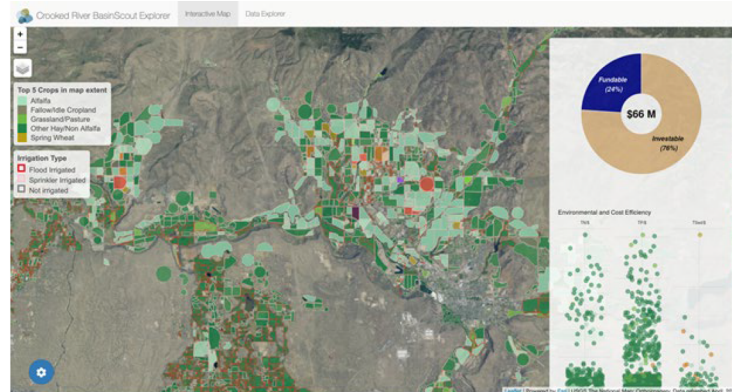


Figure 1: Crooked River Analytical Output.

In addition to identifying the most cost-effective nutrient reduction projects in the basin, the tool TFT developed characterized the most likely funding mix for potential projects in a given area. By analyzing the on-farm economic impacts associated with implementing recommended practices, TFT identified which conservation actions can generate enough positive cashflows (from labor savings, increased crop yields, and monetized nutrient reductions) to generate positive rates of return for private entities who co-invest in a basin's integrated project finance stack.

If federal agencies were to invest \$10–20 million of federal funding to purchase nutrient reductions at a watershed scale in the Crooked River Basin, there is a clear path to galvanizing another \$10–\$20 million from Oregon public and private funding sources, and to monetizing the water savings, nutrient reductions, and other benefits created by these conservation actions. Deployment would not only unlock aligned leveraged funding, but also clearly demonstrate the transparency, effectiveness, and rural resiliency benefits of this type of public-private funding strategy.

This combined funding would enable the hiring of local supply chain partners such as irrigation supply companies, water districts, and conservation organizations to work in rural communities, and to rapidly target, recruit, and implement qualified individuals to complete this important work.

TRANSITION RECLAMATION FROM AN ACTIONS FUNDER TO AN OUTCOMES BUYER

Integrating advanced watershed analytics into agency funding for natural infrastructure is feasible and replicable. It would require Reclamation and ideally, other federal agencies, to follow this four-step, technology-based approach:

1. Integrate established government models and data with satellite imagery, as well as machine-learning technology, to remotely survey a watershed and identify specific conservation practices that could be implemented at the field level.
2. From the group of feasible practices, identify optimal combinations of practices that would produce the best ecological and economic options on the ground, as well as measuring cost and desired outcomes (e.g., employment generation).
3. Develop analytical scenarios to identify the most efficient combination of regional investments for achieving watershed-level objectives, such as achieving a nutrient reduction or surface water improvement target.
4. Fund those projects and practices that individually or collectively result in quantified improvements to water quality, water quantity, habitat, jobs, and community resilience.

Using advanced analytics (see example at www.basinscout.org) would maximize cost-efficiency and ensure that limited taxpayer dollars are spent on the projects that produced the highest level of desired outcomes for Reclamation stakeholders, the environment, and the economy. With investments in these analytics, Reclamation would be able to proceed in a more streamlined way to fund the water resiliency projects that matter the most regionally, while prioritizing local benefits such as water quantity and quality improvements, jobs, and the environment.

POLICY RECOMMENDATIONS TO MAXIMIZE VALUE OF NATURAL INFRASTRUCTURE

- **New Natural Infrastructure Investment:** TFT supports federal funding for programs supporting federal, state, and local partnerships that use advanced watershed analytics to design, implement, and track projects that benefit watersheds and agriculture. TFT supports using the WaterSMART Program to fund multi-benefit natural infrastructure projects. TFT recommends those grants be directed toward projects that will generate the most quantified outcomes for water quantity, quality, and environmental and habitat improvements, resilience of western communities, and farms.
 - Natural infrastructure was explicitly authorized for the U.S. Army Corps of Engineers (Corps), in the 2020 Water Resources Development Act (WRDA) that passed as part of the omnibus bill at the end of the 116th Congress. There is great potential to replicate that effort with other federal programs under Reclamation's authority, and in coordination with similar federal programs like USDA's Rural Development, Clean Water and Drinking Water State Revolving Funds, and programs used to manage our nation's forests and streams.
 - Leveraged federal funding can also be utilized and deployed through community engagement, planning, and stewardship of natural infrastructure.

- Congress can also make clear that natural infrastructure is a capital asset—just like a road or pump station. That designation would allow local governments to capitalize the costs of restoring and caring for the streams, wetlands, and forests that serve their towns, utilizing public-private partnership financing tools to more effectively partner with the private sector to carry out that work.
- **Advance Watershed Analytics:** Require the application of advanced watershed analytics in identifying the highest value set of the most efficient and cost-effective outcomes.
- **Agency Outcomes Purchasing:** Authorize Reclamation and other federal agencies to purchase outcomes via pay-for-performance contracts (e.g., \$15 million for 15,000 pounds of nutrient reductions).
- **Prioritize Federal Investments:** Reclamation should work with other federal agencies to prioritize investments based on uniform environmental impact metrics. With a single web interface used across all federal natural resource agencies, it would be possible to track project implementation and environmental benefits against watershed targets on a single dashboard across agencies and jurisdictions. This tool could help immensely in implementing the paradigm shift from the traditional, isolated government funding programs to outcome-prioritized, integrated leverage across the rural landscape, and can be both adaptable and extremely detailed.

CONCLUSION

The Freshwater Trust supports more effective deployment of natural infrastructure funding using data analytics technology to “build back better” America’s water resources.

We look forward to working with this Subcommittee on legislative efforts that will lead to maximizing the integration of technology in implementing natural infrastructure solutions as part of the mission of the Bureau of Reclamation and other federal agencies.

Please consider TFT a resource to the Committee as you continue to evaluate ways to best apply the essential and rapidly changing world of watershed analytics. Through these technologies and pay-for-success policies, the federal government can realize the most effective solutions to many of the West’s water resource problems by providing highly effective and streamlined funding directly to the natural infrastructure projects that matter most.



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April 6, 2021

Senator Ron Wyden
Chairman
Water and Power Subcommittee
U.S. Senate Energy and Natural Resources
Committee
304 Dirksen Senate Building
Washington, DC 20510

Senator Cindy Hyde-Smith
Ranking Member
Water and Power Subcommittee
U.S. Senate Energy and Natural Resources
Committee
304 Dirksen Senate Building
Washington, DC 20510

RE: Statement for the Record of Natel Energy regarding the March 24 Water and Power Subcommittee hearing on natural infrastructure

Dear Chairman Wyden and Ranking Member Hyde-Smith:

Natel Energy appreciates this opportunity to supplement the record of the March 24 Subcommittee hearing on the prospects for, and benefits provided by, the increased utilization of natural infrastructure in western water management. Our company believes that sustainable hydropower project development, utilizing natural infrastructure applications, can play a significant role in revitalizing the connectivity of rivers and streams, assist with ground water recharge, improve fish passage and habitat, while also increasing renewable power generation.

Natel is a family-founded water and energy innovation company based in Alameda, CA. Established in 2009, our company recognized that too many watersheds, rivers, and wetlands have become degraded, depriving our country of a vast array of economically valuable ecosystem services. In response, Natel has committed to a new hydropower project development philosophy called "Restoration Hydro." Our projects propose to incorporate watershed restoration, innovative fish safe turbine designs, machine learning, and remote sensing, resulting in cost-effective production of distributed, dispatchable, renewable energy that maintains or improves the health and climate resilience of watershed ecosystems and the communities who surround them.

While touched upon briefly during the hearing, we believe hydropower sits at the nexus of energy and water, enabling hydro projects to be catalysts for positive change. By designing with both energy and water in mind, Natel believes that hydropower projects can increase reliable, renewable generation and deliver positive benefits for river ecosystems and water users. We envision Restoration Hydro projects that generate multiple environmental co-benefits including habitat creation, improved water quality, and sustained increases in groundwater recharge rates. When deployed strategically at multiple sites across a basin, these projects will enhance river, wetland, and watershed connectivity, which can help partially mitigate the impacts of droughts



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and floods – all while producing reliable renewable hydropower.

Our Restoration Hydro project design incorporates concepts of biomimicry and nature-based solutions in the form of low-head, strategically-sited structures proven to restore watershed and ecological function. Natel's projects take this concept one step further by also integrating our high performance, fish safe turbine with innovative civil works to ensure safe upstream and downstream fish passage, maintaining or improving river connectivity.

In fact, in December 2020 we completed installation of our second Restoration Hydro Turbine (RHT) design at the Monroe Hydro Project in Madras, Oregon at an existing irrigation canal. The turbine, which requires no fine fish screens and minimizes the need for excavation and installation materials, was also tested for fish passage performance. Conducted by the Pacific Northwest National Laboratory (PNNL), the test revealed a 100% survival rate for rainbow trout up to 15 inches long passing downstream through the turbine. PNNL scientists and engineers used sensor fish, RFID tag, radio tag, and balloon tag technologies to assess physical RHT stressors and enable the recovery of all fish after their passage through the turbine. Each fish was carefully inspected and no evidence of passage-related injuries was observed.

Natel has identified significant additional hydropower project opportunities, including such as those at Madras, throughout the West - up to 34,000 MW. These opportunities fall into three main categories: 1) adding capacity to non-powered water infrastructure that serves multiple purposes such as irrigation, flood control, and water supply (up to 900 MW); 2) "Restoration Hydro" project designs to improve watershed function through removing of old dams and replacing them with river restoration structures that also generate reliable, renewable energy (up to 3,000 MW); and 3) new sustainable, distributed hydropower projects that help restore watershed function and improve climate resilience through distributed flood management and increased groundwater recharge (up to 30,000 MW).

In order to realize the full development potential; however, additional energy and other support policies will be needed. As the Committee considers and advances legislation in this area, we urge you to also support provisions for sustainable hydropower deployment, such as Restoration Hydro. For example, as Natel scales deployments, we also continue to study, test, refine, and update our technology solutions. Successfully expanding the market for our products and services requires not only continued federal investment in research and development for companies like ours, but also clean energy and tax policies that stimulate growth in the hydropower industry at large. As such, Natel supports:

- Increased FY 2022 funding for the Department of Energy Water Power Technologies Office (WPTO) at a level of \$206 million, with \$69 million for the hydropower program specifically;



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- Long-term extension of the hydropower production and investment tax credits (PTC and ITC) with a direct payment or in-lieu cash grant option; and expansion of the tax credits to specifically include new, sustainable, distributed hydropower project deployment, such as Restoration Hydro;
- Adoption of a new hydropower infrastructure investment tax credit that incentivizes existing hydropower project owners to invest in innovative environmental mitigation and improvement technologies, including dam removal, such as Restoration Hydro;
- Hydropower licensing improvements to reduce unnecessary delays and to lower costs for projects pursuing the dual objectives of increased generation and watershed restoration; and
- Clean energy/climate policies that recognize and value hydropower as a renewable energy resource, along with the grid reliability and resiliency benefits it provides.

With the right energy and climate policies in place, and with greater support for innovation in hydropower technology through the DOE WPTO, Natel sees great potential to expand hydropower's contribution to our national energy portfolio while simultaneously improving the health and climate resilience of our rivers and watersheds.

Once again, Natel appreciates the opportunity to provide this statement to the Subcommittee and we look forward to engaging further with the Subcommittee, and the full Energy and Natural Resources Committee, on these issues. In the Appendix attached, we have included illustrations of the Restoration Hydro project designs and would be pleased to provide any additional information.

Sincerely,

A handwritten signature in black ink, appearing to read "Gia Schneider", written in a cursive style.

Gia Schneider
Chief Executive Officer



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Appendix

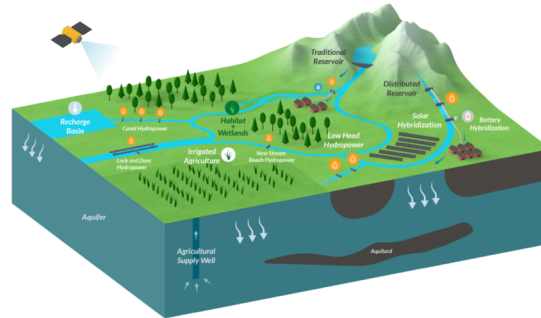
Restoration Hydro™

Digital Solutions

Combine satellite imagery and machine learning to improve operations and inform sustainable development of new projects in a changing climate.

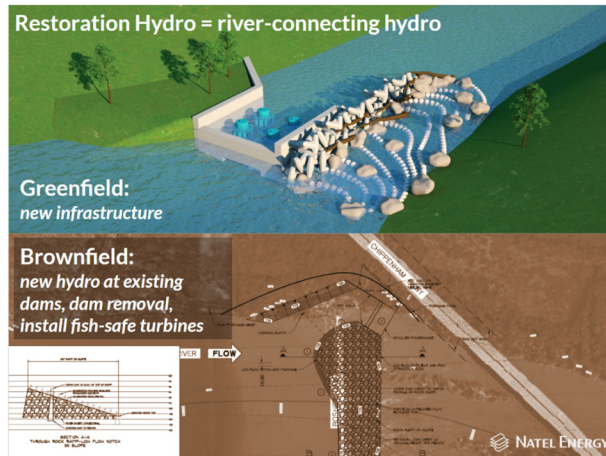
Turbine Solution

Compact, modular, high performance, fish and debris safe turbine that delivers flexible, reliable renewable energy from distributed hydropower.





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National Audubon Society

Testimony for the Record

Prepared for the U.S. Senate Energy and Natural Resources Subcommittee on Water and Power

Hearing held March 24, 2021

RE: Natural infrastructure opportunities for western water management

The National Audubon Society and its over 1.8 million members applaud the Subcommittee for conducting a hearing on natural infrastructure opportunities for western water management. Audubon advocates for common-sense solutions to protect the nation's birds and everything they need to thrive—clean air and water, protected habitat, flourishing aquatic resources, and a healthy climate.

Water is the most precious resource in the West—for people, birds, and other wildlife. Riverside habitats like the forests and wetlands that line the Colorado River support some of the most abundant and diverse bird communities in the arid West, serving as home to over 400 species. The Colorado River alone provides drinking water for more than 40 million people, irrigates 5.5 million acres of farms and ranches, and supports 16 million jobs throughout seven states, with a combined annual economic impact of \$1.4 trillion.

In addition to rivers like the Colorado that provide lifelines throughout the West, saline lakes—the landlocked saltwater lakes fringed with wetlands that dot the Intermountain West—are beacons for millions of birds crossing an otherwise arid landscape. But as water recedes (due to drought, water diversions, and climate change) and exposes toxic dust, not only is habitat lost, but surrounding communities—like those near the Salton Sea—are at higher risk for asthma and other health issues. The risk of toxic dust is also increasing at Great Salt Lake—the largest saltwater lake in the Western Hemisphere and a critically important habitat for birds. Western birds like the Yellow-billed Cuckoo, Summer Tanager, and Ridgway's Rail rely on these and other unique western ecosystems to survive and thrive.

Precipitous declines in Western water quantity and quality risk the economic and environmental health and vitality of America's West—putting communities and birds in jeopardy. Climate change will continue to impact the West, and particularly its water supply—the many impacts include longer and more damaging wildfire seasons as well as prolonged drought. Federal leadership and action are needed to address the climate crisis and promote conservation for birds and people. Audubon is advocating for federal funding and policy

priorities that restore habitat, protect communities, and support birds through proactive water management and conservation. We know that droughts and their impacts will become even more common and severe, especially in over-allocated systems like the Colorado River or in places with dwindling freshwater inputs like saline lakes. Investments in drought response will make our water systems more resilient while meeting the needs of birds and people.

Consistent with the President’s Executive Order on Tackling the Climate Crisis at Home and Abroad (signed January 27, 2021) and other Administration priorities, Congress has many opportunities to “build back better” by prioritizing robust support for natural infrastructure programs that build basin water systems to be more resilient in the face of climate change, while sustaining communities, irrigated agriculture, river recreation, and bird and wildlife habitat.

Just like roads and bridges, our natural landscapes—like wetlands, forests, and native grasslands—act like infrastructure, providing critical services to our communities. They serve as safe recreational spaces, enhance our resilience to climate threats like increasing wildfires and drought, and improve habitats for birds and other wildlife. Significantly investing now in natural infrastructure provides a historic opportunity to harness America’s immense natural wealth to support the economy while also addressing both the causes and consequences of climate change.

Natural infrastructure can refer to many different types of projects in the West. Stormwater can be managed through ephemeral washes and natural retention basins. Wetland and natural floodplain restoration can reduce stormwater erosion and flooding from heavy rainfall events. Wetlands and floodplains also help to naturally store water and recharge groundwater aquifers, reducing drought risks in more arid states. Wetlands also provide vitally important habitat for migratory birds and wildlife. Groundwater recharge projects for in-stream and ephemeral streams can be used in constructed groundwater basins. Forest management projects, such as wet meadow restoration, high elevation riparian stream rehabilitation, and forest thinning to reduce catastrophic wildlife risk help reduce drought risk while providing habitat. These types of natural infrastructure solutions are more adaptable and durable than gray infrastructure, because they naturally adapt to changing environmental conditions.

Primarily, the Bureau of Reclamation is poised to be a leader for climate action and building resilience in the West, through the increased use of natural infrastructure and multi-benefit projects. Reclamation’s WaterSMART program, implemented with changes included in the FY21 omnibus appropriations package passed in December 2020, provides opportunities for multi-benefit natural infrastructure projects, particularly through the Drought Response and Cooperative Watershed Management programs. The newly authorized Aquatic Ecosystem Restoration program within Reclamation offers an opportunity for the Bureau to expand its mission set to prioritize habitat creation and conservation measures. In addition, the Fish and Wildlife Service and U.S. Geological Survey have opportunities to prioritize programs that restore ecosystems and promote scientific efforts.

We support a balanced approach to 21st-century western water infrastructure, water supply security, and ecological resilience. We support solutions that offer multi-sector benefits wherever possible to protect river flows, ensure economic livelihoods, and secure water

resources for millions of Americans and birds dependent on this critical natural resource. Thank you for your attention to this important issue and for your recognition of the opportunities to use natural infrastructure for water management in the arid west.



Julie Hill-Gabriel

Vice President, Water Conservation



*To advance the economic, social and environmental sustainability of Northern California
by enhancing and preserving the water rights, supplies and water quality.*

**David Guy
President
Northern California Water Association**

**Written Testimony for the United States Senate
Committee on Energy and Natural Resources
Subcommittee on Water and Power**

Oversight Hearing

***“To examine the viability of incorporating natural infrastructure in western water management and
policy to support economic development, protect watershed health, and build more resilient
communities”***

March 24, 2021

Chairman Wyden, Ranking Member and Members of the Subcommittee:

The Northern California Water Association (NCWA) represents the water districts, water companies, small towns, rural communities, and landowners that beneficially use both surface and groundwater resources in the Sacramento Valley. We are committed to advance the economic, social, and environmental sustainability of the Sacramento Valley by enhancing and preserving its water rights, supplies, and water quality for the rich mosaic of farmlands, cities and rural communities, refuges and managed wetlands, and meandering rivers that support fisheries and wildlife. We have tremendous opportunities in this region to utilize natural infrastructure to improve public safety and water supply reliability for multiple-benefits, including cities and rural communities, farms and ranches, birds, fish, other wildlife and recreation. Thank you for the opportunity to submit this testimony on incorporating natural infrastructure in western water management and policy and offer NCWA’s experience to this important conversation.

The Role of Floodplains in Water Management

Historic floodplains are increasingly seen as features of natural infrastructure that can be utilized to achieve improved fish and wildlife habitat, greater water security and drought resiliency, and increased flood protection. In the Sacramento Valley, NCWA and a broad group of partners that collectively make up the Floodplain Forward Coalition (Coalition) are pursuing a portfolio of locally-driven projects designed to reactivate floodplains and recapture the water management value of these lands.

Sacramento Valley Floodplain Reactivation

In response to severe floods in 1907 and 1909, a system of levees and bypasses were constructed throughout the Sacramento River system. To contain potential flood waters, riverbanks were raised with levees, and the historic sloughs that fed the floodplains with water and juvenile fish were either plugged entirely or replaced with weirs that quickly diverted high flood waters into flood bypasses. The result was a significant reduction in the frequency and duration of flooding on the historic floodplains.

These changes to the function of the Sacramento River system also had a negative impact on fish and wildlife species. In fact, this channelization of the River led to dramatic declines in salmon populations long before invasive species, large rim dams, and Delta water export facilities were introduced into the system. Based on modern science, we now know that floodplain wetlands act like natural incubators, growing abundant food for young fish to eat and producing more vibrant juvenile fish that are more likely to survive and return as large adult salmon. Waterfowl and shorebirds, as well as many other wetland species, also rely on food and habitat provided by a wetlands' habitat.

With the impacts of disconnected floodplains now understood, NCWA and the Coalition are committed to advancing projects that together will reactivate Sacramento Valley floodplains. Taking a 'landscape scale' approach to floodplain reactivation, the Coalition is working to complete a portfolio of early implementation projects that will improve habitat conditions for fish, birds and other wildlife and advance actions to aid with their recovery. These projects, and the accompanying scientific monitoring, will also serve as the foundation for the robust science program necessary to inform the decision-making and adaptive management essential to successful fish and wildlife recovery. This portfolio is the initial collection of projects that are being advanced in the Sacramento River Basin and fall in five categories:

- River Connections - Projects which reconnect rivers to their historical floodplains;
- In-River Function - Projects which enhance, restore and create in-river function & habitat;
- Floodplain Flow Corridors - Projects which improve/create flow conveyance infrastructure needed to reactivate floodplains;
- Floodplain Reactivation & Fish Food - Projects which reactivate floodplains and/or generate fish food;
- Science & Data Acquisition - Efforts which improve the knowledge base through research, experimentation and data collection.

Multiple Benefits of Floodplain Reactivation

Floodplain reactivation projects like those advancing in the Sacramento Valley produce multiple, year-round species and water management benefits by spreading out and slowing down water across this landscape to mimic natural floodplain processes. Shallow floodwaters that remain on the floodplain for many days, or preferably several weeks, allow farmers to cultivate rice and other crops for humans during the spring and summer; provide habitat for birds, reptiles, and other fauna in the fall; and food for migratory birds and juvenile native fish species in the winter.

Fish and Wildlife:

Floodplain based projects in the Sacramento Valley are being designed to provide habitat for multiple species and help rebuild the rivers food web. One primary fish benefit of these types of projects is improved rearing habitat. Studies have been shown that increasing the duration of continuously flooded acres increases high-quality habitat, rich in food resources that support the development, growth, and survival of salmon. Additionally, shallow, inundated floodplains produce high densities of zooplankton and invertebrates that are important food sources for many freshwater fish including Salmon, Sacramento Splittail, Longfin Smelt, Delta Smelt, and Green and White Sturgeon.

Migratory birds along the Pacific Flyway will also benefit from winter water practices that generate varied depths of floodplain habitat at key times for multiple species of waterfowl, shorebirds, and wading birds.

Water Supply and Flood Control:

Floodplain reactivation also has direct and indirect benefits on water supply storage and flood control. Historic floodplains often have natural characteristics that are favorable to aquifer recharge. By spreading water and increasing the length of time it stays on these lands, significant groundwater recharge and storage is expected to occur, which is particularly important as climate change is increasingly delivering California precipitation as rainfall instead of snow.

Agriculture has also proven to be the best way to cost-effectively control vegetation in the flood control bypass, and the projects being proposed by NCWA and the coalition help ensure farms can continue to operate.

For both water supply and flood control, healthy species populations help reduce the regulatory pressure on the flood and water system. Improvements to the health of the river ecosystem will improve the path for permitting the flood system repairs and improvements. Likewise, more abundant fish populations mean water supply will be more secure and less likely to be redirected to meet instream, species related requirements.

Importance of an Inclusive Process and Diverse Partnership

Landowners throughout the Sacramento River Basin are committed to working with conservation partners to advance floodplain reactivation projects that improve habitat for fish and wildlife, while maintaining farming and managed wetland operations. Advancing this new model for water management at landscape scale requires the commitment of a diverse coalition of conservation organizations, farmers and other landowners, local governments, water suppliers and academic institutions, and the collaboration amongst the many different groups and floodplain interests to date is exciting and promising. The Coalition has also benefitted greatly from the involvement and active collaboration with federal and state agencies. Their strong leadership, commitment and funding to work with us to reactivate the floodplains for all these multiple benefits is critical, and we look forward to our continuing efforts with our partners to implement this program in the Sacramento River Basin.

NCWA also recognizes that this new approach might affect certain land-uses and landowners. That is why we have maintained that realizing this vision to reactivate floodplains must be designed and implemented in a way that respects and addresses impacts to these land-uses. As we have seen in other parts of the west, achieving success at a basin-wide scale requires a commitment to put all of the projects benefits on equal footing and advancing them together. Prioritizing one set of interests over another can quickly erode the broad-based support needed to accomplish this type of re-visioning of water management in the Sacramento Valley.

Policy Recommendations

NCWA supported and appreciates this Subcommittee's work to enact a number of the Western water provisions included in the Omnibus Appropriations bill last year, including support for aquatic ecosystem restoration projects, the use of Airborne Snow Observatory programs to provide more accurate data about predicted snowmelt runoff and improve water system operations, and reauthorization of the Cooperative Watershed Management Program.

We encourage you to build on the provisions enacted last Congress by advancing legislation that supports floodplain reactivation and other supporting water projects, including reauthorizing and expanding the Bureau of Reclamation (BOR) infrastructure programs originally authorized in the WIIN Act of 2016 - language similar to that included in S. 1932 from the 116th Congress. We strongly support the extension

and expansion of the storage account and funding for water reuse and extension and expansion of the grant funding opportunities in S. 1932, authorizing BOR to increase its support for ecosystem restoration projects, including providing funding opportunities for Sacramento Valley floodplain reactivation projects and the Sacramento River Science Partnership Implementation.

We look forward to working with you as Congress considers important infrastructure legislation and thank you for the opportunity to submit testimony for this important hearing.

Reactivating our Floodplains – A New Way Forward for California

The Floodplain Forward Coalition

The Sacramento Valley is a rich mosaic of human settlement, farms, managed wetlands, and meandering rivers that support people, fisheries, and wildlife. Farms, rural communities and cities thrive next to wildlife refuges and rivers, and together they support millions of birds and other wildlife that have lived there for millennia.

Nearly all of the Sacramento Valley floor is part of the historic floodplain—the naturally flood prone areas surrounding the river. Before levees and dams were built to protect people from catastrophic floods, this floodplain supported robust fish and wildlife populations.

Farmland (primarily ricelands), wildlife refuges, and the bypasses designed for flood protection can be managed to work together for dynamic conservation and to mimic the historic floodplain in the Sacramento Valley, while continuing to provide flood protection for Sacramento and other parts of the Valley. Spreading out and slowing down water across this landscape mimics natural flows and provides multiple benefits year-round by allowing farmers to cultivate rice and other crops for humans during the spring and summer, habitat for wild birds, reptiles, and other fauna in the fall, and food for migratory birds and native fish species in the winter. This holistic water management can bring our ecosystem to life through the careful interaction of water, sun and land.

The Sacramento Valley is fertile ground for developing a new path forward for holistic water management that incorporates best available science and practical know-how of farm and refuge managers to reactivate the floodplain in a way that:



Embraces the best available science and the work of leading scientists from the University of California and throughout the world who are demonstrating the value and importance of reactivating floodplains as the key element to improve conditions for fish and wildlife within a managed water system like the Sacramento Valley. See the U.C. Press book: [Floodplains: Processes and Management for Ecosystem Services](#).



Engages many forward-thinking landowners in the Sacramento Valley who are implementing environmental farming practices and wetlands management techniques that reactivate the traditional floodplain for multiple benefits. This includes fish growing in fields in the [bypasses](#) producing [food for salmon on farm fields](#); the [Delta Smelt food program](#) for the north Delta; and reconnecting oxbows (i.e., [Bullock Bend](#)) to the river channel.





The Floodplain Forward Coalition



Supports the return of birds and other species along the Pacific Flyway and builds on the environmental success in the Sacramento Valley, where collaborative partnerships between scientists, conservation groups, agencies, and landowners have resulted in farms, refuges and managed wetlands providing essential habitat for waterfowl and shorebirds.



Recharges precious groundwater consistent with state policy recognizing that "sustainable groundwater management in California depends upon creating more opportunities for robust conjunctive management of surface water and groundwater resources. Climate change will intensify the need to recalibrate and reconcile surface water and groundwater management strategies." (Water Code §10720.1)



Supports California's Unique Biodiversity and Executive Order N-82-20 by accelerating nature-based solutions within the floodplain and providing a model that may be applied elsewhere in the state.



Provide nourishment, spawning and safe rearing and migration for salmon as learned from the reconnection of Butte Creek with the floodplain in Butte Sink and Sutter Bypass.



Utilizes regional conservation investment strategies that encourage voluntary regional planning processes designed to help California's declining and vulnerable species by protecting, creating, restoring, and reconnecting habitat that will contribute to species recovery and adaptation to climate change and resiliency (i.e., the [Central Valley Habitat Exchange](#)).



Harmonizes water uses for the environment and farming by providing an ecosystem water budget that serves ecological values in a way that is complementary to other water uses in the region (See [PPIC Report](#)).



Implements and improves dynamic conservation strategies designed to create, retain and enhance habitat in temporary and adaptable ways, which will reinforce the value of floodplains and help species persist in a changing world. Developing and deploying dynamic conservation strategies is especially important for migratory species—both birds and salmon. Dynamic conservation strategies will become increasingly important for biodiversity conservation, especially as a means of facilitating adaptation to climate change and its concomitant variability and extremes, such as extended drought.





Laura Ziemer
Senior Counsel and Water Policy Advisor

March 24, 2021

**Senate Energy and Natural Resources Committee's Subcommittee on Water and Power
 Hearing on *Natural Infrastructure and Western Water Management*.**

Chairman Wyden, Ranking Member Hyde-Smith, and Subcommittee members:

Thank you for holding this important hearing on the power of natural infrastructure to make vital contributions to sustainable water management in the West. Trout Unlimited (TU) and its over 300,000 members and supporters nationwide support and implement natural infrastructure projects. TU's mission is to conserve, protect, and restore North America's trout and salmon fisheries and the watersheds they depend on. In pursuit of this mission across the West, TU has worked with ranchers, farmers, states, Tribes, federal, state, and local agencies, local contractors, businesses, and many other partners to restore streams while also sustaining working lands and vibrant communities.

TU recently testified before House Natural Resources Committee's Water, Oceans, and Wildlife Subcommittee regarding the return on investment of natural infrastructure projects in terms of job creation, economic recovery, and climate resilience. TU presented on-the-ground project examples and academic literature showing that investments in watershed restoration benefits local communities and economies while building ecological capacity for climate resilience. Indeed, a [recent USGS study](#) found that between \$2.2 and \$3.4 million in total economic outputs are contributed to the U.S. economy for every \$1 million invested in ecosystem restoration.

TU's recent testimony before the Water, Oceans, and Wildlife Subcommittee is attached here for the record in this hearing. TU appreciates the Water and Power Subcommittee's leadership in promoting the key role of natural infrastructure to support sustainable water use in the West.

Yours truly,

Laura Ziemer



Laura Ziemer
Senior Counsel and Water Policy Advisor

March 11, 2021

**Statement of Laura Ziemer, Senior Counsel and Water Policy Advisor for Trout Unlimited
House Natural Resources Committee's Subcommittee on Water, Oceans, and Wildlife
Hearing on *Building Back Better: Water, Oceans and Wildlife*.**

Chairman Huffman, Ranking Member Bentz, and Subcommittee members:

Thank you for the invitation to testify today on behalf of Trout Unlimited (TU) and its over 300,000 members and supporters nationwide. TU's mission is to conserve, protect, and restore North America's trout and salmon fisheries and the watersheds they depend on. In pursuit of this mission across the West, TU has worked with ranchers, farmers, states, Tribes, federal, state, and local agencies, local contractors, businesses, and many other partners to restore streams while also sustaining working lands and vibrant communities.

1. Building Economic Recovery, Climate Resilience, and Racial Justice with Water Investments.

The Coronavirus pandemic threw [millions](#) of Americans out of work and shuttered businesses. Climate change trends hit home when [millions](#) of acres burned in scorching wildfires across the West and winter storms hit southern states ill-prepared for extreme weather. At the same time, racism's fault lines and societal inequities drew [millions](#) to the streets in protest. 2020 set unprecedented records for the number of unemployed, the number of acres burned, and the number of supporters for racial justice who turned out across the country. The co-equal priorities to build economic recovery, climate resilience, and racial justice—simultaneously—have never been more important.

The fate of the West across these issues is inextricably tied to its water. Federal investment in western water builds economic recovery when we repair and modernize irrigation water delivery infrastructure; it builds climate resilience when we efficiently recycle and re-use water and restore the West's great river systems; and it builds racial and social justice when we ensure Tribal and rural communities' access to clean drinking water and resolve Tribal water rights.

The Great Recession in 2009 and subsequent passage of the American Recovery and Reinvestment Act (ARRA) provide precedent for using conservation and restoration programs to get people back to work and improve our water supplies and river health. The combination of a warming climate, long-term drought, and population growth threaten the ecological viability of western rivers critical for people, fish, and wildlife. Modern solutions that provide multiple benefits must be responsive to the co-equal priorities of economic recovery, climate resilience, and racial justice. Such modern solutions are also key to responding effectively to the West's water needs.

Trout Unlimited: America's Leading Coldwater Fisheries Conservation Organization
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TU's testimony today reflects our decades of place-based experience in the West. Our experience has taught us that working in support of Tribal water settlements aligns with river restoration and healthy communities. Our work in the rural corners of the West has taught us that partnerships to restore rivers must also sustain the people who work the land. Our work in state capitals and the halls of Congress has taught us that solutions to water scarcity must work at the basin scale for cities, agriculture, Tribes, and fish and wildlife. This work is neither easy nor fast; but the slow, difficult work of finding new ways to address water scarcity creates durable solutions that advance the health of our economies, rivers, and communities.

2. Economic Recovery and Western Water Investments.

The Colorado River Basin is emblematic of the West's needs for federal investment in water resources. More than 40 million people rely on the Colorado River and its tributaries for their water, and these rivers irrigate over five million acres of ranch and farmland, providing food and forage for people across the country. The economic importance of the Colorado River alone is estimated at over [\\$1.4 trillion annually](#). Finally, the Colorado River Basin is home to dozens of Tribal nations with substantial water interests; the federal government has not always included Tribes in water decision-making, although that has begun to change.

Despite the Basin's economic, ecological, and cultural importance, its largest reservoirs are now at historic lows due to a 21-year drought and growing demands. According to the Bureau of Reclamation, by 2060, demand for water from the Colorado River may exceed supply by more than a million acre-feet. While the federal role is more prominent in the Colorado River Basin than in any other western watershed, federal investment to address the challenges facing the Colorado River Basin—and watersheds across the West—will help the United States Build Back Better.

The following funding recommendations are based on the need for substantial investment in 21st-century western water infrastructure, water supply security, and ecological resiliency, as listed below. In addition, any infrastructure package as a whole should both improve water supply and benefit environmental conditions across watersheds; and, individual projects must minimize or avoid environmental harm:

- Increase funding to Reclamation for **WaterSMART programs**, including full funding for the **Cooperative Watershed Management** program.
- Increase funding to Reclamation for construction of water recycling and reuse projects, including **Title XVI authorized projects**.
- Increase funding to Reclamation for implementation of “natural infrastructure” strategies, including restoring natural watershed storage functions.
- Increase funding for increased municipal water conservation measures, including for low-income and economically disadvantaged communities.

- Increase funding to Reclamation for upgrades to irrigation water delivery infrastructure in ways that deliver ecosystem benefits or groundwater sustainability.
- Extend deposits into the **Reclamation Water Settlements Fund** for at least 10 years.
- Increase funding for construction of authorized Tribal water rights settlement projects.
- Full funding to Reclamation for the **Aquatic Ecosystem Restoration Program** (newly created program in FY21 Omnibus).
- Increase funding for water desalination infrastructure projects that avoid environmental harm.
- Increase funding for USGS stream gauge installation and maintenance in priority locations.

Infrastructure investment creates jobs and supports economies. Western water infrastructure investment multiplies these federal dollars by the long-term sustainability it creates. This is true across investments in **watershed restoration, municipal water infrastructure, and irrigation infrastructure.**

- a. Watershed Investment:** Restoration investment results in both immediate job creation as well as sustained, long-term economic growth.

The “natural infrastructure” investment identified above has a similar economic multiplier as investments in traditional, built infrastructure. North of the Colorado River Basin, the [story](#) of TU’s restoration of Cedar Creek on Montana’s Lolo National Forest demonstrates this multiplier effect: 96% of the \$486,033 budget went to local firms, who put a dozen people to work on the job. All fuel, grass seed, and road gravel were purchased locally. Darin Haskins, principal of the small business Haskins Excavating in the small, rural town of Superior, employed three additional local operators. Darin also traveled to Washington, D.C. for the first time in his life to receive a national award with TU from the Forest Service for the project’s outstanding conservation benefit. The restoration broke a stalemate between timber and fish interests that had been playing out in Superior for several years, where concerns over imperiled bull trout populations in Cedar Creek had blocked a timber sale on the Lolo National Forest that was anticipated as an important economic opportunity for the town of Superior. TU designed the project to use timber receipts to help bull trout by rerouting the Cedar Creek Road out of the stream corridor, rebuilding and reconnecting a functional floodplain, and installing dozens of log structures to improve habitat. The project allowed the timber sale to move forward because it restores the fluvial processes that build and maintain habitat. It showcases TU’s pragmatic approach to restoration and the multiplier effect of restoration projects investing in local jobs and long-term sustainability.

Academic economic research bears out TU’s on-the-ground experience. Professor Todd K. BenDor *et al.*, compiled estimates of job creation from investment in restoration in their paper [Exploring and Understanding the Restoration Economy](#) (2014), from which this table is excerpted:

Table 2. Variation in job impact estimates by project type and geographic scale. For estimates in Garrett-Peltier and Pollin (2009), see Heintz et al. (2009) for the methodology used to derive the multipliers.

Type of Restoration	Jobs per \$1M Invested	Geographic Scale (State)	Source
Forest, land, and watershed	39.7	National	Garrett-Peltier and Pollin (2009)
Invasive species removal	33.3	State	Edwards et al. (2013)
Grassland	13.0	County	Derived from DOI (2012)
Upland	15.0	State (OR)	Neilson-Pincus and Moseley (2010)
Wetland	6.8	County	Derived from DOI (2012)
Wetland	12.9	State (MA)	Industrial Economics, Inc. (2012)
Wetland	17.6	State (OR)	Neilson-Pincus and Moseley (2010)
Tidal marsh	7.1	County	Derived from DOI (2012)
Fish passage	10.4	State (MA)	Industrial Economics, Inc. (2012)
Fish passage	15.2	State (OR)	Neilson-Pincus and Moseley (2010)
Fish passage/dam removal	18.2	State	Edwards et al. (2013)
Dam removal	10.3	State (MA)	Industrial Economics, Inc. (2012)
Dam removal	20.5	State (CA)	Kruse and Scholz (2006)
River	9.7	County	Derived from DOI (2012)
In-stream	14.7	State (OR)	Neilson-Pincus and Moseley (2010)
In-stream	31.5	State (MT)	Shropshire and Wagner (2009)
Hydrologic reconnection	14.6	State	Edwards et al. (2013)
Riparian	19.0	State	Edwards et al. (2013)
Riparian	23.1	State (OR)	Neilson-Pincus and Moseley (2010)
Oyster reef	16.6	State	Edwards et al. (2013)
Oyster reef	20.5	County	Kroeger (2012)

Because restoration activities focus on revitalizing localized habitats, BenDor and his co-authors found that investment in these activities bolstered local economic benefits with up to 80 cents of each dollar staying local. Additionally, compensation from restoration jobs compares favorably to average wages in other sectors, as a subsequent study by BenDor *et al.*, [Defining and Evaluating the Restoration Economy](#) (2015), showed. Moreover, a [recent USGS study](#) found that between \$2.2 and \$3.4 million in total economic outputs are contributed to the U.S. economy for every \$1 million invested in ecosystem restoration. As TU's on-the-ground project experience and the academic literature show, investing in watershed restoration benefits local communities and economies while building ecological capacity for climate resilience.

- b. Municipal & Industrial Investment:** Multiplies immediate jobs with long-term sustainability, but demand for Title XVI projects far outstrips available funding.

Investment in municipal and industrial water recycling, re-use, and desalinization (where appropriate) also [creates jobs](#), and these jobs likewise support long-term economic growth by creating water security for municipal and industrial water users. Congress authorized the Bureau of Reclamation to reclaim wastewater for municipal or industrial nonpotable water supplies in 1992 under Title XVI of P.L. 102-575. The federal share for so-called "Title XVI" projects is limited to 25% of project costs. This original Title XVI legislation authorized construction of five projects to reclaim wastewater and six wastewater reuse and groundwater recycling studies. Subsequent congressional amendments to Title XVI brought the number of authorized projects up to 53. Most recently, the Water Infrastructure Improvements for the Nation (WIIN) Act in December 2016 (P.L. 114-322) made changes to Title XVI allowing an additional 54 projects to be approved under WIIN Act authority.

Relying on Reclamation data, the Congressional Research Service's [Report 46471](#), *Federally Supported Projects and Programs for Wastewater, Drinking Water, and Water Supply Infrastructure*, at 13 (July 30, 2020) estimated that the “backlog of remaining federal funding needed to construct the 107 authorized Title XVI projects (*i.e.*, both ‘traditional’ and WIIN Act authorized projects) exceeded \$1 billion.” The demand for nonpotable water recycling and re-use projects is high, but the demand for the 25% federal cost-share for even already-authorized projects far exceeds current funding.

- c. Irrigation Infrastructure Investment:** Benefits to agricultural sustainability and rivers for multi-benefit projects multiply job-creation of infrastructure project.

Investment in irrigation infrastructure projects generate much-needed jobs in rural communities. They provide needed upgrades to aging water-delivery systems and can enhance stream flows for better conveyance of surface water to points of diversion and better aquatic habitat. The Western Agricultural and Conservation Coalition (WACC) supports and encourages such multi-benefit irrigation infrastructure projects. The WACC is made up of agricultural and conservation organizations, including the Family Farm Alliance, California Farm Bureau Federation, Farmers Conservation Alliance, and TU. WACC member, Marc Thalacker, Manager of the Three Sisters Irrigation District (TSID), has led by example in piping 55 of 64 miles of canal, installing a fish screen, building fish-friendly hydropower, and permanently returning 34 cubic feet per second (cfs) to the creek so that salmon and steelhead can swim through Sisters, Oregon for the first time since 1885. TSID's modernization [story](#) includes diverse partnerships and persistence, and agricultural benefits of drastically-lower pumping costs, high-efficiency sprinklers, reliable water delivery, higher crop yields, and generation of 4 million kilowatt hours of green energy. The Farmers Conservation Alliance estimates that the cumulative impact of their irrigation modernization work with districts like TSID has supported [22,790](#) short-term jobs.

- 3. Climate Resilience and Western Water Investments:** Water and fire are the West's greatest expressions of climate change.

Water and fire are the West's greatest expressions of climate change. This makes water investments a top priority for building climate resilience. The three pillars of western water climate resilience are:

- I. **First Pillar—Water Security:** investments in water infrastructure contribute to both basin-scale and individual water users' water security.
- II. **Second Pillar—Fish Passage:** investments in water infrastructure ensure fish passage and aquatic habitat connectivity.
- III. **Third Pillar—Environmental Flows and Natural Infrastructure:** investments preserve environmental flows and restore watershed function through nature-based solutions.

Smart water investments are needed across all three pillars of western water climate resilience.

a. First Pillar—Water Security

The Yakima River Basin's Integrated Plan is a high-priority stimulus investment because its projects are planned and prioritized as important contributions to the economic and water security of the basin as a whole—including the basin's robust agricultural community, Tribal community, and the recovery of its imperiled fish and wildlife. The Bureau of Reclamation funds multi-benefit projects to implement the Yakima Integrated Plan from the Water and Related Resources account within the agency's annual spend plan. For example, TU has partnered with the Kittitas Reclamation District (KRD) on canal lining and piping, which then allows conveyance of that conserved water to streams key to imperiled salmon and steelhead. The story, [here](#), of this on-going project illustrates the important economic multiplier of well-designed projects like this one that are part of the Yakima Integrated Plan implementation.

TU and our WACC (Western Agricultural and Conservation Coalition) partners' deep experience in multi-benefit water delivery infrastructure projects that increase water security for all users demonstrate that there are **five keys to unlocking multi-benefit irrigation infrastructure**:

- **Define Shovel-Ready** such that it includes projects that can proceed to construction between 1-3 years from date of project application so that the best projects have time for project permitting and final design work to incorporate co-benefits such as improved streamflows, fish-friendly hydropower, or co-locating fiber optic cable along ditch easements;
- **Invest in Project Planning** for some projects in order to meet high goals for providing multiple benefits;
- **Provide Higher Federal Cost-Share** for those best-in-class projects to produce benefits such as improving stream flows, providing fish passage, or burying energy transmission lines along with buried pipe in order to reduce wildfire risk from exposed lines;
- **Delay Match Repayment** for the non-federal share over a decade, creating a revolving fund of incoming reimbursement dollars for federal funds advanced to cover full project costs initially, to enable support for additional projects over time.
- **Coordinate Permitting across Federal Agencies** and facilitate state and federal agency coordination to advance project planning and execution.

The Bureau of Reclamation's WaterSMART program provides important funding for irrigation infrastructure investment through its Water and Energy Efficiency Grants and Small-Scale Water Efficiency Projects under the WaterSMART umbrella. Congress' amendment to Reclamation's WaterSMART program in the FY2021 Omnibus bill authorized up to a 75% federal cost share for multi-benefit projects like TSID's. Although Reclamation has the statutory authority to provide pre-development capital or planning funding to facilitate high-performing projects like TSID's, described above, that provide important co-benefits and increase water security for all users, the agency has not implemented this authority to date under WaterSMART.

b. Second Pillar—Fish Passage and Aquatic Connectivity.

Connecting aquatic habitat around dams and diversions with fish passage structures is key to allow species like salmon and steelhead that cover great distances during their lifespan to access their full habitats. These engineered pathways are also one of the only ways of providing effective migration corridors for fish that respond to shifts in habitat suitability by moving away from water that has become too warm. Unfortunately, many dams and diversions were built over a century ago when little was understood about fish passage or salmon migration.

The new **Aquatic Ecosystem Restoration Program** added to Reclamation's program portfolio in the year's-end Omnibus bill is an encouraging response to this dilemma of aged infrastructure and modern urgency. Authorized at \$15 million/year, it provides broad authority for Reclamation to assist in and fund fish passage improvement and aquatic habitat enhancement, including removal of dams or other aging infrastructure if a project is supported by a broad multi-stakeholder group and maintains water security for all involved.

In the early implementation of this new program, Reclamation should work with the broad community of fisheries professionals to ensure a robust monitoring and adaptive management plan for up-stream and down-stream passage of the imperiled pallid sturgeon at the newly-rehabilitated Intake Diversion Dam and Bypass Channel on the lower Yellowstone River in Montana. The original infrastructure was one of Reclamation's first projects after the Reclamation Act of 1902 created the agency, and it still serves the Lower Yellowstone Project today, providing irrigation water for about 58,000 acres through 225 miles of canals.

Another priority to consider for the Aquatic Ecosystem Restoration Program is Bureau of Reclamation support for the ambitious Northern California's Potter Valley Project [collaborative](#). This multi-stakeholder effort is investigating options around aging infrastructure in the Eel River watershed to restore passage for Chinook salmon, summer steelhead, and other species above Scott Dam on the Eel River while meeting water users' needs in both the Eel and Russian river basins.

c. Third Pillar—Environmental Flows & Natural Infrastructure.

Drought resilience and flood-risk reduction start with intact hydrologic processes and healthy forest conditions at the landscape scale. This third pillar of climate resilience also requires built infrastructure that works with, rather than against, riverscapes. Examples include flows below dams that mimic a natural hydrograph and provide adequate aquatic habitat; diversion structures that avoid armoring banks or push-up dams; and, roads and bridges built to give rivers room to roam.

Healthy watersheds provide ecosystem services critical for natural and human communities and are key to improving resilience to climate change and reducing long-term severity of climate impacts. TU follows a watershed-scale approach that reconnects fragmented fish populations isolated by fish migration barriers and restores refugia habitat and water quality. These investments are not only good

for imperiled fish populations, but by restoring fluvial processes that create and maintain habitat, these watershed restoration projects also restore the ecosystem services of flood-risk reduction and drought tolerance that increase climate resilience across a watershed.

Investing in watershed restoration to build climate resilience can be accomplished by:

- Increasing funding for the ***Pacific Coastal Salmon Recovery Fund***: through which NOAA provides funding to the states and tribes of the Pacific Coast region to implement projects that restore and protect salmon and steelhead populations and their habitats.
- Increasing funding for ***NOAA's Habitat Conservation and Restoration Program***, which restores fisheries, revive populations of protected species, and improve the resiliency of coastal communities. Within this program, TU is particularly supportive of the ***Community-Based Restoration Program (CBRP)***. The CBRP supports locally driven and voluntary coastal restoration projects with national, regional, and local organizations through competitively awarded public-private partnerships.
- Increasing funding for ***USFWS, National Fish Passage Program***: This program enables partners to fix obsolete culverts and remove outdated barriers to fish passage to increase fish habitat and improve the health of watersheds. The Fish Passage Program has identified approximately 484 high-priority fish passage projects (primarily culverts, bridges, or water diversions) across the country with a conservative cost estimate of \$23 million.
- Increasing funding for ***USFWS, Partners for Fish and Wildlife Program***: This program, currently authorized at \$75 million, is one of the USFWS's best programs for working with private landowners. For example, TU has partnered with farmers on working lands in the upper Potomac River drainage in West Virginia to provide over two million feet of fencing and water resource protection to restore eastern brook trout and enhance farm operations.

An example of these programs at work is NOAA's ***Community-Based Restoration Program*** funding support of TU's North Coast Coho Project. TU started this project in California over 20 years ago as a multi-stakeholder, partnership-driven initiative involving industrial timber companies, other landowners, local watershed groups, private foundations, and state and federal agencies. To date, the North Coast Coho Project has initiated over 124 projects. Among them are the removal of 11 fish migration barriers that opened access to approximately 61 miles of upstream habitat, such as this barrier-removal [project](#) along the "Skunk Train" railway. The North Coast TU partnership has treated 113 miles of stream with over 6,265 pieces of large wood and 264 miles of road preventing 632,360 yards³ of sediment (equal to about 63,000 dump trucks). The program is successful in implementing 8-12 projects per year across three, northern California counties due to its history of implementing numerous process-based restoration activities at a regional scale, and because of its extensive partnerships with public agencies and private entities.

The North Coast Coho Project works to restore ecosystem processes to create resilient summer and winter refugia and to mitigate the impacts of climate change to North Coast salmonids. This restoration makes the coastal watersheds of northern California more climate resilient for its communities and

imperiled salmon. In addition, habitat restoration in coastal areas generates, on average, [17 jobs per million dollars spent](#), which is higher than extractive industries such as coal and gas.

4. Tribal Sovereignty and Western Water Investments.

Tribal water right settlements are an important federal investment to support Tribal sovereignty and water management. Negotiated settlements allow tribes, states, and local water users to greater certainty on difficult issues of title to water, and they promote Tribal self-determination. Settlements also allow the parties to develop creative solutions to overarching water resources issues. Congress has enacted at least 34 Tribal water settlements, including the recent passage in the year's-end Omnibus bill, for example, of the [Navajo-Utah Water Rights Settlement](#), which affirms the tribe's right to 81,500 acre-feet of water per year and provides \$210 million in federal funding for clean water access for communities on the Navajo Nation at a time when the lack of running water on the reservation has exacerbated the effects of the COVID-19 pandemic there.

Federal funding is one of the key factors in making settlements actionable for the health and welfare of Tribes and surrounding communities, and for creating water certainty and economic-development opportunities in the West. Funding Tribal water settlements is needed to secure new water supplies, to build or rehabilitate infrastructure required to deliver water, and to protect resources such as treaty fishing rights that are of critical importance to Tribes.

In 2009, Congress created the **Reclamation Water Settlements Fund**, [P.L. 111-11, Sec. 10501](#), which authorizes the deposit of funds that would otherwise be deposited into the Reclamation Fund, into a separate account within the U.S. Treasury. Currently, the Secretary of the Interior is authorized to expend from the Reclamation Water Settlements Fund, without further appropriation, up to \$120 million a year of the amounts deposited through FY 2029, plus accrued interest, in each of the years from FY 2020 to FY 2034. The Secretary may use money in the Reclamation Water Settlements Fund to implement congressionally approved water rights settlements, if the settlement requires the Bureau of Reclamation to provide financial assistance, or to plan, design or construct water supply infrastructure. [H.R. 1904](#) would make the Reclamation Water Settlements Fund permanent so that additional Tribal water settlements can be implemented. TU supports its passage.

5. Conclusion.

TU's experience in grappling with water security in the West over the last twenty years involves key federal elements to support successful efforts: support for collaborative, watershed-scale solutions; bringing financing to these solutions based on streamlined federal funding and public-private partnerships; using and advancing the best science, technology, and tools applied to water management; and recognizing that these watershed-scale, locally-driven solutions require the

development of a portfolio of projects addressing watershed and flow restoration, reliability of irrigation water supply, Tribal water rights, and security of municipal water supply.

TU appreciates the attention given by this Committee to western water issues, and I thank you again for the opportunity to testify today.

Yours truly,



Laura Ziemer

