

AGING WATER INFRASTRUCTURE

HEARING
BEFORE THE
SUBCOMMITTEE ON WATER AND POWER
OF THE
COMMITTEE ON
ENERGY AND NATURAL RESOURCES
UNITED STATES SENATE
ONE HUNDRED THIRTEENTH CONGRESS
FIRST SESSION
TO
RECEIVE TESTIMONY ON THE ISSUES ASSOCIATED WITH AGING WATER
RESOURCE INFRASTRUCTURE IN THE UNITED STATES

JULY 25, 2013



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AGING WATER INFRASTRUCTURE

THURSDAY, JULY 25, 2013

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. Brian Schatz presiding.

OPENING STATEMENT OF HON. BRIAN SCHATZ, U.S. SENATOR FROM HAWAII

Senator SCHATZ. Good afternoon.

Today the Subcommittee on Water and Power is holding an oversight hearing on aging water infrastructure in the United States. In 2008 this subcommittee held a similar hearing and we learned then that the maintenance backlog for the Bureau of Reclamation's water facilities alone exceeded \$3.2 billion. Unfortunately this situation hasn't improved much in the last 5 years.

In fact we just witnessed a near disaster right here in the Nation's capital when water in Prince George's County was nearly shut off to tens of thousands of residents during the hottest week of the summer due to an aging water main that was about to collapse. This incident has brought much needed attention to today's hearing topic.

Just this year the American Society of Civil Engineers gave the United States a D or worse for nearly every water infrastructure category on its report card. This is not acceptable because the impacts of a failing water system can be profound. Dam failures pose a significant risk to the safety of our communities and deteriorating water treatment facilities can lead to water borne illnesses.

In my home State of Hawaii these impacts are well known to residents. In 2006, after more than 40 days of rain, the privately owned Kaloko Reservoir Dam on Kauai failed releasing more than 300 million gallons of water on the community below and killing 7 people. The dam was more than 100 years old and had never once been inspected prior to its failure.

Recently the waste water system on Oahu failed causing tens of thousands of gallons of raw waste water to contaminate nearby streams.

While these examples highlight failures at non-Federal facilities much of the large water infrastructure in the Western United States including dams, levees and irrigation structures is operated

or maintained by either the Bureau of Reclamation or the Army Corps of Engineers.

The Bureau of Reclamation is the Nation's largest wholesale water supplier serving more than 31 million people, providing irrigation water for 10 million acres of farm land and is the second largest producer of hydroelectric power in the West.

The Army Corps of Engineers maintains over 700 dams with 353 hydropower generating units that can provide up to 25 percent of our country's hydropower.

As Chair of this subcommittee I often think about the connection between energy and water. The topic of aging infrastructure is a critical component of the energy/water nexus. So much of our water infrastructure is tied to energy.

Hydropower is the obvious example, but water infrastructure is also responsible for irrigation which helps to grow our biofuels and is used for cooling at power plants and used to extract and move energy resources such as coal, oil and gas. When our water infrastructure begins to break down not only do we lose water through leaky pipes, we also waste energy. So aging water infrastructure quickly becomes a topic of concern for those of us interested in the production of energy and energy efficiency.

The economic impacts of unreliable water delivery and waste water treatment services increase costs to businesses and to households. According to a report from the American Society of Civil Engineers, between now and 2020 the cumulative loss to the Nation's GDP would be over \$400 billion. Disruptions to electric generation due to aging water infrastructure will also increase the cost of electricity to those states and regions that use Federal hydropower.

Many challenges exist in managing and financing the upgrades and repairs needed to mitigate the impacts of aging water infrastructure. Further, severe weather events are increasing stresses on existing facilities. Floods will strain waste water systems and ongoing drought will mean reduced hydroelectric power generation.

I'm hopeful that today's hearing will provide the subcommittee with a holistic look at aging water infrastructure by including the Federal perspective from the Bureau and the Army Corps, as well as the local perspective with DC Water. I hope we can begin the discussion on possible solutions to address this ongoing problem.

I want to welcome all of our witnesses to the committee today. I look forward to hearing from them.

Now I'd like to turn to our Ranking Member, Senator Barrasso, for comments.

**STATEMENT OF HON. JOHN BARRASSO, U.S. SENATOR
FROM WYOMING**

Senator BARRASSO. Thank you, Mr. Chairman.

I'd like to join you in welcoming our witnesses today. I'm pleased to be sitting in for subcommittee Ranking Member Michael Lee from Utah. He and I share the same concerns regarding addressing aging infrastructure, especially in the West where the Bureau of Reclamation facilities are located.

Water is the most fundamental issue in my home State of Wyoming. The need to provide a clean, abundant supply of water is essential to the survival of the Intermountain West. The infrastruc-

ture we have today in my home State and across the Nation is aging.

Where the weak points are? We don't fully know.

The longer we wait. The more likely these facilities will fall into disrepair.

This will impact the economic livelihood of ranchers and farmers in Wyoming and across the West that rely on these facilities to provide water.

I'm very pleased that the Interior Department and its leadership has been—actually I'm very concerned that the Interior Department and its leadership has been less than forthcoming about the depth and scope of these problems. I'd asked then Interior Secretary nominee, Sally Jewell, during her confirmation hearing the following with regard to the Bureau of Reclamation's backlog.

I asked the question, "Most of the agency's infrastructure has an average age of over 50 years. In 2008 Reclamation testified before this committee that maintenance needs on Reclamation facilities exceeded \$3.2 billion. What's the current estimated backlog?"

Her response was, she says, I understand that addressing the Bureau of Reclamation's aging infrastructure is a priority for the Department. She went on to say, I recognize Reclamation's important role in delivering the water and power to the West and will work with my colleagues in the Bureau in the Department to better understand and address the challenges it faces.

Mr. Chairman, this is a non answer.

I find it hard to believe that the then nominee Jewell and the staff at Interior couldn't answer the basic question which is the current estimated backlog. This is consistent with the responses I've gotten from the Agency on what the backlog of projects is in my home State of Wyoming. When I requested a State-wide backlog project repair list I received a sheet with 18 backlog projects.

No dollar figure associated with the repair projects listed.

The repair descriptions were very abbreviated, not taking up, you know, mostly taking up maybe 5 or fewer words.

This doesn't give me a good idea of what the repair projects are or what are the highest priority and what these projects are going to cost.

So in addition, Mr. Chairman, I asked ten written questions related to this topic to Interior Secretary Jewell as part of the June 6 full committee hearing on the programs and activities of the Department of the Interior. So today is July 25, we're well over a month beyond when I asked the questions. Still don't have any answers.

Among these questions are what's the current estimate of Reclamation's indicated maintenance backlog?

Does the Bureau of Reclamation maintain a listing including dollar amounts of Reclamation's deferred and indicated maintenance needs at the project level?

Even how much of this information is publicly available?

It would just seem much more productive though that I and our colleagues on this committee be afforded answers to these questions prior to a hearing like the one today on this topic. It's not a partisan issue, Mr. Chairman. Any Senator with aging infrastruc-

ture should be very concerned and is concerned about addressing these problems.

I want to work together with my colleagues to get the answers that all of us need to find the solutions that we need to improve the aging water delivery system in the Bureau of Reclamation and the Army Corps facilities across the country.

Thank you, Mr. Chairman.

I look forward to the testimony.

Senator SCHATZ. Thank you, Ranking Member Barrasso.

Now let me take a moment to introduce our distinguished panel. We have 5 witnesses today.

Mr. Lowell Pimley, the Deputy Commissioner of Operations for the Bureau of Reclamation.

Mr. James Hannon, the Chief of Operations and Regulatory Affairs at the United States Army Corps of Engineers.

Mr. Charles Stern, a specialist in natural resources policy for CRS.

Dr. Gerald Galloway, a professor of engineering at the Department of Civil and Environmental Engineering at the University of Maryland.

Mr. Charles Kiely, the Assistant General Manager of the District of Columbia Water and Sewer Authority.

Gentlemen, thank you for being here and welcome. Your full testimony will be included in the hearing record. So please take 5 minutes to summarize your testimony.

Mr. Pimley, please proceed.

STATEMENT OF LOWELL PIMLEY, DEPUTY COMMISSIONER OF OPERATIONS, BUREAU OF RECLAMATION, DEPARTMENT OF THE INTERIOR

Mr. PIMLEY. Thank you.

Chairman Schatz, Ranking Member Barrasso, I'm Lowell Pimley, Deputy Commissioner of Operations, Bureau of Reclamation.

Thank you for the opportunity to be here today alongside the Corps of Engineers and the other distinguished members of this panel to discuss the issues associated with aging infrastructure in the United States. My full statement has been submitted for the record. I would like to proceed with a few brief remarks.

As the owner and operator of the largest number of facilities across the West, Reclamation is aware of the many challenges faced by agencies operating and maintaining water and power facilities. Reclamation is proactively maintaining and improving its existing infrastructure for system reliability, safety and sustained water conservation. Action is required to address future water supply and power generation challenges given anticipated increases in population and renewed emphasis on domestic energy production and the need for aquatic water supplies—or I'm sorry adequate water supplies.

Maintaining our infrastructure is becoming more costly over time due to the conditions of some of our components, cost increases in the broader economy and the need for additional facilities, rehabilitation, replacement and extraordinary maintenance. Most of Reclamation's major dams, reservoirs and hydroelectric plants and irrigation systems are 60 or more years old. A facility's age is not the

sole measure of its condition, but the condition of each component really is the central factor in the long term maintenance needs of the general asset.

In order to address reliability, efficiency and safety of our assets we've developed several programs detailed in my written statement. We will continue to work to improve the way we provide maintenance and rehabilitation of our entire portfolio of infrastructure to ensure that it is sound, safe and reliable.

For example, Reclamation has partnered with my colleague to the left, the Army Corps of Engineers, to address infrastructure, modernization challenges related to hydropower through the Hydropower Modernization Initiative. The program that assesses and prioritizes the inventory or the investment needs of federally owned hydropower facilities. Results from that program allowed Reclamation to assess potential capacity increases in our 58 hydroelectric plants to estimate incremental energy increases from efficiency gains and to estimate potential greenhouse gas offset that could be a credit to those energy increases.

In 1948 Reclamation initiated its facility review program to assess the condition of assets constructed by Reclamation and operated and maintained by non-Federal operating partners. These activities continue today and as a result of our preventative maintenance philosophy and related oversight initiatives, have successfully extended the service life of many of our water and power facilities beyond original expectations.

Our large portfolio of water resource infrastructure constantly presents new maintenance, replacement and modification challenges. The aging process will inevitably lead to increased pressure on Reclamation and our 350 operating partners' budgets. As such Reclamation and the operating entities anticipate infrastructure maintenance needs will continue to grow over time.

As part of Reclamation's asset management strategy, regular operation maintenance activities will be managed in concert with our strategy to improve effectiveness and funding rehabilitation and replacement needs.

In closing I'd like to stress the key component of Reclamation's mission is sound and reliable infrastructure. Reclamation will continue to ensure the integrity and reliability of Federal water and power assets. While Reclamation's reach across the West is widespread, our employees take the safety of our facilities and the protection of local customers and surrounding communities very seriously.

Thank you for the opportunity to discuss these important topics. I am prepared to answer as many questions as you may have. Thank you.

[The prepared statement of Mr. Pimley follows:]

PREPARED STATEMENT OF LOWELL PIMLEY, DEPUTY COMMISSIONER OF OPERATIONS,
BUREAU OF RECLAMATION, DEPARTMENT OF THE INTERIOR

Chairman Schatz and members of the Subcommittee, I am Lowell Pimley, Deputy Commissioner of Operations of the Bureau of Reclamation (Reclamation). I am pleased to provide the Department of the Interior's perspective on Reclamation's asset management strategy to address our aging water and power infrastructure.

As the owner and operator of large numbers of facilities across the West, Reclamation is acutely aware of the many challenges faced by agencies operating and

maintaining water and power facilities. In order to efficiently manage water resources, Reclamation is proactively maintaining and improving its existing infrastructure for system reliability, safety, and sustained water conservation, in an era of constrained budgets and changing climate. In light of the importance of Reclamation's infrastructure in the 17 Western States on the economy and environment, Reclamation continues to prudently decide how to invest available resources. Proactive engagement will be required to address many anticipated future water supply and power generation challenges and maintain economic productivity in communities served by Reclamation projects throughout the West. Anticipated increases in population, renewed emphasis on domestic clean energy development, and the need for adequate water supplies will place additional demands on Reclamation's infrastructure. Maintaining the key features of our infrastructure is becoming more costly over time due to the condition of some of the components, cost increases in the broader economy and the need for additional facilities rehabilitation, replacement, and extraordinary maintenance.

Reclamation's mission is to "manage, develop, and protect water and related resources in an environmentally and economically sound manner in the interest of the American public." We are the Nation's largest wholesale water supplier, and the 348 reservoirs we administer have a total storage capacity of 245 million acre-feet of water. We bring water to more than 31 million customers and provide approximately 20 percent of western farmers with water to irrigate about 10 million acres of farmland. We are also the Nation's second largest producer of hydroelectric power, generating more than 40 billion kilowatt-hours of energy each year. In the 111 years since Reclamation's creation, the Federal government has invested almost \$19 billion in original development costs for our facilities. In present value terms, the amount that the Federal government has spent to construct this infrastructure is estimated to be \$94.5 billion.

Most of Reclamation's major dams, reservoirs, hydroelectric plants, and irrigation systems are 60 or more years old.¹ All structures age over time. We monitor the condition of our facilities on an ongoing basis. We are working to invest in the maintenance and rehabilitation of these structures and their component systems, where needed.

Reclamation has long recognized the many challenges associated with managing a large portfolio of water and power infrastructure with a wide array of ages and conditions. In order to address the reliability, efficiency and safety of our portfolio of assets, Reclamation has developed several programs summarized below to address these issues, each targeted to address a specific type of challenge. Reclamation's Hydropower Modernization Initiative guides investments in our hydropower assets. Our Canal Inspection Program addresses canal safety and reliability. Our Dam Safety Program addresses design deficiencies and other factors contributing to conditions unsafe enough to justify corrective action. Reclamation's Facility Maintenance and Rehabilitation Program identifies, schedules and prioritizes necessary rehabilitation work at "reserved works," facilities where Reclamation still performs operations and maintenance. Our Associated Facilities Review of Operations and Maintenance Examinations is a longstanding process employed by Reclamation to track facility condition at facilities where operations and maintenance (O&M) responsibility has been transferred to others. Our authority for Extended Repayment of Extraordinary Maintenance assists non-Federal sponsors who have difficulty financing a large amount of extraordinary maintenance in a single year. And lastly, Reclamation's Title Transfer process facilitates situations in which the best course of action is to de-federalize a facility or associated asset. Through these existing programs, we are, and will continue to work to improve the way that we provide maintenance and rehabilitation of our entire portfolio of infrastructure to ensure that it is sound, safe, and reliable.

Reclamation partnered with the United States Army Corps of Engineers (USACE) to address infrastructure modernization challenges related to hydropower through the Hydropower Modernization Initiative (HMI), a program that assesses and prioritizes the investment needs of federally-owned hydropower facilities. The HMI Asset Investment Planning (AIP) program is designed to: 1) review the comprehensive list of power train assets and corresponding key attributes, 2) analyze and prioritize asset investment projects by year based on factors including Benefit-Cost Ratio, Net Present Value, and Risk, and 3) prioritize the allocation of annual budget dollars to maximize return on investment and reduce risks in the asset portfolio.

Results from the HMI allowed Reclamation to assess the potential for capacity increases at the 58 existing hydroelectric plants, and to estimate incremental energy increases from efficiency gains that would result from replacement of older turbine

¹ <http://www.usbr.gov/power/data/recl-wid.pdf>

runners with modern runners, and to estimate potential greenhouse gas (GHG) offsets that could be credited to the incremental energy increases. The results of the study were presented in a 2010 Reclamation report entitled, Assessment of Potential Capacity Increases at Existing Hydropower Plants, which is available at <http://www.usbr.gov/power/AssessmentReport/USBRHMICapacityAdditionFinalReportOctober2010.pdf>

Improved technologies, as well as innovative construction processes, like the one occurring on the Joint Federal Project at Folsom Dam near Sacramento, assist Reclamation in managing costs while fostering collaboration. Together with USACE, Reclamation is undertaking a historic effort to jointly construct features that will address both safety of dams concerns, as well as expand flood protection for the City of Sacramento. Working together to design and construct features consistent with these two distinct activities, Reclamation and the USACE estimate the joint project will lead to significant cost and time savings. Project construction has proceeded in phases by Reclamation and the USACE.

On April 17, 2008 Reclamation provided testimony before this committee focused on infrastructure improvement challenges related to Reclamation's canals and irrigation facilities. Our 2008 statement highlighted a canal failure in Nevada resulting in uncontrolled water releases into residential areas causing damage to homes. The canal, operated and maintained by the Truckee-Carson Irrigation District under a contract with Reclamation, provides water to agricultural and wetland uses in the Fernley and Fallon, Nevada areas. This canal was built over a hundred years ago.

In response to this failure \$10 million in funding was provided under the American Recovery and Reinvestment Act of 2009 to inspect Reclamation canals located in urbanized areas, where the consequences of a facility failure would typically be higher. From 2009 through 2012, Reclamation developed an inventory of canals located in urbanized areas and performed inspections of over 250 canal reaches representing more than 1,000 miles.

Reclamation also developed tools to assist in categorizing the observations on each canal reach, and expected actions associated with each rating category. For canal reaches identified as being in the "immediate action" or "follow-up monitoring" categories, additional technical analysis and/or field investigations were performed as needed. Based on additional technical analysis and field investigations, Reclamation has developed formal recommendations to address concerns for particular canal reaches in coordination with the regional and/or area office staff and the responsible operating entity. These recommendations are tracked until completion, similar to the recommendations resulting from Associated Facilities Review of Operations and Maintenance examinations, the longstanding process employed by Reclamation to track facility condition at facilities where operations and maintenance (O&M) responsibility has been transferred to others.

As these urbanized canal reaches are evaluated, categorized, and prioritized, the results have been used in determining future inspection frequencies and necessary activities under the program. This process is currently captured in Reclamation's temporary Directive and Standard, The Bureau of Reclamation's Associated Facility Review of Operations and Maintenance Program—Inspection of Canal Reaches Located in Urbanized Areas (FAC TRMR-55).

As a result of these inspections, responsible operating entities may need to provide additional funding for extraordinary operation and maintenance (XOM). Funding options such as the extended repayment authorities provided under Title IX, Subtitle G of Public Law 111-11 assist operating entities in funding this type of work. Reclamation continues to refine requirements to address XOM related to canals in urbanized areas, locations for these activities, and related funding needs.

In fiscal year 2014, Reclamation's Dam Safety Program will continue corrective actions underway at seven facilities across the West. Reclamation has also requested funds to study the need for potential corrective actions at 10 other facilities.

In 1948, Reclamation initiated a Facility Review Program to assess the condition of assets constructed by Reclamation and operated and maintained by non-Federal operating partners. These activities continue today and, as a result of our preventive maintenance philosophy and related oversight initiatives, have successfully extended the service life of many of our water and power facilities beyond original expectations.

Reclamation's budget is carefully crafted to include an appropriate amount of repair, maintenance, and rehabilitation funding for each project. The President's Budget includes \$896 million across three accounts (Water & Related Resources, Indian Water Rights Settlements, and San Joaquin River Restoration) to accomplish this task. The Administration urges the Congress to fund the Bureau of Reclamation at the requested level to support these activities.

Our large portfolio of water resources infrastructure constantly presents new maintenance, replacement, and modification challenges. Similar to other agencies with such infrastructure, Reclamation has a fiduciary duty to maintain services to its power and water customers in a cost efficient manner and to meet other requirements including environmental and endangered species management obligations. The general wear and tear of Reclamation's facilities over time will inevitably lead to increased pressure on Reclamation and our 350 operating partners' budgets, and it will be a challenge to maintain user rates while keeping infrastructure service and reliability commensurate with past levels. As such, Reclamation and the operating entities anticipate an increase in infrastructure repair needs that will continue to grow over time and will inevitably and appropriately be reflected in user charges. As part of Reclamation's asset management strategy, regular operation and maintenance activities will be managed in concert with other programs and activities addressed in our strategy to improve efficiency and effectiveness in funding rehabilitation and replacement needs.

Procedurally, Reclamation's Facility Maintenance and Rehabilitation Program identifies, schedules and prioritizes necessary rehabilitation work at "reserved works," facilities where Reclamation still performs operations and maintenance. To fulfill these responsibilities, Reclamation provides studies and designs, purchases equipment and services, and provides the resources to support the overall maintenance and rehabilitation program. Project beneficiaries advance funds for annual O&M work performed by Reclamation. However, for some of our other facilities, rehabilitation and replacement needs may exceed annually available resources and could potentially increase the risk of service interruption. To fund this work, given that operating partners cover a substantial portion of the O&M costs, the use of the entity's reserve fund is one of the first places we look for funding. However, these funds may not be contractually required, nor sufficient to meet the amount needed for major rehabilitation and replacement work. In these cases, long-term financing may be an option.

One of the challenges we face is the varying economic strength of our operating partners. For some of these partners, the cost-share requirements associated with the review and repair activities are simply beyond their means. The Administration has and will continue to be opposed to projects that are authorized without adequate cost controls and built-in accountabilities to ensure that the Federal Government is not subject to undue costs. While circumstances for each project vary, in order for projects to be sustainable, the non-federal sponsors must be responsible for a fair share of project costs and, for facilities that are being operated and maintained by non-federal entities, these entities must be accountable for maintaining the assets.

A key component of Reclamation's mission is sound and reliable infrastructure. Reclamation will continue to assure the integrity and reliability of Federal water and power assets. While Reclamation's reach across the West is widespread, our employees take the safety of our facilities and the protection of local customers and surrounding communities very seriously. To meet our obligations to the public, Reclamation ensures that our infrastructure is in good working order. I am very proud of our record to date.

This concludes my written statement. I would be pleased to answer any questions.

Senator SCHATZ. Mr. Hannon.

**STATEMENT OF JAMES R. HANNON, CHIEF OF OPERATIONS
AND REGULATORY, ARMY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY**

Mr. HANNON. Mr. Chairman, I'm Jim Hannon, Chief of Operations and Regulatory for the U.S. Army Corps of Engineers. I'm honored to appear here today before you to discuss the issues associated with our aging water resources and infrastructure.

The Corps manages an extensive water resources infrastructure portfolio. In this role the Corps helps to maintain coastal ports and their channels, operate and maintain inland waterways, support flood risk management activities, operate and maintain multipurpose dams and the reservoirs behind them and restore aquatic ecosystems. The Corps today is focused on the maintenance, repair and replacement of key features of our infrastructure and on the repair of aquatic ecosystems.

The overall budget for the program is primarily devoted to maintaining these systems so that they can continue to provide economic and environmental benefits to the Nation and address significant risks to safety.

The operation and maintenance program, for example, provides funding to help maintain our coastal ports, our inland navigation, our hydropower projects, flood risk management projects and our multipurpose dams.

Similarly the construction program deals priority to dam safety and also provides funding to rehabilitate the locks and dams on the inland waterways to support commercial navigation.

The infrastructure that the Corps helps to maintain includes 705 dams, 14,700 miles of levees, 13,000 miles of coastal harbors and channels, 12,000 miles of inland waterways, 241 locks and hydropower plants at 75 sites with 353 generating units. These projects help provide protection and reduce risk to the Nation, facilitate approximately 2 billion tons of commerce to move on the Nation's waterways and can provide up to 24 percent of the Nation's hydropower.

The Corps constructed much of this infrastructure in the first half of the 20th century. Some of it is experiencing various stages of degradation and disrepair.

Almost 60 percent of our locks are at least 50 years old.

Almost half of our dams at our hydropower plants are more than 50 years old.

However, in an attempt to address the aging infrastructure we have rehabilitated many of the components of these locks and dams, hydro facilities and other water resource infrastructure.

All structure age over time. With proper maintenance and periodic rehabilitation we are attempting to extend the lifetime of the facilities that are owned or operated by the Corps of Engineers. Maintaining the key features of our infrastructure is becoming more costly over time due to the conditions of some of the components as well as cost increases in the broader economy.

Operational demands have also grown and changed, particularly over the past 30 years which creates additional stress on the infrastructure.

Over the last 3 years the Corps has been developing an approach that we call "Civil Works Transformation." The goal of the Civil Works Transformation is to link national objectives with strategic goals and needs using a systems based watershed approach to ensure that our infrastructure continues to provide an appropriate level of service to the Nation.

A key pillar of our Civil Works Transformation is our infrastructure strategy. This strategy focuses on managing the infrastructure projects more efficiently to improve asset performance levels and support the Nation's water resource needs.

It incorporates an integrated approach to managing existing assets and future investments through their life cycle.

It also includes an evaluation to inform recommendations on whether an existing project or series of projects should or should not remain a Federal responsibility prior to making further substantial investments.

It also focuses on adjusting levels of service to make the best use of available funding.

The strategy focuses on life cycle portfolio management. As part of this effort the Corps has developed a national inventory of assets and is assessing the condition of each major infrastructure component and the risk associated with these conditions. End of life cycle analyses will support recommendations regarding which projects to repurpose, which projects to transfer to other parties and which projects may need de-authorization or decommissioning.

The Corps is also exploring alternative financing and funding options to include public/private partnerships and infrastructure banks. The intent of the strategy is to facilitate the best use of the Federal and the non-Federal dollars in investing in the Nation's water resources infrastructure. In some cases non-Federal sponsors have expressed interest in contributing funds to enable work to occur more quickly. Before entering into an agreement to accept such funds, we carefully evaluate the overall workload to ensure that execution of the proposed work will not adversely affect the directly funded programs, projects and activities.

The implementation of our infrastructure strategy will allow us to make informed recommendations to reduce risk and to improve the reliability of our infrastructure. Collaboration with our customers, stakeholders and the public, including the Congress will enable us to implement this approach.

Mr. Chairman, this concludes my statement. Again, I appreciate the opportunity to be here today and testify. We'll be pleased to answer any questions you might have.

Thank you.

[The prepared statement of Mr. Hannon follows:]

PREPARED STATEMENT OF JAMES R. HANNON, CHIEF OF OPERATIONS AND REGULATORY, ARMY CORPS OF ENGINEERS, DEPARTMENT OF THE ARMY

Mr. Chairman and distinguished members of the Subcommittee, I am Jim Hannon, Chief of Operations and Regulatory for the U.S. Army Corps of Engineers (Corps). I am honored to appear before you today to discuss the issues associated with aging water resources infrastructure in the United States.

The Corps manages an extensive national water resources infrastructure portfolio. In this role, the Corps helps to maintain coastal ports and their channels; operate and maintain the inland waterways; support flood risk management activities; operate and maintain multipurpose dams and the reservoirs behind them; and restore aquatic ecosystems.

The Corps today is focused on the maintenance, repair, and replacement of the key features of our water resources infrastructure, and on the repair of the aquatic ecosystems. The overall budget for the program is primarily devoted to maintaining these systems so that they can continue to provide economic and environmental benefits to the Nation, and to address significant risks to safety. The operation and maintenance program, for example, provides significant funding to help maintain our coastal ports, our inland navigation, our hydropower projects, flood risk management projects, and our multipurpose dams. Similarly, the construction program gives priority to dam safety assurance, seepage control, and static instability control work, and also provides funding to rehabilitate the locks and dams on the inland waterways to support commercial navigation.

The infrastructure that the Corps helps to maintain includes 705 dams, 14,700 miles of levees, 13,000 miles of coastal harbors and channels, 12,000 miles of inland waterways, 241 locks at 197 sites, and hydropower plants at 75 sites with 353 generating units. These projects help provide protection and reduce risk to the Nation, facilitate approximately two billion tons of commerce to move on the Nation's waterways, and can provide up to 24 percent of the Nation's hydropower.

The Corps constructed much of this infrastructure in the first half of the twentieth century. Some of it is experiencing various stages of degradation and disrepair. Almost 60 percent of our locks are at least 50 years old. Almost half of our dams are more than 50 years old. However, in an attempt to address the aging infrastructure, we have rehabilitated many of the components of these locks and dams, hydro-power facilities and other water resource infrastructure.

All structures age over time. With proper maintenance and periodic rehabilitation, we are attempting to extend the effective lifetime of the facilities owned or operated by, or on behalf of, the Corps of Engineers.

Maintaining the key features of our infrastructure is becoming more costly over time due to the condition of some of the components, as well as cost increases in the broader economy. Operational demands have also grown and changed, particularly over the past 30 years, creating additional stresses on this infrastructure.

Over the last three years, the Corps has been developing an approach that we call "Civil Works Transformation". Transformation of the Civil Works program is intended to foster a more targeted delivery of the Civil Works program that provides the highest returns to the Nation. The goal of Civil Works transformation is to link national objectives, strategic goals and needs using a systems-based watershed approach to ensure that our water resources infrastructure continues to provide an appropriate level of service to the Nation.

A key pillar of Civil Works Transformation is the Corps infrastructure strategy. This strategy focuses on managing the Corps infrastructure projects more efficiently to improve asset performance levels and support our Nation's water resource needs. It incorporates an integrated approach to manage existing assets and future investments throughout their lifecycle. The strategy also will include an evaluation to inform recommendations on whether an existing project or series of projects should, or should not, remain a Federal responsibility, prior to making a substantial further investment. The strategy also focuses on adjusting levels of service to make the best use of available funding.

This strategy also focuses on lifecycle portfolio management. As part of this effort, the Corps has developed a national inventory of Corps assets, and is assessing the condition of each major infrastructure component and the risks associated with these conditions. End of lifecycle analyses will support recommendations regarding which projects to repurpose, which projects to transfer to other parties, and which projects to de-authorization and decommission. Lifecycle portfolio management is already being used to inform funding priorities based on the risk and consequences of failures and unscheduled outages.

The Corps is also exploring alternative funding and financing options for water resources infrastructure, including public private partnerships and an infrastructure bank. The intent of this strategy is to facilitate the best use of Federal and non-Federal dollars in investing in the Nation's water resources infrastructure. In some cases, non-Federal sponsors have expressed interest in contributing funds to enable work to occur more quickly. Before entering into an agreement to accept such funds, the Corps carefully evaluates its overall workload to ensure that execution of the proposed work will not adversely affect directly-funded programs, projects and activities.

The implementation of our infrastructure strategy will allow us to make informed recommendations to reduce risk and to improve the reliability of our infrastructure. Collaboration with our customers, stakeholders, and the public, including the Congress, will enable us to implement this approach.

Mr. Chairman, this concludes my statement. Again, I appreciate the opportunity to testify today. I would be pleased to answer any questions you may have.

Senator SCHATZ. Thank you very much.

Mr. Stern.

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

Mr. STERN. Chairman Schatz, my name is Charles Stern. I'm a specialist in natural resources policy with the Congressional Research Service. Thank you for inviting CRS to testify on issues related to aging water resources infrastructure.

As the Nation's dams, levees, divergent structures and other water resource infrastructure age, decisionmakers are faced with the question of whether to operate Federal water projects under

the current statutory framework or to alter existing policies to facilitate the repair, rebuilding or transfer of those assets. My testimony will focus on water resource infrastructure owned by the Federal Government.

The Federal Government owns water resource facilities with a combined replacement value of about \$352 billion. The Bureau of Reclamation and the Army Corps of Engineers are the principle agencies charged with constructing and maintaining these investments, many of which are more than 50 years old. As these facilities continue to age, agencies and stakeholders have observed an uptake in needs for major project maintenance and repairs which they believe are likely to continue or increase over time.

The risk associated with aging water infrastructure include, among other things, threats to public safety, loss of services and capacity and hindrance of future economic growth. Under some circumstances failure of infrastructure may result in the loss of life and property. Congress has responded to past water infrastructure failures by authorizing and funding inspection and repair programs which focus on specific types of infrastructure such as dams and canals.

Perhaps a more common scenario than outright failure of a facility is reduced services. While it is difficult to measure the exact effects of aging infrastructure analysis of available performance data indicates that deteriorating facilities may be affecting services.

For instance, according to Corps and Reclamation data at least 12 Federal reservoirs are being operated at reduced levels due to dam safety concerns. Similarly hydropower unit availability at Corps and Reclamation facilities has been down and forced outages have been up over the last 10 years. However, it is impossible to say the extent to which these trends are due to aging infrastructure.

Primary challenges associated with aging water infrastructure have been identified in past assessments and can broadly be divided into two categories, evaluation of needs and financing for rehabilitation.

First, evaluation.

Independent expert assessments have previously noted that data on the condition and upgrade needs of Federal water infrastructure are generally unavailable at project and aggregate levels. Available estimates may encompass more than just aging infrastructure or be based on informal field surveys which are not publicly available or sufficient to inform all decisions. The absence of comprehensive, authoritative information at project and aggregate levels makes it difficult to establish what the needs of these Federal water facilities are and what progress is being made in addressing these needs.

Notably, other Federal programs supporting transportation, drinking water and waste water infrastructure are required to report regularly on estimated future needs using a consistent methodology.

The second anticipated challenge is financing. Several assessments have concluded that aging water resource infrastructure is likely to become a greater challenge over time due to increasing repair needs and expected flat or declining appropriations. In light of

these challenges some have proposed alternative financing arrangements as one potential solution.

However, alternative financing for water resource projects may pose some challenges not faced by other types of infrastructure. In contrast assets which are owned by State and local governments or which receive funding from those sources many Federal water projects have historically received the majority of their funding from the Federal Government. These projects may have beneficiaries or users that are difficult to identify or who may not be able to provide viable revenue streams to fund project upgrades.

Furthermore, even some projects with identifiable beneficiaries and revenue streams have experienced difficulties accessing capital due to other limitations. My written statement discusses these challenges as they apply to alternative financing arrangements that are commonly proposed to boost infrastructure spending.

Another way to address financing could be increasing non Federal participation in selected Federal projects. This could come from allowing more contributions from non Federal partners, raising existing fees or pursuing divestment of some assets.

For example, recently enacted authorities may expand non Federal funding available for Corps project upgrades. Similarly some Reclamation stakeholders favor more flexibility for the Bureau to transfer ownership of existing Federal projects to non Federal entities. Deciding which assets that will remain a fully Federal responsibility, which ones require increased user funding and which can be transferred to non Federal entities may be a key question going forward.

This concludes the remarks of my prepared statement. I would be happy to address any questions you may have.

[The prepared statement of Mr. Stern follows:]

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

Chairman Schatz, Ranking Member Lee, and members of the subcommittee, my name is Charles Stern. I am a Specialist in Natural Resources Policy for the Congressional Research Service (CRS). Thank you for inviting CRS to testify on issues related to aging water resource infrastructure.

The federal government owns water resource infrastructure with a total replacement value of more than \$352 billion. As these dams, levees, diversion structures, hydropower facilities, and other water resource infrastructure continue to age, decisionmakers are faced with the question of whether to continue to operate federal water projects under the current statutory framework, or to alter existing policies to increase the focus on repair, rebuilding, or transfer of these assets. My testimony will focus on water resource infrastructure owned by the federal government.

OVERVIEW OF AGING WATER RESOURCE INFRASTRUCTURE

Aging conditions are a significant challenge for the multiple types of federally owned and operated water resource infrastructure. These facilities are varied and complex, and include dams, canals, levees, locks, floodwalls, hydropower facilities, and related infrastructure. They have been constructed over two centuries to serve a number of purposes. As a result, a system of shared responsibilities to plan, construct, finance, operate, maintain, and repair this infrastructure has emerged over time, with various units of state and local government, nongovernmental organizations, and the private sector involved in the development and management of individual projects.

The Bureau of Reclamation (Reclamation) and the Army Corps of Engineers (Corps) are the principal agencies charged with constructing the federal government's largest investments in water infrastructure. Other agencies and federal entities such as the Natural Resources Conservation Service, the Tennessee Valley Au-

thority, and the U.S. section of the International Boundary and Water Commission, among others, also have played roles in water resource development.

Federal water resource infrastructure receives significant use, and in many cases individual facilities are operating beyond their original design lives. On average, Corps and Reclamation facilities were built more than 50 years ago, and some were built more than 100 years ago. They are used for commerce, recreation, flood hazard protection, electric power generation, crop production, and conservation of fish and wildlife. While appropriations for the maintenance of these facilities have remained flat or are declining in real terms over the previous 30 years, agencies and stakeholders have noted an uptick in needs for major project maintenance and repairs that they believe are likely to continue over time.

RISKS ASSOCIATED WITH AGING WATER RESOURCE INFRASTRUCTURE: FAILURE, SERVICE INTERRUPTIONS

The risks associated with aging water resource infrastructure have been documented by agencies and stakeholders and include, among other things, threats to public safety, loss of services and capacity, and hindrance of future economic growth. Under some circumstances, failure of water resource infrastructure may result in the loss of life and property. Congress has responded to past events, including the failure of facilities near populated areas, by authorizing and funding inspection and repair programs that focus on specific types of infrastructure, such as dams and canals.

Perhaps a more common scenario than outright failure of a facility is reduced or lost services. While it is difficult to measure the exact effects of aging infrastructure, deteriorating infrastructure may be affecting services such as water supply, hydropower production, and movement of commodities. Some of the examples of service disruptions documented by federal agencies that have been connected to aging assets include reservoir storage restrictions for dam safety, decreasing hydropower unit availability, and increasing lock unavailability. Specific examples include:

- **Reservoir Storage Restrictions:** According to the Corps and Reclamation, at least twelve federal reservoirs are currently operating at lower storage levels than designed as a result of dam safety concerns, some of which relate to aging infrastructure;
- **Hydropower Unavailability and Forced Outages:** According to agency data, overall hydropower peak availability over the last 10 years was down by about 7% and 9% at Corps and Reclamation units, respectively. Forced outages for both agencies were also up over this same period. There is insufficient information to determine the extent to which these trends are attributable to aging infrastructure (as opposed to other causes), but some have assumed there is a correlation;
- **Lock Unavailability:** According to Corps data, lock unavailability, which often occurs due to repairs related to deteriorating infrastructure, has increased by approximately 45% over the last 20 years in terms of the number of lock outages and has increased by almost three-fold in terms of hours of repair.

Federal agencies have taken steps to address their aging water resource infrastructure based on statutory direction and Administration initiatives. This includes, among other things, inspections and safety programs focusing on specific infrastructure types (e.g., dams, levees), as well as implementation of broader asset management strategies that are risk-based and which target funding to certain assets. These programs and activities have generally focused on identifying and addressing the highest risks to public safety and operations among specific facility types and classifying the level of risks and conditions at other facilities.

ADDRESSING AGING INFRASTRUCTURE

Challenges associated with management of the federal government's aging water resource infrastructure have been identified in past assessments. Generally speaking, two of the primary areas where observers have noted challenges are evaluation of needs and financing for rehabilitation.

MEASUREMENT AND EVALUATION

While we know that federal water resource assets are aging and that this is generally likely to result in reduced performance and increased costs over time, outside of the aforementioned inspection programs there is limited publicly available information on the magnitude and timing of the issue. Previous independent expert assessments noted that detailed information on the condition and associated upgrade needs of water resource infrastructure are generally unavailable at project and ag-

gregate levels. Available needs estimates may encompass more than just aging infrastructure repairs. For instance, they may include upgrades needed for optimal economic performance along with those to maintain public safety, security, and current services. Other estimates may be based on informal field surveys that are insufficient for long term planning. The absence of comprehensive, authoritative information at project and aggregate levels complicates efforts to evaluate the needs of these facilities. It also makes it difficult to gauge year-to-year progress in meeting the challenges of aging infrastructure at the local, regional, and national levels.

In contrast to water resource infrastructure, other federally supported infrastructure programs, including those for water supply and transportation, are required by Congress to report regularly on estimated future needs. The Environmental Protection Agency (EPA) and states conduct needs assessments for wastewater and drinking water treatment facilities, and the Department of Transportation (DOT) regularly publishes a needs survey for highway, bridge, and transit infrastructure. In both cases, agencies regularly report on needs using a consistent methodology at project and aggregate levels. For the EPA assessments, aggregate reported needs are based on a peer reviewed, random sample of facilities that is broken down by need type. Individual project cost estimates must be documented in the form of capital improvement plans and other project-specific information. While these assessments and the infrastructure they evaluate are not without their own challenges and limitations, they provide a data set and baseline for performance that is not available for most federally owned water resource infrastructure.

FINANCING FOR REHABILITATION

Observers such as the National Research Council (NRC) have judged that regardless of available information on the extent of the problem, aging water resource infrastructure is likely to pose an increasing challenge to federal agencies over time. This is assumed to be the case due to increasing repair needs and appropriations which some observers believe will be flat or declining, as they have been over the past 30 years. As a consequence, observers have also noted that financing arrangements outside of traditional appropriations are likely to be needed to maintain these projects. Observers have proposed alternative financing arrangements for multiple infrastructure types, including water resource infrastructure. However some water resource projects may face greater challenges than other project types when it comes to implementing these options. In contrast to other projects which are owned by state or local governments and which receive funding from those sources, many water resource projects have historically received most or all of their funding from the federal government. These projects may also have beneficiaries or users that are difficult to identify, or who may not be able to provide viable revenue streams to fund project upgrades. Even federal projects that are largely self-funding or which have identifiable beneficiaries have experienced difficulties accessing capital due to statutory and budgetary limitations resulting from federal ownership, among other things. This is the case for some federal hydropower and irrigation projects that have customers who are interested in financing upgrades, but are generally not authorized to commit future revenues toward these purposes because they are federal facilities.

The challenges for aging federal water resource projects to obtain financing outside of regular appropriations manifest themselves in some of the commonly proposed policy solutions to increase other types of infrastructure spending. Some of the options that have been considered, and the challenges they pose for federal water resource infrastructure, are discussed below.

Special Purpose Entities (SPE)

Infrastructure banks, corporations, and other special purpose entities have regularly been proposed as a means to finance infrastructure investments, but have yet to be authorized at the federal level (although they have been authorized by some states). Water resource infrastructure has not been consistently included among the potential recipients in many such proposals, nor has it regularly benefited from funding provided by state infrastructure banks (these state entities have generally focused on transportation projects). This may in part be due to the fact that, in order for projects to receive financing from an SPE, they must demonstrate credit worthiness and proof of a revenue stream that will allow for repayment. Additionally, since many water resource projects are federal assets, commitment by the federal government of any future project revenues may require full budgetary treatment of costs (i.e., full scoring for these costs in a budget and appropriations context).

Public Private Partnerships (PPP)

Public private partnerships involve arrangements in which a nonfederal or private entity assumes some risk or responsibility for a project. As applied to transportation programs, public-private partnerships have generally provided for the transfer of state or local projects to private entities, who are in turn authorized to make upgrades and institute user fees to repay these costs. Due to the aforementioned issues with revenue streams, such a model may not be viable for all federal water resource projects. Proposed legislation in the 113th Congress, such as S. 566 and Section 2025 of the Senate-passed Water Resources Development Act of 2013 (S. 601), would authorize a pilot program to allow the Corps to shift a limited number of construction projects to nonfederal entities. It is unclear whether this pilot program could be used for aging facilities, but it appears to differ from the framework of transportation PPP's referenced above in that no user fees would be authorized under this authority.

Observers have noted that because of their revenue generating potential, federal hydropower projects are a natural fit for some sort of PPP-like authority. A 2012 report by the NRC noted that outside of the Bonneville Power Administration, only a few Corps hydropower units have been upgraded for increased reliability and productivity. Applied to hydropower projects, a PPP model could allow operators to enter into contracts with a private company to finance the upfront costs for project repairs and upgrades. In exchange, the private entity would receive a commitment of a portion of future revenues associated with the upgrades that would be sufficient to repay the investment and result in a profit. Such an arrangement may have associated budgetary scoring requirements if it commits future federal revenues to an outside source.

"Innovative" Finance

Innovative finance for infrastructure projects is typically a shorthand term for some mix of loans, traditional funding, and/or other financing. Such a program was recently proposed under Title X of S. 601. It would allow the Corps (as well as the EPA) to provide direct loans or loan guarantees to selected projects that meet certain criteria. Similarly, a Loan Guarantee program for rehabilitation projects by the Bureau of Reclamation was previously authorized in Title II of P.L. 109-451, the 21st Century Water Works Act, but has yet to be funded. These programs would fund a portion of qualifying projects with direct loans or loan guarantees, and leave the remainder of project costs to be funded through other financing (either traditional appropriations or other sources). While some view these authorities as promising, repayment ability may still pose issues for some projects with insufficient revenue streams, and some projects may need to have new user fees authorized before they can utilize these programs. Disagreement regarding the executive branch scoring of Reclamation's loan guarantee program suggests that even after authorization, these programs may face additional hurdles.

In addition to the aforementioned financing alternatives, some have proposed increasing nonfederal participation in selected federal projects through proposed and existing authorities. Specifically, some have proposed allowing more contributions from nonfederal partners, raising existing fees, or pursuing divestment of some federal water resource assets (although the latter is generally authorized on a project-by-project basis). Recent changes, such as congressional enactment of expanded Corps authority to receive project funding from nonfederal contributors, could address aging infrastructure issues for some projects. Another option is outright transfer of some federal projects to nonfederal entities. For example, some Reclamation stakeholders favor increased flexibility for the Bureau to transfer ownership of existing federal projects to nonfederal entities, thereby allowing them to use these projects as collateral to obtain financing. In its 2012 report on Corps infrastructure, the National Research Council noted that divestment of some Corps resources may be considered to better manage the agency's portfolio, but that the prospects for greater private sector involvement will vary by project type. How to prioritize among those water resource assets that should remain a fully federal responsibility, those which require increased user funding, and those which should be transferred to nonfederal entities may be a key question going forward for the Executive Branch and Congress.

My testimony today focused on federally owned water resource infrastructure, but many observers have noted that aging infrastructure issues are perhaps an even larger threat to nonfederal water infrastructure. Most observers note that needed repairs for nonfederal dams, levees, and other facilities are probably greater than the federal needs noted above. Some of these facilities have been proposed for additional support or have received increased federal support in the past. Additional federal funding for this nonfederal infrastructure would likely require new authorities.

In closing, publicly available information and data are currently limited, but federal water infrastructure assets are aging over time. Many have concluded that needs associated with this process will increase. Therefore, if these conditions are to be addressed, policy makers are faced with deciding what changes to existing policies are most appropriate, and the extent to which they should be authorized.

This concludes the remarks of my prepared statement. Thank you for the opportunity to appear before the Subcommittee today. I would be happy to address any questions you may have.

Senator SCHATZ. Thank you.

Dr. Galloway.

STATEMENT OF GERALD E. GALLOWAY, PE, PH.D., GLENN L. MARTIN INSTITUTE PROFESSOR OF ENGINEERING, UNIVERSITY OF MARYLAND, COLLEGE PARK, MD

Mr. GALLOWAY. Thank you very much, Senator. I'm Gerry Galloway, a Professor of Engineering and Public Policy at the University of Maryland.

The Nation's neglect of its water resource infrastructure threatens our long term economic vitality and our national security. I'd like to make 5 points about this.

First, there is no question that the water infrastructure is aging and its condition is fragile. Study after study, including the ASCE report card you mentioned, clearly make this information available.

The average age of our 87,000 dams is 52 years.

There are at least 40,000 miles of levee, many of which are seriously deficient.

By 2020 nearly half of our 54,000 drinking water systems will have exceeded their design life or will be in very poor condition.

Our more than 14,000 water treatment facilities and 700,000 miles of buried pipes are in much the same shape.

As Mr. Hannon said, much of our water way system is over a half a century old. The vast majority of this infrastructure is in the hands of local and private entities, not just the Federal Government. They're all looking to Washington.

Second, climate change will exacerbate the impacts of this aging and will increase the potential for system disruptions and collapse.

Third, there's a substantial link between the production of energy and the condition of water resource infrastructure. Energy needs water as you noted and water needs energy.

Fourth, the Nation must take steps to address the aging infrastructure problem now. The cost of the Nation to remediate identified deficiencies and support modernization of the national water infrastructure is estimated to be as high as \$500 billion or even higher. It's another case of pay me now or pay me a lot more later.

Fifth, Congress must act to deal with challenges that fall within its domain. There must be realism and open discussion of the funding shortfalls. An honest acknowledgement of what we can and can't do in Washington needs to get sent out to the people in the field who have to live with the challenges that still exist.

Let me briefly expand on two of these points.

First, climate change is only going to make things worse. A recent National Research Council study found that and I quote. "Climate change is occurring and poses significant risk for a broad range of human and natural systems."

It points out the potential for sea level rise, large storms, coastal erosion, more intense rainfall and finds that these threats make it prudent to design the infrastructure for transportation, water and utilities to withstand a range of weather extremes. More recent national and international studies confirm these same conclusions.

In June, FEMA released a report indicating a potential 45 percent increase in areas subject to flooding across the United States as a result of climate change and population growth between now and 2100.

Point two.

There's a substantial link between water and energy. In 2012 the heads of 15 of the world's largest national academies met here in Washington to discuss important issues. One of the 3 was Energy and Water.

They found that and I quote. "Needs for affordable and clean energy, for water of adequate quantity and quality and for food security will increasingly be the central challenge for humanity. These needs are strongly linked. It is important that planning and investment in energy and water infrastructure take into account the interaction between water and energy."

They also pointed out that fossil fuel and nuclear power plants require large water withdrawals and some consumption and that even the use of increasingly important unconventional sources such as tar, sands, gas hydrates and gas and oil in tight formations have substantial implications for quantity and quality of water.

I would note that our aging waterway infrastructure also has a significant impact on energy. Twenty-two percent of the Nation's energy products are carried on inland waterways.

Hydropower production, although providing only 8 to 12 percent of the national energy pool, has also provided critical resources in many parts of the country. But more than half of the 2,000 hydroelectric dams regulated by FERC are older than 80 years.

What must be done?

I would put 3 things at the top of the list.

One, we must determine the full extent of the problems we face.

As Mr. Stern just said, studies have been directed by Congress must be completed and those that are undertaken must be sufficiently resourced to get the information that is needed and not just an overview.

Two, we must find ways to fund what needs to be done.

Mr. Stern also discussed some of the things that might be done and are under consideration and do merit immediate attention.

Third, we must recognize we most likely cannot do all the infrastructure work that needs to be done and that we must embrace alternatives that reduce the magnitude of the infrastructure investment. This would include both conservation of energy and water and use of natural systems, green infrastructure for flood risk reduction and water supply. Individuals and communities can do much to assist.

Let me conclude.

The Nation is faced with an aging water resource infrastructure with significant resource implications. We have no plan to properly maintain and upgrade this infrastructure and to adapt it to the potential impacts of climate change. It's time to act.

Thank you very much.
[The prepared statement of Mr. Galloway follows:]

PREPARED STATEMENT OF GERALD E. GALLOWAY, PE, PH.D., GLENN L. MARTIN INSTITUTE PROFESSOR OF ENGINEERING, UNIVERSITY OF MARYLAND, COLLEGE PARK, MD

Chairman Schatz, Ranking Member Lee, Members of the Committee. It is a distinct privilege to participate in this important and timely hearing concerning our much neglected aging water resources infrastructure. I want to thank the Committee for the opportunity to speak.

I am Gerald E. Galloway, a Glenn L. Martin Institute Professor of Engineering and Affiliate Professor of Public Policy at the University of Maryland, where I teach and do research in water resources and natural disaster management. I came to that position following a 38 year career in the US Army and eight years service in the federal government, most of which was associated with water resources management. I served for three years as District Engineer for the Corps of Engineers in Vicksburg, MS, and later, for seven years as a member of the Mississippi River Commission. I also serve as a consultant to a number of national and international government organizations. I am currently a member of the Governor of Louisiana's Advisory Commission on Coastal Protection, Restoration and Conservation and a Senior Fellow in the Department of State Energy and Climate Partnership of the Americas charged with sharing US experiences in these fields with our Latin American neighbors. I am also a member of a WWF (UK)—China Ministry of Water Resources team that is reviewing flood risk management worldwide. In 1993 and 1994, I was privileged to be assigned to the White House to lead an interagency study of the causes of the Great Mississippi River Flood of 1993 and to make recommendations concerning the nation's floodplain management program.¹ As a member of the American Society of Civil Engineers (ASCE), I have worked closely with ASCE staff in disseminating the ASCE Report Card on national infrastructure. I am a former president of the American Water Resources Association and chaired National Water Policy Dialogues in 2002, 2005, 2007 and 2008. In 2011, I was a co-principal investigator for FEMA on a University of Maryland Review and Evaluation of the National Dam Safety Program, and from 2011-2013, I chaired a National Research Council study of Levees and the National Flood Insurance Program.

The nation's neglect of its water resources infrastructure threatens our long-term economic vitality and our national security. This infrastructure is aging and is not being upgraded to meet the demands of this century. Much of what we do every day and many of our economic successes are tied to the availability of water infrastructure. The gradual deterioration of what was once a world class water resources infrastructure can only have deleterious effects on the nation. To this end, I would like to make five points with respect to the aging water infrastructure of the United States:

- There is no question that our water infrastructure is aging and that its condition is fragile. Study after study has made this clear. The impacts from having aging infrastructure are substantial and without action they will become critical. Because most of this infrastructure is out of sight and because many fine professionals work every day to keep it operating under difficult conditions, the full extent of the challenge we face is generally not understood by government officials, businesses, and the public.
- Climate change will exacerbate the impacts of this aging and will increase the potential for system disruptions and collapse. Climate change could be a "tipping point."
- There is a substantial link between the production of energy and the condition of the water resource infrastructure. In many cases these linkages are overlooked or are poorly understood. Energy needs water and water needs energy.
- The nation must take steps to address the aging infrastructure problem. It is another case of "pay me now" or "pay me a lot more later." A failure to act on aging infrastructure will have serious consequences now and will increasingly burden our children and grandchildren. Delay only drives up costs. Priorities must be established based on the risks to public safety and the national economy. A fix-as-fails approach is unsustainable and short sighted.

¹Interagency Floodplain Management Review Committee, Executive Office of the President. 1994. Sharing the Challenge: Floodplain Management into the 21st Century. Washington, GPO. (available at <http://www.floods.org/Publications/free.asp>)

- Congress must act to deal with the challenges that fall within its domain and, through its influence and bully pulpit, provide leadership to the nation as a whole where it does not. There must be realism and open discussion of the funding shortfalls and honest acknowledgement of what will and won't get done under our current unsustainable 'business as usual' approach. Suggesting that funding is around the corner when it is not could cause those who operate and maintain that infrastructure to be waiting for help when little will be coming, thereby jeopardizing the long term well-being of those who rely on this infrastructure.

OUR AGING WATER INFRASTRUCTURE

What Is It?

The nation's water infrastructure is found in every city and village across our land. It is the dams that provide storage for floodwaters, water supply, recreation, hydropower, downstream navigation, and environmental stewardship. It is in the engineered rivers that carry millions of tons of cargo from farm fields, fuel extraction, and factories to ports and facilities and that drive domestic and international trade. It is the irrigation canals that carry millions of gallons of water to many of the same farm fields. It is the levees, coastal barriers and other flood mitigation activities that provide security for those living in areas at risk of flooding and hurricanes.

The extent of this infrastructure becomes apparent in examining the statistics on the numbers and nature of structures. However, true appreciation emerges in recognizing the diversity behind these numbers. Dams vary in size from the giant (Grand Coulee) to the small (local recreation dams). Major locks and dams on the Mississippi provide 1200 foot chambers for transiting vessels, while small facilities facilitate commerce and recreation on rivers like the Monongahela and the Ouachita. Water and wastewater treatment facilities serve millions of our citizens in metropolitan areas but also provide support to the residents of small villages.

The statistics describe a massive national asset base:

- 87,000 dams in the National Inventory of Dams and tens of thousands smaller dams that are not. The average age of the 87,000 dams is 52 years. Of 14,000 high hazard dams, 2000 are deficient. More than half of the 2525 hydroelectric dams regulated by the Federal Energy Regulatory Commission (FERC) are older than 80 years.²
- At least 40,000 miles of levees.³ Because, in the case of many levees, the current structures were built on top of or integrated within earlier structures, it is difficult to accurately determine their ages. The legacy of many of the major structures dates to the late 19th or early 20th century. Reports by FEMA and the US Army Corps of Engineers indicate serious deficiencies in many of the structures.
- 8,116 miles of irrigation canals for which the federal government is responsible and thousands of miles of canals operated by local sponsors.⁴
- 54,000 community drinking water systems with over one million miles of pipe. In 2002, EPA estimated that by 2020 the useful life of nine percent of the nation's drinking and waste water piping will have expired and 36% will be in poor or very poor condition. There are some 240,000 water main breaks each year.⁵ Even the National Capital Region is not immune.
- 14,780 municipal waste water treatment facilities.⁶ The normal life span of such facilities varies by type but is in the range of 25 years for mechanical-electrical components and 50 years for structures. As with drinking water piping, there is no national inventory of wastewater piping but estimates range from 700,000 to 800,000 miles, much of which was installed immediately following World War

²Water Policy Collaborative, University of Maryland. 2011. Review and Evaluation of the National Dam Safety Program. <http://www.fema.gov/library/viewRecord.do?id=5794>; 2012 Statistics on State Dam Safety Regulation: Association of State Dam Safety Officials - www.damsafety.org

³National Research Council (NRC). 2013. Levees and the National Flood Insurance Program: Improving Policies and Practices. Washington: National Academy Press.

⁴US Bureau of Reclamation. Reclamation Facts. <http://www.usbr.gov/facts.html>

⁵AWWA. 2011. Buried No Longer: Confronting America's Water Infrastructure Challenge. American Water Works Association.; ASCE 2013 Report Card for America's Infrastructure. <http://www.infrastructurereportcard.org/a/#/home>; EPA. 2002. The Clean Water and Drinking Water Infrastructure Gap Analysis. <http://water.epa.gov/infrastructure/sustain/infrastructureneeds.cfm>.

⁶EPA. 2010. Clean Water Needs Survey 2008 <http://water.epa.gov/scitech/datait/databases/cwns/upload/cwns2008rtc.pdf>

II and its now at the end of its useful life.⁷ The growing need to develop adequate storm water capacity adds to the challenge. (Capacity limitations of 19th century stormwater drainage caused a significant flood in the Washington DC Federal triangle in 2006

- 12,000 miles of commercially navigable channels, with over 200 lock chambers.⁸ More than 50% of the locks and dams have exceeded their design life, and many are over 70 years old.
- 300 commercial harbors and 600 smaller harbors.⁹ The viability of these facilities is a function of the maintenance of adequate channel and harbor width and depth. The growing size of modern vessels exceeds the current depths of many coastal ports and inadequate dredging has reduced the capacity of many inland ports.

Grading the condition of the water infrastructure

Every four years, ASCE sends the nation a Report Card for America's Infrastructure,¹⁰ which grades the current state of its national infrastructure on a scale of A through F. In 2013, ASCE's most recent Report Card gave the nation's infrastructure an overall grade of D+, a slight rise from the 2009 Report Card. As highlighted in figure 1* below, in the water arena all categories were rated at D or below except for ports which were rated C l. ASCE indicates that since 1998, grades in all categories have been near failing primarily due to delayed maintenance and underinvestment.

Figure 1. The ASCE 2013 Report Card for America's Infrastructure.¹¹

The cost to the nation to remediate identified deficiencies and support modernization of the national infrastructure by 2020 is in excess of \$3.6 trillion. Figure 2 identifies ASCE's estimated funding needs for water infrastructure, the expected funding given past history and the \$187 billion funding gap that exists as a result. The ASCE figures are supported by information available from the federal agencies involved and other infrastructure reports.¹²

Figure 2. Water sector resource needs through 2020.¹³

According to ASCE, although slight increases in short-term federal funding in some of the categories such as drinking and wastewater have prevented a further decline of those grades over the past four years, many continued to fall. The funding picture for the future, given sequestration and economic realities, is not bright.

Unfortunately, the exact condition of the infrastructure is not accurately known and aging continues. Recent reports on dams and levees indicate that in the case of levees both the exact location and condition of a substantial percentage of the national levee stock is unknown. In the case of dams, lack of funding for inspections and differences among standards applied by states call into question the uniformity and arguably the reliability of the assessments that are made. Some dams such as those related to mine tailings receive only cursory review emphasizing only the potential risks to miners and not necessarily to surrounding communities. Water and wastewater systems are buried, and even with sophisticated technologies, accurate assessment of their condition is difficult and costly to obtain.

A look at the daily papers quickly provides examples of failures in infrastructure across the nation. Last week we saw a near-disaster with a broken water pipe right outside of the District. Bridges have collapsed on major highways, lock gates have fallen off their hinges on major waterways, water and sewer lines have broken and left communities without water or dumped raw sewage into nearby rivers, and the condition of many levees and dams has been declared unsatisfactory increasing the risk to those that live in their shadows. Much of the national water infrastructure has exceeded its design life and some is approaching the century mark. Major levee failures such as those in New Orleans result in billions of dollars of damages. Dam failures in the past have resulted in significant loss of life. As was illustrated in the weeks following Superstorm Sandy, loss of water and wastewater systems can bring communities to their knees and shut down all economic activity. Offices are

⁷ EPA. Id.

⁸ ASCE 2013 Report Card

⁹ Id.; National Waterways Foundation. 2012. Waterways Working for America. Based on study by Texas Transportation Institute.

¹⁰ ASCE 2013 Report Card

* Figures 1-3 have been retained in subcommittee files.

¹¹ Id.

¹² Shapiro, M., EPA. 2013. Financing Water Infrastructure: Clean Water and Drinking Water Revolving Funds. Presentation to NAS Panel, Infrastructure Funding Mechanisms. June 25, 2013

¹³ Id.; EPA. Clean Watersheds Needs Survey 2008. <http://water.epa.gov/scitech/datait/databases/cwns/upload/cwns2008rtc.pdf>

unable to open and factories are unable to produce. When flood structures fail or their capacity is exceeded, transportation corridors are closed and health and sanitation facilities become inaccessible.

CLIMATE CHANGE AND POPULATION GROWTH

According to the 2011 study, America's Climate Choices, conducted by the National Research Council at the behest of U.S. Congress (P.L. 110-161), ". . . climate change is occurring, is very likely caused by human activities, and poses significant risks for a broad range of human and natural systems." The study points out the potential for sea level rise and large storms to result in significant coastal erosion and for more intense rainfall to increase the probability of flooding in selected areas around the nation. The study notes that these threats make it "prudent to design the infrastructure for transportation, water, and utilities to withstand a range of weather extremes including intense rainfall flooding and drought scenarios. . ."

A Federal Advisory Committee Draft Climate Assessment¹⁴, released earlier this year, found that:

- "Summer droughts are expected to intensify in most regions of the U.S., with longer term reductions in water availability in the Southwest, Southeast, and Hawai'i [sic] in response to both rising temperatures and changes in precipitation.
- Floods are projected to intensify in most regions of the U.S., even in areas where average annual precipitation is projected to decline, but especially in areas that are expected to become wetter, such as the Midwest and the Northeast.
- Expected changes in precipitation and land use in aquifer recharge areas, combined with changes in demand for groundwater over time, will affect groundwater availability in ways that are not well monitored or understood.
- Sea level rise, storms and storm surges, and changes in surface and groundwater use patterns are expected to challenge the sustainability of coastal freshwater aquifers and wetlands."

The assessment also reports that the "reliability of water supplies is being reduced by climate change in a variety of ways that affect ecosystems and livelihoods in many regions. . ."

The 2012 report by a task committee of the Intergovernmental Panel on Climate Change, *Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation*, identifies many of the same impacts.

Growth in population will also influence the need for infrastructure activity. The U.S. Census Bureau currently projects that the population of the United States will increase by 27%, 85 million, between now and 2050.¹⁵ This growth will increase the need for expansion and upgrading of much of the water infrastructure and, as indicated below, will increase the number of people at risk to floods and coastal storms. The aging infrastructure may well be both too old and too small.

In June 2013, the Federal Emergency Management Agency released a report indicating the increases in potential flooding across the United States that could result from climate change and population growth between now and 2100.¹⁶ "For the [contiguous US] riverine environment, the typical 1% annual chance floodplain area nationally is projected to grow by about 45%, with very large regional variations. The 45% growth rate is a median estimate implying there is a 50% chance of this occurring. . . 30% of these increases in flood discharge, SFHA, and base floodplain depth may be attributed to normal population growth, while approximately 70% of the changes may be attributed to the influence of climate change. . . for the coastal environment, under the assumption of a fixed shoreline, the typical increase in the coastal SFHA is projected to also be about 55% by the year 2100, again with very wide regional variability. The 55% increase is a median estimate so there is a 50-percent chance of this occurring." Figure 3 provides the geographic distribution of these changes.

Figure 3. The land area covered by the floodwaters of the base flood is the Special Flood Hazard Area (SFHA) on NFIP maps. The SFHA is the area where the National Flood Insurance Program's (NFIP's) floodplain management regulations must

¹⁴Federal Advisory Committee Draft Climate Assessment. 2013. <http://ncadac.globalchange.gov/>

¹⁵United States Population Projections: 2000 to 2050. Jennifer M. Ortman and Christine E. Guarnieri <http://blogs.census.gov/2012/12/12/what-a-difference-four-years-make-u-s-population-projected-to-grow-at-a-slower-pace-over-the-next-five-decades/>

¹⁶FEMA. The Impact of Climate Change and Population Growth on the National Flood Insurance Program through 2100. AECOM.

be enforced and the area where the mandatory purchase of flood insurance applies. Source: FEMA¹⁷

Climate and population change will have direct effects on our aging water infrastructure. Structures designed to protect against current or past flooding and coastal erosion threats may not be able to stand up against the forces of larger events or deal with the increased magnitude of these events. Increases in population, will in many cases require current water and wastewater systems to be not only upgraded but also to be sized to the increased demands that will be expected. Additional surface or subsurface storage may be required and older facilities may not be in a position to be modified or expanded. Major storm flows, which are currently stressing many of existing dams and levees, may increase even more under climate change and further threaten those that rely on these structures. Sea level rise is already affecting the US East and Gulf coasts.

Droughts will also increase the stress on water infrastructure. During droughts rivers run low and substantially increase the amount of dredging and other maintenance activities required in channels and at ports. Droughts result in severe stress on water supply systems, whether for agricultural or municipal and industrial use. They also increase the pressure for additional storage or expansion of the water supply storage in existing facilities.

THE ENERGY AND WATER NEXUS

There is a substantial link between water and energy. This should be recognized and addressed in in plans to deal with aging water infrastructure.

In 2012, the heads of 15 of the world's largest National Academies met in to discuss important scientific issues facing the world community.¹⁸ The "Energy and Water Linkage: Challenge to a Sustainable Future" was one of three topics addressed by the group. Following the meeting, in which I was fortunate enough to participate as a facilitator, the Academy heads signed a statement identifying the issues they had discussed. In this statement, they reported that

"Needs for affordable and clean energy, for water and adequate quantity and quality, and for food security will increasingly be the central challenges for humanity: these needs are strongly linked. . . It is critically important that planning and investment in energy and water infrastructure and associated policies take into account the interaction between water and energy. A systems approach based on specific regional circumstances and long-term planning is essential. Viewing each factor separately will lead to inefficiencies, added stress on water availability for food protection and for critical ecosystems, and a higher risk of major failures or shortages in energy supply."

They also noted that energy production requires water and that the production of water supplies in adequate amounts and quality requires energy. They pointed out that fossil fuel and nuclear power plants and solar thermal require large water withdrawals and some water consumption and indicated that even use of "increasingly important 'unconventional sources' such as tar sands gas hydrates in gas and oil and tight formations have substantial implications for quantity and quality of water. . .producing alternative transportation fuels, in particular biofuels. . . can involve substantial impacts on water resources and water quality."

Our aging inland waterway infrastructure also has a significant tie to energy production. Twenty-two percent of the nation's energy products are carried on inland waterways barges that are energy efficient. Inland waterways separate potentially volatile cargo from heavily populated areas. Operating as part of the national intermodal transportation system, waterways also provide alternative routes should problems occur with energy product movement on parallel systems such as pipelines and rail, increasing the resilience of the overall system and the resultant national security.

Hydropower production, although providing only 8 to 12 percent of the national energy pool, provides critical services in many parts of the country. 20th century development in the Tennessee Valley and in the Columbia basin relied on use of low cost hydroelectric power. Many communities are reliant on hydropower for base supply and many others for the peaking power necessary to meet electricity needs during periods of high demand. Many of the nation's hydropower facilities are aging

¹⁷ Id.

¹⁸ G-Science Academies Statements 2012. Energy and Water Linkage: Challenge to a Sustainable Future. US National Academies: Washington. Participants included representatives of the national academies of Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, Mexico, Morocco, Russia, South Africa, UK, and the US.

and, although carefully supervised by the Federal Energy Regulatory Commission and state agencies, require substantial and continuous attention. Again, where rate setting becomes political instead of true cost based, funding challenges will develop.

WHAT MUST BE DONE?

ASCE's Report Card together with reports from agencies and independent bodies have alerted public officials to some of the problems of aging and poorly maintained infrastructure that is reaching the end of its useful life. Unfortunately, what we see may be only the tip of the iceberg. In spite of the alerts, little seems to get done. What steps are necessary to move our efforts forward with infrastructure renewal and alternative approaches to meet our water needs?

Filling the information gaps

As a follow-up to Katrina, in 2009 a congressionally directed National Committee on Levee Safety reported that considerable attention needed to be paid to the development of an inventory of the nation's levees and their conditions. Some work has been accomplished by the U.S. Army Corps of Engineers and FEMA in addressing levees under their oversight but the work is far from complete and no action has been taken by the Congress on recommendations of the National Committee on Levee Safety. The condition of tens of thousands of miles of levees in the US has yet to be assessed and many of these levees have yet to be precisely located.

Information about the condition of only 75% of the 87,000 dams has become part of a national inventory of these structures. We know where the dams are located and if their failure would pose a threat to those below the dams, but we have yet to complete thorough assessments of the condition of all dams. Some of these dams date to before the Civil War. On a positive note, the condition of the approximately 4000 dams under federal oversight has, for the most part been assessed and continues to be monitored, even if funds to deal with identified problems cannot be fully addressed. Four percent of dams are federally owned and the Federal Energy Regulatory Commission (FERC) provides oversight of an additional 2525 private and public dams.¹⁹

In 2007, Section 2032 of the Water Resources Development Act (PL 110-114) directed the President to, within two years, conduct an analysis of the vulnerability of the nation to flooding. Such an analysis would identify the exposure—what is in the path of a potential flood or storm surge—and the vulnerability of affected communities to such events. Vulnerability reflects the ability of existing flood protection infrastructure to carry out the functions for which it was designed. No funds have been appropriated by Congress for this activity, in the nearly six years since the law was passed and, as a result, no analysis has taken place.²⁰

The Environmental Protection Agency has invested resources in gathering information about the condition of water and wastewater infrastructure and has prepared reports that identify the challenge the nations faces in drinking and waste water. Such analyses however represent only estimates and given that much of the infrastructure is below ground, there is considerable uncertainty with the completeness of the survey information.

Considerably more is known about the condition of the inland waterways and ports, although, as with water and wastewater there is still some uncertainty given that much of the infrastructure is below water or underground and is reaching or has exceeded its design life.

Funding approaches

As indicated earlier in this testimony, addressing deficiencies in aging infrastructure and ensuring that the infrastructure will be ready for the impacts of climate change and population growth will require significant resource commitments or close attention to innovative alternatives to structural approaches. The Congress, the Administration, state and local governments, and businesses including those that are directly affected by or operate water resources infrastructure have been struggling to find funding outside of direct federal expenditures.

Immediately following Hurricane Katrina, former Sen. Warren Rudman and businessman Felix Rohatyn proposed the development of National Infrastructure Investment Corporation with the authority to issue bonds with maturities of up to 50 years to finance infrastructure projects.²¹ Their recommendations went nowhere. States like California have issued bonds to deal with critical infrastructure issues

¹⁹ Federal Energy Regulatory Commission. Personal communication, 16 July 2013

²⁰ Blumenauer, Earl. Congressional Record. July 9, 2013. 113th Congress, 1st Session Issue: Vol. 159, No. 97 - Daily Edition, H4242.

²¹ It's time to rebuild America. Washington Post, December 13, 2005

such as levees, but its example has not been followed in many places. Public-private partnerships have been suggested for some infrastructure, but unlike toll highways where a future revenue stream can be seen, such partnerships for levee maintenance and repair have lacked credibility. The water and wastewater communities generate revenue through user charges, but these charges generally have not kept up with the full costs of providing these services. History indicates that it is frequently difficult for these agencies (approximately 90% public in water supply for communities over 10,000 and 98% public in wastewater²²) to garner the local political support necessary to raise the rates to a level necessary to carry out the needed infrastructure servicing.

The inland waterway community has suggested raising the tax on fuel use by their vessels to increase the amount of funding available in the Inland Waterway Trust Fund to carry out needed infrastructure renewal. Legislation to this end is currently being considered in the Water Resources Development Act, but even this self-taxing has opponents who see it as a violation of the 'no new taxes' principle.

Much of the infrastructure for ports and harbors is privately or non-federal government owned as opposed to being supported by the federal government. Various approaches have been used to successfully modernize the on-land infrastructure necessary to operate the ports. Funding of dredging to maintain channel depth and width is shared by the federal government and local sponsors and, where the federal government does not have plans for its share of the work, local sponsors must either assume the entire cost or live with the consequences of inefficiently sized channels.

Similarly a large percentage of dams are privately or non-federally owned. There are a few state loan or grant funding sources to rehabilitate dams and some federal funding through the Department of Agriculture Natural resources Conservation Service, but these funds usually only support state or municipally owned dams. Private owners, even the most conscientious ones, typically do not have the funding needed to do necessary safety upgrades.

Several other proposals have been made in recent years and some others are currently under consideration to assist in meeting the significant gaps in drinking water and waste water infrastructure funding. They include²³

- Increased funding for State Revolving Fund programs under the Clean Water Act and the Safe Drinking Water Act.
- Lifting of the private activity bond restrictions on water infrastructure projects
- Creating a federal water infrastructure trust

EPA reports²⁴ that the President's 2014 Budget request:

- Supports lifting the cap on private activity bonds for sewage and water facilities. This will help address the hundreds of billions of dollars needed for capital investment over the next 20 years.
- Includes a proposed National Infrastructure Bank that would have the ability to leverage private and public capital to support infrastructure projects of a national and regional significance, including water infrastructure.
- Proposes establishment of America Fast Forward Bonds (AFFBs). The program would reduce the cost of infrastructure financing for municipalities and their private sector partners by providing interest subsidies on taxable bonds.

The Senate version of the Water Resources Development Act includes a pilot version of the Water Infrastructure Finance and Innovation Act (WIFIA) that would fund water projects that are too large to receive EPA State Revolving Fund loans and that could be used to finance a variety of water projects whose cost is greater than \$20 million.²⁵

Adapting to a murky future

Recognizing that full funding of actions needed to repair and upgrade aging infrastructure may not occur or may be slow in coming, every effort must be made to ensure that the water resources community carefully examines those steps that can be taken to adjust current operations and activities to better deal with the advent of climate change and funding shortfalls and to ensure that it fully considers those actions that do not require or lessen the need for structural measures. If our water

²² EPA. 2002. The Clean Water and Drinking Water Infrastructure Gap Analysis; 2009. Drinking-water infrastructure needs survey and assessment: Fourth report to Congress (2007). Office of Water. EPA-816-R-09-001.

²³ Copeland, C., William J. Mallett, Steven Maguire. 2012. Legislative Options for Financing Water Infrastructure, Congressional Research Service. R42467.

²⁴ Shapiro. Id.

²⁵ Id.; AWWA, Undated. Water Environment Federation, Association of Metropolitan Water Agencies. A Cost-Effective Approach to Increasing Investment in Water Infrastructure: WIFIA.

resources infrastructure is to be resilient to the many forces which could threaten its viability, action must be taken.

In 2010, the US Geological Survey, U.S. Army Corps of Engineers, the National Oceanographic and Atmospheric Administration, and the Bureau of Reclamation prepared a report outlining steps that could be taken to better adapt water resource activities to these challenges.²⁶ Since that time major federal agencies, operating under the coordination of the White House Council on Environmental Quality, have been working through task forces to develop steps that can be taken to reduce the impact of climate change and to find ways to face this challenge using innovative approaches, many of which are nonstructural. Efforts to promote conservation, efficiency, and changes in operating procedures that would influence both demand and use of water resources have been highlighted.

Many communities have embarked on programs that use natural hydrological features increase rainfall infiltration and reduce the necessity for stormwater systems. Many of these systems also provide for water capture and reduction in heat islands in urban areas. Consolidation of area and regional water systems can also reduce the costs associated with modernization. The need for flood reduction structural systems can similarly be reduced through use of natural storage during major events as was demonstrated by the U.S. Army Corps of Engineers during the 2011 floods on the Mississippi River. Natural storage can also be combined with sound land-use planning to remove most frequently flooded properties and ensure that future development takes into account climate change and other potential changes in the landscape.

Use of renewable energy sources and micro-hydropower systems can reduce the necessity for complete replacement of some aging hydropower facilities. As has been suggested by National Research Council studies,²⁷ upgrade of some locks and dams might be able to be delayed through use of nonstructural approaches such as congestion management and scheduling, or in the case of low-use segments, the divestment of these assets. Non-structural approaches not only may reduce infrastructure investment costs but may also significantly enhance the natural environment.

ON BEING BOTH REALISTIC AND HONEST

The nation is faced with an aging water resources infrastructure and with resource significant requirements to properly maintain and upgrade this infrastructure, and to adapt it to the potential impacts of climate change and growth.

Unless there are significant and rapid changes in the national economy and adjustment of long-standing responsibilities, it is unlikely that the federal government will be in a position to fund the needed maintenance, rehabilitation and upgrades. It is more likely that new approaches will have to be taken and that much of the burden will continue to rest at the local level. This fact must be recognized by all concerned.

Continuing to believe or to support beliefs that somehow enormous sums of money will be found by the federal government to completely eliminate this significant national backlog in the infrastructure is unrealistic and support of this belief is unethical. For example, the Senate version of the Water Resources Development Act contains provisions that would provide local levee districts access to \$300 million annually for levee repairs. Given that the maintenance backlog is estimated to be over \$50 billion, it would be foolish for levee districts across the country to believe that all they need do is wait until their turn for funding to deal with the infrastructure deficiencies they currently face. Similarly, putting off other actions such as price rises for services in the hope that they may later be found to be necessary, is unrealistic and deceptive.

It should be made clear that federal resources that are available will go to those facilities where there is the highest national interest and need and where the return on investment is highest and the greatest risks to life and property exist.

IN SUM

- The nation's water infrastructure is aging and its condition is fragile.
- Climate change will exacerbate the impacts of this aging .
- There is a substantial link between the production of energy and the condition of our water resource infrastructure.

²⁶ USGS Circular 1331. 2009. Climate Change and Water Resources Management: A Federal Perspective. <http://pubs.usgs.gov/circ/1331/>

²⁷ National Research Council. 2005. Waterway; National Research Council. 2012. Corps of Engineers Water Resources Infrastructure: Deterioration, Investment, or Divestment?

- The nation must take steps to address the aging infrastructure problem. A failure to act on aging infrastructure will have serious consequences now and will increasingly burden the future.
- Congress must act with realism and openness to deal with the challenges that fall within its domain and, through its influence and bully pulpit, provide leadership to the nation as a whole where it does not. It must also overcome the tyranny of agency silos and committee turf to address these challenges in a comprehensive manner. Something must be done now.

Thank you for your attention.

Senator SCHATZ. Thank you.

Mr. Kiely.

STATEMENT OF CHARLES KIELY, ASSISTANT GENERAL MANAGER, DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY

Mr. KIELY. Good afternoon, Chairman Schatz. I am Charles Kiely, the Assistant General Manager of Customer Care and Operations at the District of Columbia Water and Sewer Authority, known as DC Water. I am grateful for the opportunity to provide testimony today on the very important subject of aging water and sewer infrastructure.

DC Water serves the more than 17 million people who live, work and visit the District every year. We maintain and operate 1,350 miles of water pipe, over 3,700 valves, 4 pump stations, 5 reservoirs, 3 elevator water tanks, more than 9,300 public hydrants that deliver our current water across Washington, DC. The median age of the water system is over 78 years old with some pipes in service today that were installed before the American Civil War.

Once that water is used it is returned to our sewer system that is even older than the water system with a median age of 85 years old. The sewer system has 1800 miles of separated and combined water and storm water lines, 9 base water pumping stations, 16 storm water pumping stations, 12 inflatable dams and a swirl facility. The existing sanitary sewer system in the District dates back to 1810.

I have with me an actual section of tuberculated, unlined, cast iron main that we frequently encounter on our drinking water system to bring to the surface what lies deep along the ground in many areas across the country. Tuberculation is the cause of corrosion materials inside the pipe that accumulate over time. As these deposits grow they restrict the flow of water for everyday use and fire suppression.

The tuberculated deposits can also impact the quality of the water we deliver and they promote microbiological activity and can cause discolored water and can also impact disinfection.

This aging infrastructure that delivers water and sewer services is a vital resource to every home, business and facility in the District, including the Capitol. Our work also affects vital ecosystems and our rivers and waterways. Balancing the delivery of service, improvements in treatment and the cost to ratepayers is one of the largest challenges facing DC water today.

Over the next 10 years DC Water plans to spend over \$3.8 billion on capital improvements with \$1.7 billion allocated to meet federally mandated environmental projects. Another \$1.2 billion in our 10-year plan will be used to improve the aging water and sewer in-

infrastructure. We are ramping up to replace 1 percent of this infrastructure per year, 3 times the rate of replacement in previous years, but still on a hundred year replacement cycle.

As you know direct Federal investment in water and sewer infrastructure has severely declined. In fiscal year 2012 the District of Columbia received \$6.9 million from the Clean Water State Revolving Fund and \$8.9 million from the Drinking Water State Revolving Fund. Although we are grateful for these funds the overwhelming majority of this work is funded by the 135,000 ratepayers that we serve. The scale of the work needed means that our ratepayers will have to shoulder rate increases each year well into the foreseeable future unless other funding sources become available.

Unlike roads and bridges our extensive assets are very deep underground and problems can persist for many years without detection. Some may recall that DC Water was involved in emergency work recently at 14th Street where segments of the road fell down and actually collapsed the sewer that was constructed in 1897. All told the emergency repairs caused most of the intersection to be closed for 11 days.

We have not received all the invoices to date. But we anticipate spending upwards of close to \$2 million when everything is finally paid. We have provided other examples in our written testimony to illustrate the costs and customer inconvenience experienced when there is catastrophic failure of the aging infrastructure which seems to be happening with more frequency in the past few years. Emergency repairs are costly and they do not rehabilitate or replace the 100-year-old assets that remain in the ground.

Moreover, extreme weather events place additional stress on the aging combined sewer system. For unusually intense rain events in the summer and fall of 2012 resulted in damaging overland flooding and sewer line backups in homes located in a section of the northeast boundary trunk sewer. This system originally constructed by the Federal Government in the late 1800s was identified as insufficient soon after its construction. More recent development and the associated increase in a previous area only exacerbated the problem.

DC Water is in the process of addressing the capacity concerns in this area through the use of short, medium and long term engineering projects that will ultimately cost over \$600 million. Limited resources force DC Water to make strategic investments in our water infrastructure by prioritizing replacement projects based on age and material, customer feedback, water quality testing and other inspections we do.

When defects are discovered consideration is given to implying various new technologies including structural and non structural pipe linings and coatings, corrosion protection technologies, and various other products and techniques to build a robust toolbox of methods to suit our various needs. In addition to utilizing technology on our linear assets, DC Water is also constructing bio-sol digester, an advanced waste water treatment facility that will turn waste produced by a treatment process into fuel. This nationally recognized project will make DC Water the largest generator of renewable electricity in the metropolitan area.

Ultimately the project will save the equivalent of 554,000 tons of coal energy every day and save the agency approximately \$20 million.

We hope to work with Congress to address the critical issue of aging infrastructure. We also look forward to working with the committee to help advance innovative technologies that will allow us to improve the service to our customers, decrease costs and improve the environment.

Thank you for the opportunity to provide my remarks today. I'm happy to answer any questions you may have.

[The prepared statement of Mr. Kiely follows:]

PREPARED STATEMENT OF CHARLES KIELY, ASSISTANT GENERAL MANAGER, DISTRICT OF COLUMBIA WATER AND SEWER AUTHORITY

Good afternoon Chairman Schatz, Ranking Member Lee and members of the Senate Committee on Energy and Natural Resources Subcommittee on Water and Power. My name is Charles Kiely and I am the Assistant General Manager of Customer Care and Operations at the District of Columbia Water and Sewer Authority, known as DC Water. I am grateful for the opportunity to provide testimony today on the very important subject of aging water and sewer infrastructure.

DC Water serves the more than 17 million people who live, work, and visit the District of Columbia every year. We maintain and operate 1,350 miles of water pipes; over 37,000 valves; four pumping stations; five reservoirs; three elevated water tanks; and more than 9,300 public fire hydrants to deliver water across Washington, DC. The median age of the water system is over 78 years old with some pipes in service today that were installed before the American Civil War. Once that water is used, it is returned to our sewer system that is older than the water system with a median age of 85 years old. The sewer system has 1,800 miles of separated and combined sewer and storm water lines, nine wastewater pumping stations and 16 stormwater pumping stations, 12 inflatable dams and a swirl facility. The existing sanitary sewer system in the District of Columbia dates back to 1810, and includes a variety of materials such as brick and concrete, vitrified clay, reinforced concrete, ductile iron, plastic, steel, brick, cast iron, cast in place concrete, and even fiberglass. A significant number of the sewers in the DC Water system were constructed more than one hundred years ago and are still in operation today. An image of this type of structure is included in my written testimony along with a chart depicting the age of our water and sewer system.

The aging infrastructure that delivers water and sewer services is a vital resource to every home, business and facility in the District, including the U.S. Capitol. Our work also plays a critical role in ensuring the health of the environment. Balancing the delivery of service, improvements in treatment, and the cost to ratepayers is one of the largest challenges facing DC Water. Over the next ten years, DC Water plans to spend over \$3.8 billion on capital improvements with \$1.7 billion dollars allocated to meet federally-mandated environmental projects. Another \$1.2 billion in the 10-year plan will be used to improve our aging water and sewer infrastructure. We are ramping up to replace one percent of our aging infrastructure per year, three times the rate of replacement in previous years, but still a 100-year replacement cycle.

As you know, direct federal investment in water and sewer infrastructure has severely declined. In Fiscal Year 2012, the District of Columbia received just \$6.9 million from the Clean Water State Revolving Fund and \$8.9 from the Drinking Water State Revolving Fund. Although we are grateful for these funds, the overwhelming majority of this work is financed by our ratepayers. The scale of the work needed means that our ratepayers will have to shoulder rate increases each year well into the foreseeable future unless other funding sources become available.

I have with me an actual section of tuberculated unlined cast iron main that we frequently encounter in our drinking water system to show what is deep below the ground in many areas across the country. Tuberculation is the deposit of corrosion materials inside the pipe that accumulate over time. As these deposits grow, they restrict the flow of water for everyday use and fire suppression. The tuberculated deposits can also impact the quality of water because they can promote micro-biological activity, cause discolored water, and impact disinfection. Limited resources force DC Water to make strategic investments in our water and sewer infrastructure by prioritizing replacement projects based on the age and material of the asset, customer feedback, water quality testing, and camera inspections. Given that our

infrastructure is located beneath roadways, DC Water works closely with the District Department of Transportation to coincide water and sewer infrastructure upgrades with transportation projects in public space whenever possible.

We are also exploring alternative technologies to minimize disruption to the public and decrease road restoration costs. In addition to a data-driven and coordinated replacement schedule, DC Water utilizes alternative technologies that are less invasive than the traditional open trench replacements to reduce the cost of improving our infrastructure. For example, DC Water is responsible for maintaining approximately 150,000 sewer laterals in public space and we replace approximately 400 per year. A sewer lateral is the underground pipe, typically four inches in diameter that connects the home or business to the main sewer line. For decades, DC Water employed the conventional open cut construction method for lateral replacements, resulting in significant restoration costs, labor charges, and unavoidable customer inconveniences. DC Water has evaluated and employed trenchless technologies to reduce the life cycle costs by selecting a cured in place pipe (CIPP) solution. Typically, it can be installed in less than one day compared to the four days needed for the conventional. Work is completed with minimal surface excavation, providing a far safer environment for employees and minimizing customer disruption. The CIPP process virtually eliminates road and pavement restorations associated with open trench construction while also reducing the need for traffic control. Time spent on the job site is significantly reduced, and the average cost of installation is about \$3,900—or a \$7,300 savings over the conventional open cut method. Quite simply, we are spending 65 percent less to do more by working smarter.

DC Water was also one of the first water utilities to implement an advance meter infrastructure to not only provide customers with accurate bills but also to monitor the consumption from the service line into the customer's home or business to proactively detect leaks from aging infrastructure. DC Water is also piloting various emerging technologies including sonic and ultrasonic leak detection, radar for the geophysical detection of underground voids associated with large diameter pipes, and metallurgical analyses of metal for the strength of pipe components. When defects are discovered, consideration is given to applying various new tools including structural and non structural pipe linings and coatings, and corrosion protection technologies.

Unfortunately, age, corrosion, and weather often force us to address our aging infrastructure in a less proactive manner. Unlike roads and bridges, our extensive assets are buried and problems underground can persist for years without detection. Some may recall the large diameter water main break on Constitution Avenue NW in the fall of 2010. The break resulted in the closure of three blocks of a major arterial roadway, and surrounding buildings like the Smithsonian Museum of Natural History and the U.S. Department of Justice were left without water service until the repairs were completed. Once replacement materials were identified and repairs were made, three blocks of the severely damaged roadway had to be resurfaced. All told, the emergency work took three days to complete and cost \$740,000.

This past May, DC Water was involved in emergency work related to a sinkhole on the heavily trafficked intersection of 14th and F Streets NW. The hole developed when segments of the road fell upon a portion of our sewer that was constructed in 1897. The falling road debris caused the sewer to collapse and triggered the road to cave in. Repairs to sewer infrastructure can be more complicated than water mains since the infrastructure is located 15 feet or more below the roadway. To determine the cause and repair the sewer, DC Water crews had to cut through old trolley tracks and navigated a multitude of gas, electric and telecommunication lines. Fixing our 54-inch brick sewer meant cutting four foot sections of steel pipe and re-welding them together underground inside the broken sewer—essentially lining the existing tunnel to avoid digging a long trench 20 feet below the roadway surface. The steel had to be specially cut so that connections to the existing sewer laterals could be reconnected. All told, the emergency repairs caused most of the intersection to be closed for 11 days. We have not received all of the invoices for this work yet, but we estimate that the repair will cost ratepayers \$1-\$2 million.

Disruptions from aging infrastructure are not limited to commercial areas downtown. Recently, an 8-inch water main break on a residential street washed out two manholes that extended 50 feet below the surface to a deep sewer. The restoration work took 31 days and ultimately cost our customers over \$600,000. While the repair was taking place, DC Water had to run pumps and generators to bypass the sewer flow. The street was closed for over one month causing a major inconvenience to our customers in the neighborhood.

While DC Water has prioritized maintaining and upgrading our water and sewer delivery system, emergency repairs will be a routine occurrence as our system continues to age. Though it may not sound ambitious, our goal of replacing one percent

of our aging infrastructure per year exceeds the replacement average of many of the older cities that we have surveyed. Moreover, DC Water has projected an additional need of \$2.3 billion over the 20-year horizon for water and sewer infrastructure improvements. We hope to work with Congress to identify measures to help address the critical issue of aging water and sewer infrastructure. Thank you for the opportunity to provide remarks today and I am happy to answer any questions you may have.

Senator SCHATZ. Thank you very much.
Ranking Member Barrasso.

Senator BARRASSO. Thank you very much, Mr. Chairman.

Mr. Pimley, you state in your testimony that most of the agency's infrastructure has an average age of over 60 years. In 2008 Reclamation testified before this committee that maintenance needs of Reclamation facilities exceeded \$3.2 billion. I didn't really see a figure in the written testimony today.

Do you know what the current estimated backlog is?

Mr. PIMLEY. Excuse me, the apples to apples comparison of that number we project 5 years out what the needs are and that today is about calculated at roughly two and a half billion, 2.5 billion.

Senator BARRASSO. Two and a half.

Is that information public that we could, kind of, go through and take a look at?

Mr. PIMLEY. The overall listing is not necessarily publicized because it's constantly changing. But it is reflected in our annual—we prioritize that—and it's reflected then in our annual appropriations request.

Senator BARRASSO. OK.

You talk about in your testimony the Bureau of Reclamation proactively maintaining and improving its existing infrastructure for system reliabilities a safety sustained water conservation in an era of constrained budgets and changing climate. Can you tell me a little bit about how much money is being spent on maintenance backlog versus spending money on climate change adaptation?

Mr. PIMLEY. We put about \$400 million a year into operations and maintenance every year. Roughly 140 million of that is in against the projects that are included in that 2.5 billion list of 5-year projects out there.

Our contribution to that list is about half. We put in half and our partners put in about half. So we basically we double up that investment every year against the \$2.5 billion 5-year projection.

I don't have the information on how that would compare to the climate change, but we could provide that for the record.

Senator BARRASSO. I'd appreciate that.

I'm just curious in terms of what, in your opinion, which is more important use of the money?

Mr. PIMLEY. We continue to try to operate the systems that had been funded over the years.

Senator BARRASSO. Mr. Stern, in your testimony you talked about the limited publicly available information on the magnitude and timing of the issue and talked about detailed information on the condition and associated upgrade needs of water resource infrastructure being generally unavailable. You talked about the EPA does these types of project by project upgrade needs lists for facilities under their charge with cost estimates. You did, kind of, a comparison there.

What are the benefits as well as the disadvantages, if any, of the Bureau of Reclamation developing and releasing such a list to policymakers and to the public as well, in your opinion?

Mr. STERN. Senator Barrasso, as you know we don't draw any conclusions or have any opinions about what's appropriate and what's not appropriate information for the agencies to provide. Certainly what we can say is that based on what's out there now, it's difficult to evaluate what the needs and what the year to year progress in addressing the challenge of aging infrastructure are. There are other needs assessments that are out there, as you mentioned, for drinking water and waste water infrastructure and transportation infrastructure. Those are different kinds of infrastructure with different challenges but there is simply nothing comparable that's available from Reclamation.

Senator BARRASSO. Thank you.

Mr. Kiely, I was just curious about for DC Water how DC Water is financing its efforts to address aging infrastructure?

Mr. KIELY. The majority of DC Water's funding is through our rate base and through the capital markets. We issue our own revenue bonds. We do seek the capital market to cover our water and sewer infrastructure needs.

So the \$3.6 billion that I mentioned in the testimony, would actually be accessed through the capital markets.

Senator BARRASSO. Alright. Thank you.

Thank you, Mr. Chairman.

Senator SCHATZ. Thank you, ranking member.

There are 80,000 dams in the country and yet only about 3 percent of them produce hydropower. So my question is for Mr. Hannon from the Army Corps of Engineers and perhaps followed by Mr. Stern from CRS.

Do you have any thoughts about the potential for hydropower?

For Mr. Stern, on hydropower in particular it seems to me that the innovative financing tools that are being proposed and the difficulty behind them is a lack of a revenue stream. It seems to me that increasing hydropower at Federal facilities may provide the revenue stream to make some sort of innovative financing tool more viable.

But Mr. Hannon first, please.

Mr. HANNON. Thank you, Mr. Chairman.

Certainly one of the things that we're doing within the Corps is meeting with our private sector interests who are interested in developing non Federal hydropower development at our Corps facilities. So we're working closely with the Federal Energy Regulatory Commission.

We have a memorandum of understanding with the FERC to look at how we can collectively improve the review of the applications from non Federal hydropower development so that we avoid duplication. We're continually looking at our processes to see how that we can more streamline, if you will, those processes to be able to have that non Federal development at our Federal infrastructure move forward and move forward in a quick manner.

Senator SCHATZ. Thank you.

Mr. Stern.

Mr. STERN. Mr. Chairman, your general assertion that outside observers have noted that hydropower facilities could potentially lend themselves to alternative financing, more so than other facilities, has been confirmed by independent expert assessments. Most recently a report by the National Research Council on the Corps of Engineers noted that hydropower facilities would lend themselves, perhaps more than other projects, toward public/private partnerships specifically because upgrades to those facilities could provide for increased revenues.

The fundamental challenge with Federal hydropower facilities is since they are Federal facilities any commitment of future revenues associated with those facilities would be coming in normally to the Federal Government. So there would need to be legislation from Congress that would allow for those revenues to be committed to the private entities to make the upgrade.

Senator SCHATZ. Thank you very much.

Dr. Galloway, can you expand on some of the alternative financing ideas that you included in your written testimony and in particular this committee is interested in the concepts based on TIFIA as it may apply to water infrastructure?

Mr. GALLOWAY. Yes, sir.

As you may well know that's under consideration in the—currently to have a water base of that. The idea would be to supplement and provide for the high dollar value projects more revenue than is currently available through the State revolving fund loan system. It is something that is needed.

It's supported by the industry. People are looking for ways to get major projects taken care of. Right now it seems that if you're looking for a high value project that isn't capable of being quickly funded. So the idea of having a WIFIA is very attractive to people.

Another approach that's being used right now certainly is the raising of the gas tax, the fuel tax, on inland water ways. The group is supporting that. Quite surprisingly, to me, they're running into objections because it is taxed. Whereas this is the group that is using it is saying we want to put more money into the pot so that our infrastructure can be taken care of in a better manner.

So that's another one. There are others. The ideas of infrastructure banks have been around for some period of time. But they're never run through to fruition.

I think what's needed is the systems look at what are the opportunities and how could they be combined and how could the Federal Government deal with this as a whole?

Senator SCHATZ. Thank you.

Senator BARRASSO.

Senator BARRASSO. I just had one question, Mr. Chairman to Mr. Pimley.

You said there's about a \$2.5 billion backlog. Senator Risch and I were just discussing that. I don't know if you have a specific State-by-State breakdown so that, you know, you could say, yes. This much of this \$2.5 billion is Wyoming. This much of the \$2.5 billion is Utah.

I take a look at the list that I have for Wyoming of the various—there's no price related to it. I'm just trying to get a better handle

on the backlog and how you value the cost to see if we agree on that.

Mr. PIMLEY. Right now the best data that I have is there's about 15 million of that account in what we called deferred maintenance within the State of Wyoming. I don't have a breakdown for other states. But that is what is in Wyoming, at least identified right now.

Senator BARRASSO. Alright. Thank you. Thank you.

I know Senator Risch would like a similar breakdown.

Mr. PIMLEY. I'm sorry I don't have that.

Senator BARRASSO. OK. I appreciate your attention to that. Thank you.

Senator SCHATZ. Mr. Pimley, following up on Senator Barrasso's question.

Is there an annual reporting mechanism to the Congress with respect—I understand that it's a moving target. That makes perfect sense to me. But is there an annual reporting mechanism because it seems to me that at some point in time you should have a sort of an accounting of where we are by geography, by priority, by cash-flow, by category, all the rest of it.

Are you reporting to the Congress on a periodic basis other than to the extent that we conduct hearings?

Mr. PIMLEY. I'm not aware of a specific reporting tool that we send to Congress. I do know that we maintain internal data bases to make sure that we are tracking the progress we're making against the priority list that we come up with. But I'm not aware, as I sit here today, of what we have as far as specific reports.

Senator SCHATZ. I think what you're hearing from this committee is that those data bases need to be a little more than internal and a little bit more than a, sort of, a working tool, but a real reporting to Congress so that we can exercise our own oversight responsibility.

I have a question about your testimony which mentioned the possible de-Federalization of facilities as a potential course of action. Mr. Hannon, you mentioned that as well.

But what would be the criterion and processes for consideration of that? How would you undertake the possible transfer of assets from the Federal Government to some other entity?

Maybe Mr. Hannon first.

Mr. HANNON. Yes, sir, Mr. Chairman.

We have transferred some ownership in the past of some of our locks and dams. An example is the Wisconsin's Fox River. We transferred to the State of Wisconsin when the volume of commercial traffic went down.

Right now we do not have authority though to really decommission ourselves. So it's a process that we go through. Studies looking at both the environmental, looking at the safety aspects and working with within the Administration and Congress to get the authority to actually decommission and de-authorize.

Senator SCHATZ. On a one by one basis basically?

Mr. HANNON. Yes, sir.

Thank you.

Mr. Pimley.

Mr. PIMLEY. We've been looking at title transfer for, excuse me, for a number of years within Reclamation. Of course, we deal very closely with our operating partners. Specifically we look for willing partners that are willing to take on the duties and responsibilities and liabilities of that facility.

Once we identify that and if the project has a very limited Federal role such as a single use project, we do proceed with the title transfer process which is relatively straight—or well established within our agency.

The advantage, from our perspective, is candidly we have a smaller portfolio to manage as far as operation maintenance. The advantage to the operating entity is they have a little more flexibility in their operations.

Senator SCHATZ. Thank you very much.

I'm going to ask this question of the entire panel before we end this hearing.

What is the one thing that the Congress ought to be doing to address our aging water infrastructure from your perspective?

Starting with Mr. Pimley.

Mr. PIMLEY. I guess from our perspective we prioritize this list of what needs the money first every year. All I would ask of Congress is that you keep that in mind that we do try to prioritize that. Also please keep in mind that, as I think everyone here on the panel has mentioned, that that list and that request is likely to grow in the coming decades.

Senator SCHATZ. Thank you.

Mr. Hannon.

Mr. HANNON. Thank you, sir.

I think in my testimony, you know, I mentioned our implementation of our infrastructure strategy. I think one of the keys for us from the Corps of Engineers perspective, as we continue to mature the strategy and look at opportunities to make recommendations to reduce the risk and improve the reliability, we want to continue that relationship working with our customers, stakeholders and of course, working with the Congress to enable us to implement that approach.

Mr. STERN. Mr. Chairman, as you know, CRS doesn't make recommendations to Congress on what should be done. But what we can do is summarize what previous expert assessments have concluded. In that regard the most recent expert, independent assessment on Reclamation was an NRC report I believe in 2006. The most recent report on the Corps was in 2012.

I believe the 2012 report on the Corps did note that private sector involvement in these Corps projects is likely to vary by asset type. So the suite of options that Congress chooses may depend on what the specific asset type you're looking at is.

In addition to that the same report concluded that more guidance in general from Congress on which specific classes of assets are priorities from the Federal perspective and what should be transferred and moved on to—move more toward user fees would also be helpful guidance from Congress.

Mr. GALLOWAY. Mr. Chairman, we need a national water strategy of some kind to bring together the disparate issues that are here that deal with water. How to meet present and future chal-

allenges? Right now the Federal Government works in silos and there are over 24 Federal agencies with responsibilities, all of which touch on this infrastructure problem.

Our implementation is decentralized. Coordination is fragmented. Communication is relatively non-existent.

Now that's not my quote. That's a quote from Congressman Jim Oberstar when he was the head of the T and I committee. This is a problem that's been around.

We are dealing with this in terms of eaches and not as a whole. As you've seen and mentioned with the energy water nexus, it's critical that we bring these things together in the way we address them.

Thank you.

Mr. KIELY. From the distribution perspective the debt that we will have to incur to deal with the aging infrastructure is very, very large. From a Federal Government perspective we'd like to see more of a holistic viewpoint in terms of how funding is allocated and among transportation and other types of projects. If we could tie some of those in to the funding mechanisms to deal with parts of the water and sewer infrastructure it would help in some of the financing.

But there's other things we could be considering also.

For example, when we go out to the debt markets, to the capital markets for debt, we're generally going out for 30-year terms. If we could extend the terms of that debt through some type of Federal subsidy, through an infrastructure bank or something we can actually stabilize the rates that we're putting out to our customers and deal faster with an aging infrastructure that is becoming a problem.

Other things that we could do is getting into somewhat of a more public/private partnerships where the public and the private entities are willing to take on some of the risk and also some of the reward as we deal with some of these problems moving forward.

Senator SCHATZ. I thank the testifiers. I agree with the Ranking Member Barrasso. This is a bipartisan issue. The need to repair our aging infrastructure in water and elsewhere applies to each of our States.

I also agree with what Dr. Galloway said. We do need a national water strategy as well as a national infrastructure strategy.

I thank you for all of your deep thinking on this matter. It may be that we need some statutory changes to allow public/private partnerships to be more easily done. I think the process of de-Federalizing assets also needs our oversight and our assistance so that you're not actually wasting time doing them on a one off basis.

There's no doubt that we need appropriations. I think innovative financing tools are encouraging and are interesting. But this is really a Federal responsibility. This is something we're going to have to appropriate the dollars to help to solve.

Finally, Mr. Pimley, we look forward to working with you in improving your reporting to the Congress so that we can work with you better to assess your needs and appropriate toward them.

Thank you very much.

[Whereupon, at 3:25 p.m., the hearing was adjourned.]

APPENDIXES

APPENDIX I

Responses to Additional Questions

RESPONSE OF JAMES R. HANNON TO QUESTION FROM SENATOR SCHATZ

Question 1. In the Super Storm Sandy Supplemental Appropriations Bill billions of dollars were set aside to rebuild coastal infrastructure. What are agencies like the Corps and Interior doing to ensure that those funds are spent in ways that address aging water-related infrastructure and in ways that are resilient to future storms and potential impacts of climate change?

Answer. Prior to Hurricane Sandy and since, the Corps has been working with the National Oceanic and Atmospheric Administration (NOAA), Federal Emergency Management Agency (FEMA), United States Geological Survey (USGS), other agencies, and national and international experts to evaluate how future conditions such as sea level rise and future storms could affect water-related infrastructure. As part of this effort, the agencies have been seeking to improve our understanding of how climate change might affect the performance of water resources infrastructure and require adaptation of how we develop, implement, and manage that infrastructure. The Corps has participated in activities of the Climate Change and Water Working Group (since 2007), the working groups of the Interagency Climate Change Adaptation Task Force (since 2009), and the National Climate Assessment. With the help of an interagency team including staff of the NOAA, USGS, FEMA, Federal Highway Administration, U.S. Coast Guard, National Park Service, and experts from academia and the private sector, the Corps has also drafted guidance on how to account for expected changes in sea levels and how those changes influence infrastructure, including water resources projects. At its foundation, the guidance offers a tiered approach for disclosing how new and aging infrastructure might function in response to changes in sea levels (ranging from extrapolated historical sea level trends to a higher curves which incorporate additional ocean warming and ice melt) so that such information can be considered among factors affecting funding priorities.

Following Hurricane Sandy, an evaluation (Hurricane Sandy Project Performance Evaluation Study, HSPPES) of the performance of existing projects constructed by the Corps and affected by Hurricane Sandy was conducted, in accordance with PL113-2, to determine how well each project performed during the storm. The results of the evaluation are being integrated into the Corps ongoing North Atlantic Coast Comprehensive Study (NACCS), which seeks to deliver a framework for addressing flood risks among vulnerable coastal populations within the geographic boundaries of the Corps North Atlantic Division that were affected by Hurricane Sandy. The NACCS is looking at an array of potential measures/strategies that might be pursued to deliver more sustainable reductions in risk for these communities and the environment.

The Corps is using each of these above-referenced efforts to inform the use of the funds provided in PL 113-2. For instance, the “Infrastructure Systems Rebuilding Principles” (February 2013) jointly authored by the Corps and NOAA were developed to help guide rebuilding efforts and promote delivery of sustainable risk reduction measures. The principles reflect recognition of a changing environment and emphasize the significance of economic, social, and environmental factors on the sustainability of risk-reduction strategies and the resulting resiliency of coastal communities. The NACCS is exploring how integrated land-use planning, floodplain management, and a range of other risk-reduction approaches—(e.g., traditional projects (beaches, concrete, and steel, etc.), non-structural, nature-based, and natural—) can

be integrated to result in more sustainable risk-reduction strategies that reflect contemporary planning practices, existing scientific knowledge, and modern engineering principles.

RESPONSES OF JAMES R. HANNON TO QUESTIONS FROM SENATOR BARRASSO

Question 1. What is the impact of aging infrastructure on the Corps hydropower generation? Has the Corps developed a reinvestment strategy for its hydropower infrastructure, and if so what are the anticipated annual funding needs for the next decade and how does that compare to the rates of appropriations for FY2012, FY2013, and the request for FY2014? How much additional hydropower could be generated under optimal investment scenarios?

Answer. Since 2000, overall unit forced outage rates due to mechanical and/or electrical breakdown have more than doubled for the Corps hydropower program. Hydropower unit availability during peak demands for energy has decreased more than 12 percent over the same time period. Hydropower is considered a renewable energy source; when it is replaced with thermal generation, more greenhouse gases are emitted into the atmosphere.

Under its Hydropower Modernization Initiative (HMI), the Corps assesses rehabilitation and upgrade opportunities for 54 of its 75 hydropower plants (those that are located outside of the Columbia River basin). The Corps evaluates the potential investments in terms of the risk of failure and economic consequences and ranks them for consideration in the Budget process.

The Corps executed \$395 million in FY 2012 and \$280 million in FY 2013 for the hydropower program. The FY 2014 Budget for the Corps included \$210 million for this program. This funding would support operation and maintenance of our hydropower projects, and completion of construction work on hydropower units at Garrison Dam, Lake Sakakawea, North Dakota. There were no appropriations in FY 2012 or FY 2013 to start the construction of new hydropower replacement projects, and the FY 2014 Budget did not propose to start the construction of such projects. The HMI primarily focuses on this form of investment, but also includes other types of investment such as major maintenance, which the Budget has been funding based on the priority of that work. The HMI has identified approximately \$3.4 billion of potential work over the next 20 years to replace equipment and otherwise restore and/or improve their reliability and operating efficiency, including \$1.5 billion over the next 10 years. If the Congress does not appropriate these funds, the power users could fund this work.

Approximately 915 million kilowatt-hours of additional hydroelectric generation can be produced on an annual basis by the end of the 20-year period if the Corps were to receive the maximum that it can efficiently and effectively use each year for such work over the 20-year period. This level, which is roughly a 1.5 percent increase in the current amount generated from all Corps projects, would only be achieved by the end of the 20 years of added investment. The first decade of this period would not yield any significant energy gains while the work on replacement and/or major maintenance of power plant components proceeds.

The Civil Works Budget allocates funding among studies and projects on a performance basis in a manner that will enable the Corps to use that funding effectively and efficiently. The capability estimate for each study or project is the Army Corps of Engineers estimate for the most that it could efficiently and effectively spend during the fiscal year for that study or project. However, each capability estimate is made without reference to the availability of manpower, equipment, and other resources across the Army Civil Works program, so the sum of the individual capability estimates exceeds the amount that the Corps actually could spend in a single fiscal year. Also, while the Corps could obligate additional funds for some studies and projects beyond the amounts proposed, offsetting reductions within the Army Civil Works program would be required to maintain overall budgetary objectives.

Question 2. Can you provide an example or two of how aging infrastructure has disrupted the production of federal hydropower, the provision of water supplies, or movement of energy products on waterways or at harbors?

Answer. In 2010, Units 1 and 4 at the 45-year old Barkley power plant experienced generator winding failures. As a result, two 35 megawatt units were out of service for several months. Also, in 2009, a large section of a turbine blade broke off of the hydraulic turbine at the 45 megawatt Stockton power plant, resulting in an outage for seven months.

We are not aware of a case in which aging Corps infrastructure disrupted the provision of water supplies. The Corps closes the locks on the inland waterways from time to time, both for scheduled and unscheduled repairs. In these cases, barges

generally cannot use that lock until the Corps has repaired or replaced the components in question. This can affect the movement of cargo on that waterway, including energy products. The extent of the impacts will vary depending upon a range of factors, such as the length of the closure, when the shippers and users knew that the closure would occur (for scheduled outages) or learned about it (for unscheduled outages), the amount and nature of the traffic at that location that time of year, the availability of another lock at the same dam site, and the availability of alternative modes or routes of transportation, alternative destinations for the product, or other options (such as shipping that cargo earlier or later, or obtaining the product from another source).

Question 3. In your statement, you mentioned that the Corps is exploring whether alternative financing, public-private partnerships, and divestment may be possible for some of its infrastructure. Are there lessons from this research that may apply to the Bureau of Reclamation or nonfederal water resource infrastructure reinvestment?

Answer. The Corps is in the early stages of developing these alternative financing and public-private partnership concepts, some of which can be very complex and require additional authority. Our initial efforts are examining what we can do within our existing authorities, to include development of some initial “pilot” projects to determine opportunities to engage additional non-federal investment in water resources infrastructure consistent with existing authorities. While we will not have specific lessons learned to share with our federal partners in the near term, we have had regular discussions of alternative financing strategies with the Bureau of Reclamation during our quarterly and annual leadership meetings. We will most definitely share our lessons learned in these forums as our initiative progresses.

Question 4. Does the Corps have the ability to provide assistance in the case of imminent failure of an aging nonfederal water resource facility?

Answer. Under authority of Public Law (PL) 84-99, the Corps can provide assistance in the case of imminent failure of an aging non-federal water resources facility for flood risk management projects, e.g., levees, flood damage reduction channels, single or multi-purpose dams constructed to reduce the risk of flood damage, and beach replenishment and other storm damage reduction projects, etc. PL 84-99 assistance for threatened flood risk management projects (whether aged or new) is provided at 100 percent federal cost and includes technical assistance, provision of flood fight supplies, and emergency contracting for work such as seepage blankets, riprap, driving sheet piles, and temporary levee raises. For active flood risk management projects in the PL 84-99 Rehabilitation Program damaged by a flood or coastal storm, PL 84-99 assistance may repair the project to its pre-storm condition or level of protection.

Other types of water resources facilities, e.g., locks, navigation dams, hydropower units, and aquatic ecosystem restoration projects, are beyond the scope of PL 84-99.

If the water resource facility is a dam, the Corps may also provide inspection services under the National Dam Inspection Act, PL 92-367, at the request of the non-federal owner.

Question 5. Can the Corps provide technical assistance to address state or local aging infrastructure challenges?

Answer. Yes, the Corps has authority to provide technical assistance to address state or local aging infrastructure challenges. Section 22 of the Water Resources Development Act (WRDA) of 1974, as amended, authorizes the Corps to provide technical assistance to support state, local government, or Native American Tribe preparation of comprehensive water and related land resources development plans, including watershed and ecosystem planning. Technical assistance provided under this authority is cost shared 50 percent federal/50 percent non-federal.

Question 6. Do the Corps and the Bureau collaborate on developing best financial and technical practices for addressing aging infrastructure?

Answer. In relation to hydropower, both agencies utilize the Hydropower Modernization Initiative to prioritize projects for modernization and/or replacement of major generating components. Additionally, both agencies collaborate on the development of major component operating condition assessments and operation and maintenance practices. Additional collaboration between the agencies is in the area of performance metrics definitions and utilization.

Question 7. What is the Corps estimated backlog for maintenance needs, including those related to aging infrastructure? Is it comparable to the Reclamation-cited figure of \$2.6 billion?

Answer. The Corps does not keep track of a backlog of maintenance work as such on an ongoing basis. Instead, it compiles a new estimate each year of the sum of all amounts not funded that the individual project managers say they could effi-

ciently and effectively use by the end of the fiscal year. All of the maintenance work funded in the Budget is of higher priority than the unfunded work. Also, a large portion of the unfunded work is not related to the aging of infrastructure.

The mix of both funded and unfunded maintenance work in the Civil Works program, and the priority of each item of such work, changes from year to year. Maintaining the key features of our infrastructure is becoming more costly over time. Generally, this is because of the condition of some of the components, as well as cost increases in the broader economy, not because of the age of our projects. Operational demands nationwide have also grown and changed, particularly over the past 30 years, creating additional stresses on this infrastructure.

Also, we understand that the Reclamation figure is a five-year estimate of the costs of certain potential investments, and that many of these costs are not a federal responsibility. The Corps estimates of unfunded work covers a single year, and only includes the federal share of the costs.

RESPONSE OF LOWELL PIMLEY TO QUESTION FROM SENATOR SCHATZ

Question 1. In recent years the Bureau of Reclamation has become increasingly involved in ecosystem restoration in carrying out its mandate. Can you tell us more about the Bureau's work in retrofitting, decommissioning, and changing the operations of aging infrastructure to support healthy ecosystems? How does this work address challenges associated with repairing and replacing aging infrastructure?

Answer. Reclamation's actions to support healthy ecosystems often require facility modifications or "retrofitting", but more often tailoring the way major infrastructure is operated is the principal means by which Reclamation supports healthy ecosystems. Participation in open, multi-party programs with Reclamation customers and interested stakeholders is the most common forum for these activities. A prime example is the Platte River Recovery Implementation Program (Program), a joint effort by local stakeholders, the states of Colorado, Wyoming and Nebraska and the Department of the Interior to manage the Platte River to improve habitat for three bird and one fish species listed under the Endangered Species Act (ESA).

Through a contract between Reclamation and the State of Wyoming, Reclamation provides water to the Program by delivering water from the Pathfinder Modification Project through Reclamation's other facilities on the North Platte to the Program's Environmental Account in Lake McConaughy, a privately-owned facility in western Nebraska. The water provided to the Environmental Account is a contribution to the Program by the State of Wyoming, and the water is further re-timed to provide flows to the Central Platte River in order to reduce shortages to target flows by an average of 130,000 to 150,000 acre-feet per year. This water is also used to provide short duration high flows in the spring to create vegetation-free sand bars suitable for nesting by piping plovers and least terns, and to create roosting habitat for whooping cranes, which are three of the Program's target species. Several other actions are part of the Program, and the Program's ongoing activities provide critical ESA compliance for operation of Reclamation projects on the North and South Platte Rivers, which includes the Colorado-Big Thompson and North Platte projects, that supply water and power to irrigators and municipalities in the three states.

In some cases, actual facility modifications are undertaken to address ecosystem needs. One such example is the installation of temperature control devices on dams that allow for water to be drawn from different depths of the reservoir. Instead of only drawing water from original dam intake openings which can be fairly deep and cold, temperature control modifications allow for warmer water to be drawn from closer to the reservoir surface, in order to retain a cold water pool for use at certain times of the year. The goal is to determine the right temperature combination of the cold and warmer water flows to benefit the native and/or endangered fish, while avoiding the possibility of encouraging competitors (non-native, warm-water fish) into the system. Temperature controls have been installed on several dams including: Flaming Gorge (UT), Shasta (CA), Hungry Horse (MT), and Jordanelle (UT).

Removal of dams may be considered in cases where the benefit of continued operation is outweighed by the cost of doing so. Such costs will include required operations or structural modifications to allow continued operation pursuant to applicable laws or dam safety requirements. This Committee's June 20 Roundtable on Water Resource Issues in the Klamath River Basin featured an in depth discussion on this subject, which is continuing.

As with any agency objective, there are costs associated with supporting healthy ecosystems, just as there are costs associated with the operations, repair and replacement of aging infrastructure. There is no single correlation between ecosystem-based activities and traditional water delivery for human uses, because the activi-

ties are intertwined under modern natural resources law. Reclamation's work to support healthy ecosystems has a statutory basis, as does Reclamation's work to design, build and maintain traditional water supply infrastructure with its customer community.

RESPONSES OF LOWELL PIMLEY TO QUESTIONS FROM SENATOR BARRASSO

Question 1. What are the aging infrastructure hotspots within Reclamation's portfolio for the next decade? What is the strategy for making these investments?

Answer. Each Reclamation project and facility is different, and all have their own set of maintenance challenges that can stem from aspects of the original design, general wear and tear that comes with age, environmental conditions during their lifespan, demands of operation, and many other factors. Facilities like the Colorado-Big Thompson Project (CO), Minidoka Area Projects (ID), Milk River Project (MT), and Middle Rio Grande Project (NM) are examples of projects with significant work scheduled or underway in the next decade. The ongoing modifications at Glendo and Guernsey Dams (WY) are good examples of our efforts to modernize our infrastructure and where infrastructure is being addressed through the Safety of Dams program. Seminoe (WY) and Bull Lake (WY) Dams are also good examples of aging infrastructure that will be addressed through the Safety of Dams program in the near future. Reclamation's overall Asset Management Strategy relies on analysis of four types of data to make investment decisions that are in turn presented in our annual budget request: 1. condition assessments; 2. condition and performance metrics; 3. technological research and deployment; and 4. strategic collaboration to continue to improve the management of our assets and deal with aging infrastructure challenges.

Reclamation applies the results of these analyses through a preventive maintenance philosophy in collaboration with operating entities to identify deficiencies and issues at an early stage. Regularly-scheduled inspections (condition assessments) of reserved and transferred works are conducted, resulting in prioritized formal recommendations which are tracked until completion. Through the completion of these recommended actions, more significant concerns are avoided or minimized such as service interruptions, structural failures, and extraordinary operation and maintenance (XOM) activities.

To address XOM activities in a timely manner, Reclamation uses its established Extraordinary Operation and Maintenance prioritization criteria, which evaluates: engineering need, consequences of failure, efficiency opportunities, financial consideration, and schedule.

Question 2. What has been Reclamation's experience with alternative financing for addressing aging infrastructure? What is the status of Reclamation's loan guarantee program?

Answer. Authority for what may be called "alternative financing" was provided in Title IX of Public Law 111-11. This law provides authority for the extended repayment of extraordinary (non-routine) operations and maintenance costs (XOM), and Reclamation has developed eligibility criteria in the Reclamation Manual. Reclamation has received five requests for funding and repayment under Title IX. All five requests have been approved; however, only three of the requesting entities chose to move forward with the funding. Two of the entities opted to use their own funds for the necessary extraordinary operation and maintenance (XOM) costs after the request for Title IX funding and repayment had been approved. Reclamation is aware of an additional request that is in preparation at this time for XOM funding and repayment under Title IX.

P.L. 109-451 authorized loan guarantees for certain rural water supply projects; operation and maintenance of facilities authorized by or under contract pursuant to Reclamation law, and improvements to some existing Bureau of Reclamation water projects. Reclamation requested public comment on a proposed rule to implement the loan guarantees program published in the Federal Register on October 6, 2008. The proposed rule established criteria to determine eligibility of entities to use loan guarantees to fund Rural Water projects, as well as extraordinary maintenance and rehabilitation for existing federal facilities. Reclamation received comments from 14 entities mainly dealing with: 1) the appropriate portion of loans to be guaranteed; and 2) using loan origination fees to offset appropriations needed to fund the program. The rule has not been finalized. Authority for the program will end in December 2016.

Question 3. Is there interest at the state, local, and customer level in the transfer of ownership of Reclamation facilities? If so, which categories of facilities are attractive for transfer and how might such a transfer affect the federal balance sheet in the short-run and the long-run?

Answer. There is interest at the state, local and customer level in the transfer of ownership of some Reclamation facilities, but it is very focused on specific facilities in specific areas, with a specific set of circumstances. Over the past 20 years, Reclamation has transferred title to numerous projects and facilities across the West. In most cases, the recipients of title were already responsible for operations and maintenance of these facilities—both for carrying out the work and for paying the cost. In most cases, taking title has afforded recipients some additional flexibility with respect to operations and the recipients' ability to seek loans and other sources of funding, since loan eligibility often hinges on asset ownership. For Reclamation, title transfer has enabled us to redirect some of our limited resources to other activities.

When projects are fully repaid, the benefits to the United States of title transfer include the elimination of any future liabilities or costs on Reclamation's appropriated budget related to ownership—specifically design, construction, safety, and management oversight and responsibility to address any deficiencies or inadequacies. The potential disadvantages include the possibility of costs associated with the preparation of an asset for title transfer; and the challenges of ensuring that the title transfer relieves the Federal Government of all future liabilities and costs. Additional information on title transfer, as well as a checklist of prerequisites that make title transfer a viable option, are available to Reclamation customers on our Web site at <http://www.usbr.gov/title/>.

Approximately two-thirds of Reclamation's assets have been "transferred" to non-federal operating entities where the operation and maintenance of these assets is the responsibility of operating entities that benefit from the projects. These "transferred works" are facilities owned by Reclamation where operation and maintenance of the facility has become the responsibility of an operating entity (irrigation district, state, county, city, local customers, managing partners, or others) pursuant to contracts with Reclamation. "Transferred works" are not the same as projects where title transfer has occurred. Title transfer refers to the asset leaving the federal portfolio and being fully owned by non-federal entities.

Only transferred works facilities are operated and maintained by non-federal operating entities. "Reserved works" are facilities operated and maintained on a day-to-day basis by Reclamation staff, and this designation applies to approximately one-third of Reclamation assets.

Question 4. When federal hydropower facilities are not available for generation, it results in reduced federal revenues. What were the estimated federal revenue losses due to the decrease in availability of Reclamation hydropower units over the last 10 years?

Answer. Hydropower units are unavailable for generation for two main reasons; scheduled outages and forced outages. Scheduled outages are those outages that are planned to accomplish routine maintenance and minor and major rehabilitation. Because they can be planned, every effort is made to plan them at times when the impact to the Bulk Electric System and federal revenues is minimized. This is usually during the spring and fall months as electricity demands are lower in those months. These outages usually last for a period of a few weeks to several months but can last over a year for major work. When they extend past the low demand periods, the likelihood of the outage impacting revenues is increased. In some cases and for some periods during a scheduled outage, other generators may be able to meet the demand and eliminate impacts to revenue. Forced outages are those that are caused by unexpected equipment failures and system conditions or emergencies. By their nature, they can occur at any time and last from a few minutes to months. Because of this, their impact on revenues varies significantly. In some cases, when a plant is not running at full load, other generators can fill in to absorb the lost generation and prevent loss of revenue.

Reclamation works with our power customers to maintain a robust program of inspection, repair, and replacement that is intended to minimize forced outages, minimize the impact of scheduled outages, and maximize the efficiency and reliability of our hydropower facilities. This collaborative decision-making process helps us to make cost-effective, appropriately-timed investments to address specific needs at each of our facilities. Because lost revenue depends largely on outage timing and length and system conditions during the outage period, Reclamation does not track lost revenue. However, we do track our facilities' forced outage factor, which has averaged 2.2% in recent years, equal to the overall industry average. We also track the condition of major generator and turbine related components, and in recent years we have maintained over 90% of those components in good or fair condition.

Question 5. Analytics are increasingly used by utilities to manage their assets and performance; analytics describes technologies and processes that use data to understand and analyze business performance. These can include real-time monitoring

sensors of structural integrity and processes to support predictive maintenance strategies. What role do analytics play in Reclamation's asset management and performance strategy?

Answer. As summarized in the answer to Senator Barrasso's question 1, Reclamation's overall Asset Management Strategy relies on condition assessments, condition and performance metrics, technological research and deployment, and strategic collaboration to continue to improve the management of our assets and deal with aging infrastructure challenges. The outcome of these data points are recommendations that are required to be acted upon over various periods of time and in many cases in collaboration with our operating entities. Regularly-scheduled inspections (condition assessments) of infrastructure (e.g. Power, Dams, Associated Facilities) are conducted, resulting in prioritized formal recommendations which are tracked until completion in systems such as the Reclamation's Dam Safety Information System and the Power Review Information System.

RESPONSES OF CHARLES STERN TO QUESTIONS FROM SENATOR BARRASSO

Members of the Senate Energy and Natural Resources Committee requested that the Congressional Research Service respond to questions for the record from the July 25, 2013, Senate Energy and Natural Resources Committee, Subcommittee on Water and Power hearing titled "Issues Associated with Aging Water Resource Infrastructure in the United States." The following provides responses to the questions. CRS does not make recommendations; questions asking for recommendations or opinions are addressed by providing relevant information and identifying recommendations made by other entities.

Question 1. What are the lessons for state or local water resource investment efforts based on your research and recent federal experiences with alternative financing?

Answer. There are advantages and disadvantages associated with the use of alternative financing for federal water resource projects, including the use of Special Purpose Entities, "innovative" finance (i.e., a mix of federal loans and traditional financing), and Public-Private Partnerships. Some of these lessons may apply to state or local projects. Generally speaking, an important lesson seems to be that some water resource projects may face greater challenges than other types of infrastructure in successfully implementing these options. Some specific challenges to federal facilities that may apply to state or local water resource investments are discussed below.

Regardless of the specific type of alternative financing that is used, new revenues (often in the form of project-based user fees) are likely to be needed to facilitate various forms of alternative financing. Whether projects are owned by the federal government or another entity, water resource projects may have difficulties raising revenues for a number of reasons. One such difficulty, associated with many Army Corps of Engineers (Corps) projects and some Bureau of Reclamation (Reclamation) projects, is that water resource projects often have multiple beneficiaries which are difficult to identify. This may in turn make it difficult to institute user fees that may be required to facilitate alternative financing. Water resource projects may be operated for any number of purposes (e.g., flood control, municipal or agricultural water supply, navigation, recreation, ecosystem restoration hydropower), and each of these purposes may have different users who benefit from a project to varying degrees. If most or all of a project's expenses are funded out of a government's general revenues (i.e., the General Fund of the Treasury, or a comparable state or local source), there may not be a need to identify and charge the beneficiaries for these projects. However, this is not the case for projects financed by user fees. In the latter case, defining these beneficiaries and assessing fees on them can be a challenging exercise.

On the other hand, a water resource project with existing relationships with users (e.g., Reclamation irrigation projects) and an established process for repaying some investments may not have a problem identifying project beneficiaries, but may face other difficulties. Prior experience suggests that these users may have difficulties financing high cost aging infrastructure projects through existing or new user fees. This is largely due to the cost of repairs and ability to repay them through project revenues. For other types of infrastructure, such as transportation projects, alternative financing has largely been utilized with high-use infrastructure projects where it is possible to institute user fees that do not result in significant disruptions to user behaviors. These projects are most likely to provide a reliable stream of revenue that repays the investment of the financing entity, and are thus more attrac-

tive to investors. The extent to which this is the case for water resource projects is largely unknown.

Taken together, these complications suggest that significant analyses of investment requirements and user behaviors at individual water resource facilities, and extrapolation to the larger portfolio of investments, may be required to make any actionable decisions regarding the potential use of alternative financing. The required analyses may in some cases be highly complex, and require a significant degree of sophistication that may pose challenges for project sponsors.

CRS has completed limited analyses that have hypothetically applied alternative financing concepts to federal water projects and that may be illustrative for state and local entities. One potentially illustrative analysis estimated the cost of construction of five new locks on the Upper Mississippi River. It employed a number of assumptions in regards to traffic levels, borrowing costs, and related factors to these projects, and assumed the construction would be financed only by user fees (i.e., not cost shared between the Inland Waterway Trust Fund and the General Fund of the U.S. Treasury). CRS's analysis found that for a comparable barge trip from Minneapolis to New Orleans, such an approach would require four times as much in user fees as is currently collected in federal fuel taxes. Other independent expert assessments, including one such assessment by the National Research Council, have similarly concluded that the potential for alternative financing to benefit water resource projects appears to vary significantly and depend on project type. These same assessments concluded that those projects with existing revenue streams, high usage and significant commercial value, such as hydropower and port projects, seem to possess the most potential for this type of financing.

Question 2. What are the practical impacts for congressional decision makers of not having comprehensive data on federal aging water resource infrastructure?

Answer. Some stakeholders and Members of Congress assert that the lack of a comprehensive source of publicly available information on aging infrastructure makes it difficult to evaluate the status and needs of aging water infrastructure, both for individual water resource facilities and the larger portfolio of these federal investments. While this information is in some cases available upon request from agencies, it is not typically provided in a regular, publicly available reporting format that uses consistent terminology, methodologies, and performance metrics. The lack of such a frame of reference to use as a basis for discussion of aging infrastructure issues could potentially delay or complicate congressional deliberations such as annual appropriations bills, which recommend funding levels for individual Corps and Reclamation projects as well as broad categories of funding (i.e., dam safety improvements and extraordinary operations and maintenance programs). Additionally, the lack of comprehensive data on aging infrastructure could theoretically affect congressional consideration of authorizing legislation and agency oversight activities related to the status of infrastructure investments, since this information may be used by Congress to inform these deliberations. The extent to which any of this would actually be the case would likely depend on the specific project or program under consideration, and the extent to which information needed for decision making is readily available from the agency or other sources.

APPENDIX II

Additional Material Submitted for the Record

STATEMENT OF ROBERT C. WEAVER, KELLY & WEAVER P.C.

DISCUSSION PAPER.—NATIONAL INVESTMENTS IN AMERICAN CLEAN WATER
INFRASTRUCTURE

AN AMERICAN CLEAN WATER TRUST FUND TO SUPPORT NATIONAL CLEAN WATER GOALS

February 2013.

All Americans benefit from clean and safe water. Adequately performing, sustainable and continuously improving wastewater and water infrastructure is critical to protect public health and the environment, and economically strong and vibrant American communities. These expenditures are financed chiefly by local governments—cities, counties and separate publicly owned wastewater utilities.

The federal government made significant investments to contribute to achievement of secondary treatment for wastewater in the 1970s and 1980s through Clean Water Act grant funding. But construction to control of combined and separate systems wet weather overflow controls, replacement of aging infrastructure and to provide more stringent water quality-based treatment remains a local cost alone as financed primarily by local municipal bonds and loans from the federal state revolving loan funds for wastewater and drinking water facilities.

Expanded national investments including grants supported by national dedicated revenue would:

- (1) Advance the national commitment to clean water;
- (2) Provide jobs;
- (3) Provide a further incentive for investments by local governments in wastewater and drinking water infrastructure;
- (4) Support compliance with enforceable Clean Water Act requirements;
- (5) Capture benefits to downstream users now financed by communities upstream;
- (6) Expand community sustainability; and
- (7) Add to the Nation's infrastructure base and related economic benefits; and
- (8) assist with the replacement of aging infrastructure some parts of which are over 100 years old.

LOCAL RATE INCREASES & IMPROVED MANAGEMENT ALONE ARE NOT SUFFICIENT

Local governments spend \$63 billion annually on clean water infrastructure—second only to education. Since the inception of the Clean Water State Revolving Fund loan program in 1990, local governments have financed most facilities with municipal bonds or SRF loans requiring repayment from local customer fees. Over 97 percent of all wastewater construction is financed using local resources provided by local economies.

The National Association of Clean Water Agencies (“NACWA”) has reported that member agencies responding to its 2009 Service Charge Survey reported average rate increases of 8.5 percent while the national Consumer Price Index fell by 0.4 percent that year. NACWA, 2009 Service Charge Index. In the wastewater community, private financing generally has been avoided since private companies must provide a profit to shareholders and pay taxes. An efficient public wastewater utility further reduces total service costs freeing more investment capital than an efficient private utility.

Utility Asset Management

Over the past decade local utilities have expanded the use of tools known as asset management. The use of these tools is considered in developing capital project esti-

mates. An Environmental Protection Agency (“EPA”) source has said that the rate of adoption of asset management has been very fast over the last couple of years. At least 50 percent of the larger utilities are well on their way to adopting significant aspects of an asset management approach. Within a couple more years, there will be very few utilities, that aren’t moving towards basic asset management practices.

Water Efficiency and Growth

More efficient water use, which may cut operation and maintenance costs initially, is short-run fine-tuning. Efficiency may reduce the need to invest today in growth-related infrastructure, but estimates of the national funding gap do not include a component for growth. By reducing demand on treatment plants, water conservation can at best defer investments in capacity expansion, but in the long run, nothing else changes.

Watershed Management

Reduction in costs from the application of watershed management are estimated as limited across the country and the potential to reduce investments at wastewater utilities is limited to perhaps 2-3 percent based on the number of water-quality limited stream segments that contain POTWs.

ECONOMIC BENEFITS OF WASTEWATER INFRASTRUCTURE INVESTMENTS

Public investments in wastewater facilities improve: (1) competitiveness for American industry, (2) jobs, (3) private profitability, and (4) wages, which in turn yield higher tax revenues. Businesses, particularly manufacturers, benefit from continual improvement in wastewater treatment facilities.

An increased national commitment to meeting the gap in clean water infrastructure would be a sound national economic investment for jobs and growth. Each \$1 billion in wastewater improvements generates over 47,000 direct and indirect jobs. By comparison, total job creation by highway and road construction has been estimated to be approximately 34,000, for each \$1 billion spent. *A Report on Clean Water Investment and Job Creation prepared by the National Utility Contractors Association by Apogee Research, Inc., March 30, 1992.*

Additionally, the U.S. Conference of Mayors has reported that construction of wastewater facilities infrastructure has an estimated gross domestic product multiplier of 6.3 to 1.

Grant funding is a stronger economic incentive

Only federal grants can provide adequate incentive and capital for moving the national clean water program forward at an appropriate pace recognizing the burden of massive requirements placed on local governments. Additionally, national grants limit local fiscal impacts that would provide incentive for businesses to move to other communities where local rates are not as high.

Finally, infrastructure networks are a national priority with social, economic and environmental equity implications when provided unevenly across America. Congress recognized these networks as a national in enacting the Clean Water Act of 1972 and the Safe Drinking Water Act in 1974.

NATIONAL, SUSTAINABLE, LONG-TERM, RELIABLE CAPITAL

National requirements for wastewater infrastructure are driven by: (1) the federal Clean Water Act enforced by EPA and NPDES delegated states; and (2) three waves of aging infrastructure constructed from the late 19th Century to the 1960s, the useful lives of which are now ending. Approximately \$10 billion dollars annually is required to close the national gap in wastewater infrastructure construction, with a similar amount for drinking water infrastructure.

In 2000, a coalition of organizations under the Water Infrastructure Network (“WIN”) documented the importance of a national source of sustainable, reliable and long-term capital recognizing that all Americans benefit from clean water. The WINow 2000 Report projected that the costs of maintaining and advancing water quality and reducing wet weather flows would require \$550 billion in new construction. An additional \$450 billion is needed in new, drinking water construction.

In 2002 and 2003, EPA and the General Accountability Office reported a gap of \$300 billion to \$500 billion between what is being spent and what needs to be spent on legacy infrastructure replacements and new construction to meet future water quality requirements.

- EPA's Progress in Water Quality Report issued in 2000 concluded that, if additional improvements are not made, America could see a return to pre-Clean Water Act levels of stream impairments by as early as 2016.
- National requirements for clean water are estimated to cost well beyond local governments' ability to pay and will result in major increases in local water and wastewater rates nationwide.
- Wastewater infrastructure is no less important than other infrastructure because of the value of clean water to the nation as a whole, public health of American communities, the downstream and interstate impacts of polluted waters, and the networking benefits of such facilities.
- Local governments are simultaneously building other infrastructure to assure public health, safety and well-being. Debt incurred from all infrastructure needs is a major burden on communities, thereby, limiting future borrowing capacity, and the ability to meet national water quality goals and objectives.
- Grants capture downstream clean water benefits: Treated wastewater is a national public good. Under present financing arrangements including the CWA SRF loan program, down stream communities and their ratepayers realize, but do not contribute to, clean and safe water benefits from infrastructure improvements financed by upstream communities. Expanded federal funding that includes matching grants supported by national dedicated revenue would capture those benefits.
- Continuing advances in advanced water and wastewater infrastructure technologies are critical to public health and water quality improvements, improved service, and effective asset management.
- Expansion of SRFs provide additional funding to pay for municipal bond insurance and guarantees, now authorized for the existing SRF programs, and thereby attract more private capital.
- A sustainable source of new public capital is essential: Local capital funding, municipal bonds, and SRF loan paybacks all increase local customer rates. As rates increase, the ability of local governments to pay off bonds and SRF loans decreases, and with it, local government credit ratings on which further bond financing and loans are based.

New capital from a national source, representative of the national funding gap and the national commitment to clean water, is fundamental and essential to advance water quality in America. Even with federal grant funding, most of the cost of infrastructure improvements will be financed by local customer rates.

ELEMENTS OF A NATIONAL CLEAN WATER TRUST FUND ("NCWTF")

Essential Objectives and Uses include:

- Matching grants to local utilities for construction of wastewater treatment and transport facilities, overflow controls, and biosolids treatment.
- Matching grants to states to further capitalize state revolving funds for loans, bond insurance and other SRF assistance.
- Research, development and full-scale demonstration of advanced wastewater treatment technologies.
- Grants to advance watershed management including substate water quality management planning for American rivers, lakes and streams including under §208 of the Clean Water Act.
- Grants for urban stormwater and rural nonpoint source management.
- Grants for rural nonpoint source programs.
- Permanent funding for § 106 Clean Water Act state program management grants to support §301 water quality standards; §303(e) continuing planning process by states; and the §402 NPDES permit program.
- Grants for substate water quality management planning and total maximum daily loads development under §208.
- Permanent funding for the §319 nonpoint source program and other CWA programs.
- Innovative financing supportive of the SRF programs.
- Other similar authorities under the Safe Drinking Water Act.

NATIONAL CLEAN WATER USER FEES

All Americans—citizens and their places of employment and community, benefit from clean water and all should contribute to a renewed national commitment. To be successful and nonburdensome, revenue sources to finance a national trust fund would be:

- (1) Funded from the national economy instead of local economies,

- (2) Long-term,
- (3) Sustainable,
- (4) Reliable,
- (5) Low rate,
- (6) Broad-based on products sold in interstate commerce, and
- (7) Fair and equitable.

One combination of clean water user fees meeting these criteria include:

- Low rate user fees on a range of flushable products sold nationally;
- Low rate fee increment on the national corporate income;
- Fines and penalties collected under the federal Clean Water Act; and
- Other similar national user fees.

BENEFITS

- Such revenue helps reduce the current deficit in the federal General Fund.
- States could be authorized to charge an additional increment on national fee sources for use in further aiding wastewater construction in their states.
- National, dedicated revenue trust funds have been extremely successful as a source of national capital devoted to national infrastructure improvements such as for highways, mass transit and airports.
- Federal or state taxes on local governments or their wastewater and water utilities would only increase the burden on local governments and local economies, and are opposed by local governments and their national organizations.
- A national clean water trust fund would be deficit neutral because it would be financed by new revenue, dedicated to the purposes and uses of the fund for clean and safe water infrastructure. Authorizing legislation should establish a fire-wall to assure that the funds would be spent only for those purposes on an annual basis.

GOVERNMENT ACCOUNTABILITY OFFICE REPORT

A VARIETY OF ISSUES TO BE CONSIDERED WHEN DESIGNING A CLEAN WATER TRUST FUND BILL

CERTAIN IMPLEMENTATION CHALLENGES

2009

In December 2007, Congressman James Oberstar, Chairman of the House Transportation and Infrastructure Committee requested the U.S. Government Accountability Office (“GAO”) conduct a study of potential revenue sources for a National Clean Water Trust Fund.

GAO’s report, A Variety of Issues to be Considered When Designing a Clean Water Trust Fund Bill, was issued in June 2009 and hearings were held on the report by the House Transportation and Infrastructure Committee on July 15, 2009.

The 2009 GAO report reviewed and analyzed the following national revenue options: (1) excise taxes on flushable products, pesticides, fertilizers, pharmaceuticals, and water appliances and plumbing fixtures; (2) an additional tax on corporate income; (3) a water use tax based on volume and added to residential, commercial, industrial utility rates paid by local customers and collected by local utilities; and (4) an industrial discharge tax.

A summary of GAO’s findings include:

1. Excise taxes on products that may contribute to the wastewater stream would:

- Identify precise product definitions.
- Modify IRS’s current excise tax collection and enforcement framework.
- “According to IRS officials, collecting and enforcing an excise tax at the manufacturing level is preferable because it involves fewer taxpayers than a tax that is levied at the retail level.”

2. Additional Tax on Corporate Income

- “According to IRS officials, implementing an additional tax on corporate income would require defining the type of corporations and the portion of their income that would be subject to his tax.”
- The current collection system for the corporate environmental income tax for the Superfund program is available and “was levied only on corporations that had income in excess of \$2 million.”

3. Water Use Tax on Localities

- “Collecting this tax could be difficult, because . . . it would most likely involve relying on some of the billing systems in place for the nation’s existing 50,000 community water systems and over 16,000 publicly owned wastewater plants along with other local government entities” that together do not use uniform billing systems. Some systems charge based on volume used and others use flat fees or other types of rate structures.
- “In addition, decisions would need to be made regarding which users of the system—households, commercial, and industrial—would be subject to the tax.”

4. An Industrial Discharge Tax

- An industrial discharge tax or fee would require determining whether to charge amounts in discharge permits or actual discharges.
- Suffers from a lack of complete and accurate data on the number of permittees and quantities of industrial discharges.
- Determining whether individual or general NPDES permits would be taxed and setting a tax rate.
- Effluent and levels of discharge can vary significantly between “and charging a flat tax to all permit holders may not be equitable.”
- EPA “would have to develop a basis for establishing a tax rate and put in place a collection and enforcement framework before a permit-based tax could be implemented.”
- “Currently, EPA does not collect any taxes on industrial discharges, and to implement such a tax would require EPA to put in place a collection and enforcement framework.”
- EPA does not have complete data for designing and for an enforcement framework on the environmental and human health hazards posed by such discharges.
- There are a large number of chemicals and their varying characteristics, and there are “inherent scientific difficulties in using existing toxicity weighting systems to compare toxicity among chemicals.”

The GAO report also provides information on: (1) stakeholder and industry interest in revenue options based on a limited sampling data; and (2) estimates of revenue, also based on limited information that could be collected under the options included in the report. A comparison of revenues analyzed by the GAO report and included in the newest House bill follows.

Comparison of Revenue Options

GAO Report: A Variety of Issues to be Considered When Designing a Clean Water Trust Fund Bill	Blumenauer Trust Fund Bill: Water Protection and Reinvestment Act, H.R.6249, 112th Congress
June 29, 2009; revenue options analyzed:	August 1, 2012; revenue options included in bill:
1. Excise taxes that may contribute to the wastewater stream	1. Excise taxes
A. flushable products	A. wastewater disposal fee
B. pesticides	
C. fertilizers	
D. pharmaceutical products	B. pharmaceutical products
E. water appliances and plumbing fixtures	C. water-based beverages
2. Additional Tax on Corporate Income	
3. Water Use Tax: volume based added to local residential, commercial, industrial utility rates paid by customers	
4. Industrial discharge tax	
Total estimated revenue varies with rates.	Total estimated revenue: \$6.5 billion for wastewater only.

CHRONOLOGY OF POLICY AND LEGISLATIVE DEVELOPMENTS

1996

EPA reported to Congress on alternative funding and dedicated revenue options.

2000

The Water Infrastructure Network reported construction needs of \$550 billion for wastewater and \$450 billion for drinking water, and needs continue increase.

2000

EPA's Progress in Water Quality Report concluded that, if improvements are not made, America could see a return to pre-Clean Water Act levels of stream impairments by as early as 2016.

2002 & 2003

EPA and the Government Accountability Office ("GAO") report a gap of \$300 billion to \$500 billion between what is being spent and what needs to be spent on legacy infrastructure replacements and new construction to meet water quality requirements.

2005

Congressman John Duncan (R-TN) and bipartisan cosponsors introduced H.R. 4560 to establish a clean water trust fund subject to revenue source studies.

2009, June

GAO report, A Variety of Issues to be Considered When Designing a Clean Water Trust Fund Bill, detailing suggested revenue options and reasons not to impose federal tax on local government wastewater and drinking water systems.

2009, July

H.R. 3202, Water Protection and Reinvestment Act introduced by Congressman Blumenauer (D-OR) and bipartisan cosponsors to fund the clean water and drinking water SRFs, grants for wet weather control, state CWA and SDWA programs, and research and development.

2010

Simpson-Bowles National Commission on Fiscal Responsibility and Reform recommend reauthorization of transportation trust funds with dedicated revenue to maintain national investments in highways and transit systems.

2011

H.R. 4135 Water Protection and Reinvestment Act of 2011 introduced by Congressman Bishop (D-NY) and bipartisan cosponsors to reauthorize clean water SRF, establish clean water trust fund, provide for a Congressional Budget Office report on revenue sources for the fund, establish a Water Innovative and Finance Infrastructure Authority program, and for other purposes.

2011

The Administration and Congress begin reductions in federal capital grants to states for the clean and safe water SRFs, though national commitment to clean water and regulations remain and needs continue to expand. One estimate is that the corpuses of SRFs will reduce 30 percent in 10 years if annual federal capital grants are ended by the Congress.

2012

Congressmen Bishop (D-NY), LaTourette (R-OH) and Blumenauer (D-OR) send letter to the Congressional Budget Office ("CBO") requesting analysis and report of national revenue sources for clean water trust fund legislation.

2012

Senate committee hearing witnesses support trust fund legislation.

2012, August 1

Congressman Earl Blumenauer (D-OR) H.R. 6249 introduces Water Protection and Reinvestment Act to create a clean water trust fund to support the Clean Water Act State Revolving Fund program and related EPA programs.

WIDE NATIONAL SUPPORT

An overwhelming majority of Americans (84 percent) would support legislation in the U.S. Congress that would create a long-term, sustainable and reliable source of federal funding for clean and safe water infrastructure. Luntz Research for NACWA.

The Clean Water Trust Fund has attracted support from many individuals and organizations as reported by Clean Water America, www.cleanwateramerica.org. Among supporting national organizations are:

Ducks Unlimited, Trout Unlimited, American Rivers, National Association of Towns and Townships, Association of State and Interstate Water Pollution Control Administrators, American Society of Civil Engineers, Western Coalition of Arid States, Rural Community Assistance Partnership, National Association of Clean Water Agencies, American Sportfishing Association, American Council of Engineering Companies, Theodore Roosevelt Conservation Partnership, Construction Management Association of America, International Association of Fish and Wildlife Agencies, American Public Works Association, Association of Equipment Manufacturers, The Associated General Contractors of America, Design Build Institute of America, Underground Contractors Association, Plastics Pipe Institute, American Concrete Pressure Pipe Association, American Supply Association, Portland Cement Association, Associated Equipment Distributors, BASS/ESPN Outdoor.

CONCLUSION

Continuing under-investment in clean water threatens water resources, the environment, public health, community sustainability and the national economy. The national government is best able to provide new sources of capital for national investments in essential infrastructure because funding can be available even in periods of fiscal stress by:

- Support from the national economy rather than depending on local economies alone;
- Removing the present clean water and drinking water SRFs and related program costs from the federal General Fund to reduce its deficit; and
- Providing new funds supported by new, dedicated revenue to move the national clean water program forward for the benefit of all Americans.

Enactment of a National Clean Water Trust Fund financed by a fair and equitable system of clean water restoration user fees would provide a national source of capital for investments to contribute to the achievement of national clean water goals and job creation.

STATEMENT OF PETER B. KING, EXECUTIVE DIRECTOR, THE AMERICAN PUBLIC WORKS ASSOCIATION

Chairman Schatz, Ranking Member Lee, and members of the subcommittee, thank you for the opportunity to submit testimony relating to the recent hearing on the state of water infrastructure in the United States. My name is Peter King, Executive Director of the American Public Works Association (APWA). I submit this statement on behalf of the more than 28,500 public works professionals who are members of APWA. Improving the condition of our nation's aging water infrastructure requires increased funding for capital investment, and local governments will need a suite of financing tools to meet these funding demands.

BACKGROUND

APWA is an organization dedicated to providing sustainable public works infrastructure and services to millions of people in rural and urban communities, both small and large. Working in the public interest, APWA members plan, design, build, operate and maintain transportation, water supply and wastewater treatment systems, stormwater management, drainage and flood control infrastructure, waste and refuse disposal systems, public buildings and grounds, emergency planning and response, and other structures and facilities essential to the economy and quality of life nationwide.

APWA's members play an important role in providing clean and safe water to their communities. However, the current water infrastructure system is deteriorating and strains under the increasing demands for sound flood control, efficient waterway transportation systems and for clean and safe water. In their most recent

infrastructure report card, the American Society of Civil Engineers (ASCE) gave the state of our nation's water infrastructure, encompassing dams, levees, wastewater and drinking water infrastructure, an average grade of a D. There are an estimated 240,000 water main breaks per year in the United States and the average age of the 84,000 dams in the country is 52 years old. Nearly 14,000 of those dams ranked as high hazard.

Inadequate investment will only exacerbate the dire state of our aging water systems. According to the ASCE report, capital investment needs for the nation's wastewater and stormwater systems are estimated to total \$298 billion over the next twenty years. Additionally, reports released by the Environmental Protection Agency (EPA), the American Water Works Association and others show our drinking water utilities and wastewater utilities face needs upwards of \$1 trillion or more to fund their systems over the next twenty years.

Currently, local governments are the primary investors in water and sewer systems. According to a 2008 report by the US Conference of Mayors, local governments cover 95 percent of the costs for water infrastructure maintenance and 99 percent of the cost of wastewater infrastructure maintenance. Local governments will need strong state, federal, and private partnerships to meet the significant financial needs of our water infrastructure. Additionally, the federal government is encouraged to curb the practice of imposing unfunded mandates and ensure that state and local governments receive strong financial support to fulfill federal mandates. To ameliorate the state of our water infrastructure, APWA supports a variety of funding mechanisms and initiatives to increase capital investment in our dams, levees, drinking water, and waste water infrastructure.

PROGRAMS AND INITIATIVES TO BOLSTER CAPITAL INVESTMENT IN WATER INFRASTRUCTURE

Water Infrastructure Finance and Innovation Act (WIFIA)

APWA supports the Water Infrastructure Finance and Innovation Act (WIFIA). WIFIA is one of the many innovative funding mechanisms that will be essential to closing the water infrastructure funding gap. Modeled after the popular Transportation Infrastructure Finance and Innovation Act or TIFIA plan, the WIFIA plan will lower the cost of borrowing funds for municipal water/wastewater agencies. This will be accomplished by leveraging funds directly from the U.S. Treasury which would subsidize borrowing costs and lend the money at a lower interest rate than is available in the municipal bond market. APWA supports WIFIA because it gives local government agencies access to low cost funds for water infrastructure projects. However, APWA supports all efforts to establish increased funding opportunities for water, wastewater and stormwater treatment system enhancements. WIFIA should be one of the many tools that local government agencies can use to finance water capital projects.

State Revolving Funds

In addition to WIFIA, APWA supports continued federal funding for programs such as the State Revolving Funds (SRFs) that have proven to be successful mechanisms for providing local jurisdictions with necessary funds for water infrastructure capital. Clean and Safe Drinking Water SRFs have provided \$111 billion to local governments for water infrastructure since their inception. SRFs are a vital resource for financial support especially for small and rural communities. The Clean Water SRF provides 23 percent of water infrastructure funding for localities with fewer than 10,000 residents and the Drinking Water SRF provides 37 percent.

Clean Water Trust Fund

APWA also supports the establishment of a trust fund as a complement to the WIFIA program. A trust fund could serve as the funding vehicle for a WIFIA program or simply as another financing tool available to water infrastructure projects. The establishment of clean water trust fund will ensure that there is a permanent, dedicated funding source for clean water and drinking water infrastructure in the U.S. There are a number of potential methods to fund the clean water trust fund. Organizations such as the Water Infrastructure Network (WIN) propose using fees on objects such as bottled beverages, flushable products, pesticides, agricultural chemicals, and pharmaceuticals to finance such a trust fund. APWA supports these and many other innovative measures to ensure that there is a dedicated funding source for water and wastewater infrastructure projects in the future. A dedicated water infrastructure funding source supports local governments and gives them the stability needed to finance and plan long term infrastructure projects that typically span years.

Reauthorization of the Water Resources Development Act

APWA supports the reauthorization of The Water Resources Development Act of 2013 (WRDA). A WRDA has not been authorized since 2007. A new authorization is necessary to continue approved flood control, navigation, and environmental projects and studies by the United States Army Corps of Engineers that improve and maintain our nation's water infrastructure. Reauthorization of WRDA is important to public works and the communities they serve. WRDA promotes investment in the nation's critical water resources infrastructure, authorizes projects that improve our nation's water infrastructure and environment, and accelerates project delivery, saving local government time and money. WRDA reauthorization will demonstrate that investment in water infrastructure is a national priority.

Other Initiatives

Additionally, APWA supports the creation of public private partnerships. A government service or private business venture funded and operated through a partnership of government and one or more private sector companies will provide additional needed capital funding for water infrastructure projects. Public private partnerships will also shift the financial, technical and operational risk in the projects from taxpayers to private companies. APWA also supports raising the cap on private activity bonds, maintaining the tax exempt status of municipal bonds, the creation of a long term dedicated funding source such as a trust fund to fund local water system projects, and the establishment of a national infrastructure bank as potential funding vehicles for water infrastructure.

Conclusion

The consequences of inadequate investment in water infrastructure are serious. Without increased funding in water infrastructure, local communities will not be able to keep pace with growing demands for flood control, waterways transportation, and clean and safe drinking water. Economic opportunities will be lost. Water infrastructure funding should be a national priority; the stakes are too high to neglect this problem.

Chairman Schatz and Ranking Member Lee and members of the subcommittee, thank you for holding this hearing and continuing to pursue a solution to the nation's aging water infrastructure. We are especially grateful to you and subcommittee members for the opportunity to submit this statement. APWA stands ready to assist you and your Congressional colleagues as you work to craft a solution to this critical problem.

STATEMENT OF DAVID RABBITT, CHAIR, NORTH BAY WATER REUSE AUTHORITY

Chairman Schatz and members of the Subcommittee, I am David Rabbitt, chair of the North Bay Water Reuse Authority (NBWRA), a regional-scale partnership of 10 water resource agencies and local governments in three counties (Marin, Napa and Sonoma) that rim the north San Francisco Bay. I appreciate the opportunity to provide the Authority's perspective on the issue of how the federal government can assist local agencies in addressing the challenge of addressing the critically important issues of aging and inadequate water infrastructure.

Our North Bay communities face long-term water challenges to meet the needs of agriculture, urban centers and environmental protection. The North Bay Water Reuse Program (NBWRP) is developing and implementing a series of regional-scale projects that are helping to meet the region's water supply needs by producing, distributing and storing a reliable source of recycled water and addressing water demand and wastewater discharge issues concurrently using an integrated, regional approach. The NBWRP promotes collaboration of smaller sanitation districts and allows them to have access to funding and expertise that they would normally not have. It also allows the partnership to leverage state and federal funding. The NBWRP is unique in its approach of collectively expanding reuse efforts—and in doing so redefining regional—scale water reuse.

Addressing the problem of aging and inadequate water infrastructure is a major challenge for the NBWRA members, as well as the country's water and wastewater industry as a whole. The Environmental Protection Agency has estimated that nationwide water agencies must invest \$633 billion over the next two decades just to keep the existing water infrastructure operating at current levels of service. Consistent with these estimates, our own experience is that our member agencies will need to invest more than \$150 million, over the next ten years, in treatment plants, pumping stations, storage facilities and distribution lines around the three county region just to maintain current levels of service.

In addition to the challenges of making age-related repairs to existing water infrastructure is the challenge of addressing climate change-related impacts. 2009 estimates by national water utility organizations indicate that utilities will be required to invest between \$448 billion and \$944 billion to address climate change-related issues. The NBWRA members face similar pressures: drought conditions have become more frequent; traditional sources of surface and groundwater supplies are limited; and the quality of groundwater supplies continue to degrade.

Without any new surface or groundwater supplies available, water reuse offers the best near-term, reliable regional water supply alternative.

Recent Successes in Accelerating Investments in Water Infrastructure.—Implementation of Phase I of the NBWRP is well underway. Under Phase I, the Authority members have six recycled water projects underway or constructed. When complete, Phase I will provide 5,500 AFY of tertiary treated recycled water for agricultural and landscape irrigation, salt marsh restoration and other environmental benefits. Phase I will also create the backbone of a system that will, in Phase II, generate more than 30,000 acre-feet of water per year.

The NBWRP has been successful in obtaining both state and federal support. Phase I is authorized to receive \$25 million in federal construction assistance, for example. To date, the NBWRP has received \$16,590,000 in federal assistance under this authorization through a combination of American Recovery and Reinvestment Act (ARRA) and Bureau of Reclamation (Reclamation) WaterSMART and Title XVI grants.

In addition to federal assistance, the NBWRA members have been awarded \$2,875,000 through the various State of California competitive grant programs and the members expects to receive an additional \$5 million from other state sources between now and calendar year 2019, when Phase I is scheduled to be complete.

The federal and state assistance, totaling \$32,875,000, will be matched by approximately \$71,125,000 in non-federal program sponsor funding. Of the \$104 million total project cost for Phase I, the non-federal sponsors are covering 68 percent of the costs. The message is that WaterSMART and Title XVI are working. The programs, with a limited federal investment, are making it possible for local agencies to invest far greater sums to not only address their aging water infrastructure challenges, but meet the broad water supply needs of a region in a cost-effective, affordable and sustainable manner. Without the federal and state investments, the local agencies would not have been incentivized to work together to address the broad water supply needs of the region, and a much delayed, piecemeal solution would have necessarily and understandably been pursued by the individual member agencies.

Additional Tools Needed to Facilitate New Investment in Aging Water Infrastructure.—The NBWRA has begun planning work on Phase II of its project, which, again, is expected to yield an additional 25,000 acre-feet of water per year for a broad array of beneficial purposes. Because of many of the systems, particularly the treatment facilities, of Phase I were constructed to be easily expanded, Phase II will achieve this five-fold increase in water yield through an additional investment of somewhere between two-and-a-half and three times the costs of Phase I, or \$150 to \$175 million.

Much of Phase II will focus on increasing available storage of recycled water. Storage is the key to capturing the full value of recycled water systems.

To secure the benefits of Phase II and assist other regions of the West in addressing their aging water infrastructure challenges, the NBWRA recommends the following:

- **WaterSMART, Title XVI.**—The NBWRA recommends funding WaterSMART, Title XVI at the highest practicable levels. The President's request of \$14 million for FY 2014 in the WaterSMART Title XVI grant program is less than half that requested in FY 2012, and a fraction of the actual need expressed by the many water reuse projects previously studied and authorized by Congress. Water recycling and reuse remains the one reliable and readily available new source of fresh water. Yet Reclamation still maintains a backlog of between \$400 million and \$600 million in authorized federal cost-share funding that could be leveraged in partnership with willing non-federal water purveyors in the construction of these viable and necessary water reuse projects under Reclamation's Title XVI program, creating literally hundreds of thousands of acre-feet of clean, usable water supplies annually—water that is currently lost to the ocean.
- **Support Regional-Scale Water Reuse Projects.**—The NBWRA recommends that Congress direct Reclamation to support regional-scale water reuse projects by expanding available planning assistance under Title XVI for regional-scale

projects that include multiple jurisdictions and generate environmental, as well as water supply benefits. These regional projects can require longer planning timeframes than other more narrowly focused projects. Accordingly, the NBWRA urges Congress to direct Reclamation to allocate a portion of the funds within the overall Title XVI program to advance regional-scale water reclamation and reuse projects by providing planning grants of up to \$2.5 million over periods of up to five years. Reclamation currently only makes available planning grants of up to \$150,000 and requires the funds to be expended within 24 months. Moreover, projects, even large-scale regional projects, are barred from applying for multiple planning grants. This is Reclamation's policy; there is no statutory prohibition to increasing the size of available grants and extending the period of time over which they must be expended.

- **Support Access to Long-Term, Low Interest Financing for Water Infrastructure Projects.**—The NBWRA urges Congress to approve an amendment to the Twenty-First Century Water Works Act (Title II of Public Law 109-451) that would authorize the Bureau of Reclamation to make long-term, low-interest financing to large-scale, regional water infrastructure projects that generate multiple benefits, including water reuse facilities. The 113th Congress has recently seen the introduction of several water infrastructure loan programs, including a pilot provision in the Senate passed Water Resources Development Act (WRDA) of 2013, mirrored after the Transportation Infrastructure Finance and Innovation Act (TIFIA). The Water Infrastructure Finance and Innovation Act (WIFIA) would allow for the Army Corps of Engineers (Corps) and the Environmental Protection Agency to provide loans, lines of credit, and loan guarantees to eligible water infrastructure projects with a total cost of over \$20 million (the Senate WRDA pilot program allows for a smaller \$5 million threshold for rural (< 25,000 population) community water projects) in an amount not to exceed 49 percent of the total cost of the project. The Senate WRDA pilot program would provide for a low interest rate (T-bill rates) and a longer repayment period (35 years, including an upfront five year no-payment grace period) than traditional financing mechanisms, but would not allow communities to access tax exempt municipal bonds to finance the 51 percent balance of the project's cost. Eligible water projects, among others, include water reuse, recycling and desalination projects. While this type of assistance would be very helpful to water reuse and recycling projects in the West, the NBWRA urges Congress to broaden this authority to the Bureau of Reclamation for this purpose as well.

One avenue to congressionally authorize a Reclamation Infrastructure Finance and Innovation Act program, or RIFIA, would be to amend existing law rather than pass an entirely new authorization or add the agency to the current effort in the Senate WRDA, both of which require a significant effort in the Congress to find offsets for any new authorization or amend an already Senate passed bill.

Title II of Public Law 109-451 already authorizes the Secretary of the Interior, acting through the Commissioner of the Bureau of Reclamation, to provide loan guarantees to finance up to 90 percent of the cost of an eligible water project for certain non-federal borrowers as defined in Title II. For non-federal water projects financed by Title II guarantees, such guarantees would only "cost" the federal agency appropriated funds in the amount of the actual risk (subsidy) underwritten by the federal guarantee, which in most cases for publicly owned water infrastructure equals about 2-5 percent of the total amount guaranteed. However, Title II was written with more traditional Reclamation projects in mind, including the rehabilitation and betterment of existing water infrastructure. Due to the way the provision scores in the budget process, no loan guarantees have been made under the authority.

- **Create Expanded Grant Opportunities to Support the Implementation/Construction of Integrated Water Management and Storage Facilities.**—The NBWRA urges Congress to expand the opportunities within Reclamation to compete for grants that support integrated regional water management and reuse projects. Currently, Reclamation only has authority to participate in water management projects with cost-shared grants of not more than \$5 million per project. Projects that support sustainable water management practices should be eligible to compete for grants of up to \$15 million and funds, once granted, should remain available for up to five years.
- **Transfer Title to Certain Reclamation Facilities or Separable Elements of Such Facilities.**—The NBWRA urges Congress to consider steps that can be taken to create opportunities for the non-federal sponsor of a Reclamation project to in-

vest in the project to allow the project to continue to provide or enhance authorized project purposes to project beneficiaries. The federal budget rules create barriers to Congress providing assistance to non-federal sponsors of federal projects to help them make investments to maintain or improve federal projects. To address this problem, Congress should grant the Secretary, under specific conditions, the authority to transfer to a non-federal operating entity of a reclamation project or a separable element thereof constructed by the United States and titled in the name of the United States where the project construction and other obligations have been paid out by the project beneficiaries, the project is in need of additional investment by the non-federal operating entity in order to continue to provide or enhance project purposes to project beneficiaries, and the transfer meets all federal requirements (such as NEPA/ESA/etc.). Once transferred, an opportunity for congressional review should also be provided. Allowing the non-federal operating entity to obtain access to low cost, long-term federally-backed RIFIA financing under these circumstances would not constitute a "third-party" financed obligation, would be favorably "scored" under congressional budget rules, and would provide an incentive for the non-federal operating entity to make these essential investments.

CONCLUSION

The NBWRP can serve as a model for how communities of a region can join together, develop and implement a common vision, and work in partnership with the federal and state governments to maximize the benefits of limited water resources in the West. The NBWRP experience highlights the importance of continued federal and state investments in water infrastructure and some of the ways those essential, yet limited, federal investments can be made most effective.

NATIONAL TAXPAYERS UNION,
Alexandria, VA, August 6, 2013.

Hon. BRIAN SCHATZ,
Chairman,

Hon. MIKE LEE,
Ranking Member, Subcommittee on Water and Power, Committee on Energy & Natural Resources, 304 Dirksen Senate Office Building, Washington, DC.

DEAR CHAIRMAN SCHATZ, RANKING MEMBER LEE, AND MEMBERS OF THE SUBCOMMITTEE: On behalf of National Taxpayers Union's (NTU's) 362,000 members, I write to offer comments for the record in regard to the Subcommittee's July 25 hearing to address aging water infrastructure resources in the United States. NTU applauds you for exploring this topic, which has major implications for taxpayers.

As you may know, NTU's members believe that the nation's considerable challenges for replacing, renovating, and financing infrastructure must be met in a fiscally responsible manner that encourages innovative policy approaches at all levels of government and relies more heavily on private-sector involvement. According to calculations from Harris Kenny of the Reason Foundation, the combined 2012 renewal rate of private contracts for water and wastewater services by local governments (whether re-approving the incumbent or awarding to a new bidder) was nearly 90 percent. This should be a testament to the feasibility of public-private partnerships in delivering such a critical infrastructure component. Although far from perfect, recent Congressional action on a pilot program version of a Water Infrastructure Finance and Innovation Authority is another sign of bipartisan interest in developing alternatives to high-cost funding processes for water and sewer initiatives. Yet, given the fact that the estimated average replacement value of the entire water network in the U.S. could amount to trillions of dollars, the need for a fundamental shift in thinking about this issue remains clear.

Accordingly, I wish to commend your attention to a report NTU commissioned in April concerning one component (amounting to roughly 60 percent) of this massive potential liability for taxpayers and ratepayers: underground pipes. The full study*, entitled *Reforming Our Nation's Approach to the Infrastructure Crisis: How Competition, Oversight, and Innovation Can Lower Water and Sewer Rates in the U.S.*, is available at www.ntu.org. Gregory Baird, President of the Water Finance Research Foundation (WFRF), examined for NTU the challenges of decaying water and

*Document has been retained in subcommittee files.

wastewater systems in the U.S., and determined that impediments to change are more fiscal and political in nature than they are technical.

For example, although corrosion is the main factor in deteriorating metallic pipes such as cast and ductile iron—boosting long-term replacement costs to a trillion dollars or more—other types of material could, with proper evaluation for local needs and conditions, help to reduce or control that problem. Drawing upon established industry standards and research from prestigious institutions, WFRF developed a methodology incorporating pipe diameters, water main breakage/decay tests, pressure specifications, and other variables to provide an estimate of potential savings by allowing materials such as PVC pipes to be considered in the water delivery process. Among the study's findings:

- A nationwide switch from cast iron and ductile iron pipes to PVC, given open procurement and cost justification analysis, could benefit water ratepayers and taxpayers in the average total amount of \$371 billion, or 17.4 percent of the total replacement value of U.S. underground water pipe infrastructure. About one-fourth of these savings would occur over roughly 25 years, with the rest in subsequent decades.
- However, population growth will drive the need for new underground infrastructure, not just replacement. If these pipes were also subjected to rigorous open procurement and cost justification analysis across the country, an average total of \$139.6 billion in savings could be realized through the year 2050.
- Individual states and cities, many of which do not allow open procurement policies, could reap large benefits from such reforms. The author conducted PVC-based cost-cutting estimates for places such as Chicago (\$33.6 million in savings) and Detroit (\$8.5-\$11.9 million in savings).

Baird noted that various industries and utilities are likely to argue over the estimates, but they are missing the point of the NTU-WFRF study: reforms such as open procurement practices and life-cycle cost analysis (LCCA) methods allow that very kind of debate to occur in a rational way. Indeed, NTU believes that LCCA should be a standard for all types of infrastructure considerations, including roads. As Baird wrote, "The issue at hand is not really the selection of one pipe over another, but the ability for a utility to take advantage of all materials, processes, technologies, and products that create the most cost-effective solution while meeting sustainable performance levels." In any case, other stakeholders, including most recently the Mayors Water Council of the U.S. Conference of Mayors, have spoken out for competitive procurement of underground infrastructure, improving the prospects for overhauling current, flawed practices. Furthermore, according to Baird, utility managers and elected officials must embrace regular public reviews and financial analyses of their operations, including multi-year condition assessments, to reduce risks to ratepayers and earn their confidence.

Although an abundance of research exists on the salutary fiscal impact of these methods, ensuring that they are employed at the most basic decision-making levels will require a more concerted effort. While NTU believes that Washington's involvement in local government infrastructure projects should be minimized, federal grants and cost-sharing will likely persist in this area in the near term. For that reason, lawmakers should thoughtfully design guidelines that help encourage utilities and other entities to embrace open procurement and life-cycle costing techniques. While care must be taken to avoid regulatory impulses that restrict localities' freedom to experiment or that add to compliance expenses, it is reasonable for Congress to offer positive leadership that will protect taxpayers and ratepayers from subpar infrastructure asset management in their communities.

NTU is committed to helping citizens and elected officials reach a mutually productive consensus on the need for better stewardship, oversight, and allocation of the public's resources toward all manner of infrastructure, including water and wastewater undertakings. Please feel free to call upon us in your future deliberations over these and other matters that come before your subcommittee. Our members are most grateful for your consideration of these comments.

Sincerely,

PETE SEPP,
Executive Vice President.

STATEMENT OF BOB CHALKER, EXECUTIVE DIRECTOR, NACE INTERNATIONAL, THE
CORROSION SOCIETY

Can a water pipeline outlive its design life? With proper materials and installation, and vigilant maintenance, pipelines and other vital infrastructure can outlive

its proposed design life. When it comes to water pipelines, corrosion control plays an essential role in extending the life of a pipeline or ensuring the safe, productive life of a new pipeline.

It is more than time that causes infrastructure to weaken and fail; corrosion has caused billions of dollars of damage nationwide each year, with estimates as high as \$452 Billion, which is approximately \$1,500 per American citizen. We see headlines about the nation's aging infrastructure and we live each day hedging our bets that our old infrastructure will provide the safe delivery of water and energy to our homes and businesses, but these are true risks to public safety and a potential waste of taxpayer money.

Water main breaks can be prevented if precautions are taken from the outset through the use of a corrosion control plan and timely maintenance practices implemented throughout the life of the water main. The only reason to replace a water pipeline is if it is damaged beyond repair and totally nonfunctioning, or if a community outgrows it due to increased use. For example, if a community that consisted of 1,000 people now has 10,000 people, the demand for water resources will overwhelm the existing community infrastructure.

Today, the majority of America's water infrastructure is approaching the end of its useful life. In the United States, there are over 155,000 public water systems, and, by 2020, nearly half of these systems will be in poor condition or have exceeded their designed life span. In its 2013 Infrastructure Report Card, the American Society of Civil Engineers (ASCE) gave the United States' water infrastructure a grade of D+ and warned that many of our pipes and mains are in need of replacement.

The average age of water and wastewater systems is 41, with some systems being built around the time of the Civil War. Our infrastructure is beginning to fail, and millions of Americans are starting to suffer the consequences. The ASCE estimates that there are 240,000 water main breaks each year in the United States. According to a New York Times article in 2010, "A significant water line bursts on average every two minutes somewhere in the country."

Water main breaks can have a profound impact on public safety and the economy. In 2008, a water main break in Bethesda, Maryland flooded a road stranding drivers in their cars until they could be rescued by boats and helicopters. More recently, residents of Prince George's County Maryland just miles away from the Nation's Capital faced a major crisis when a 4½ foot main, built in 1965, was expected to fail. In an interview with the Washington Post, Scott Peterson, spokesman for Prince George's County Executive Rushern L. Baker III (D), said the "economic impact of this event will be the equivalent of a natural disaster hitting the county."¹ Ultimately local utilities were able to find a solution; however, the pipe supplies water to nearly 100,000 people and regional business including the commercial complex at National Harbor, and all of those people and businesses were forced to scramble to prepare for the days ahead without water. Businesses closed, the 2,000 room Gaylord hotel was forced to relocate its guests and events to other hotels, grocery stores were empty. Emergency shelters were set up, fire departments were prepared with contingency plans; the failure of the pipeline may have been averted, but some of its potential impact was not.

According to an American Water Works Association (AWWA) report the U.S. will need to spend \$1 trillion over the next 25 years to maintain current levels of water service. A 2011 survey released by the Environmental Protection Agency indicates that \$384 billion is needed to invest in pipes, treatment plants and storage tanks to meet the needs of 73,400 water systems across the country over the next 20 years. The AWWA report notes that "delaying the investment can result in degrading water service, increasing water service disruptions, and increasing expenditures for emergency repairs."

Reports from ASCE, AWWA, and many other stakeholders capture the problems and challenges we face; however, simply investing billions of dollars into updating infrastructure is only part of the solution. Any investment into infrastructure should adequately address one of life's most basic, yet avoidable natural occurrences—corrosion. Like other natural hazards such as earthquakes or severe weather disturbances, corrosion can cause dangerous and expensive damage to everything from automobiles, home appliances, and drinking water systems to pipelines, bridges, and nuclear plants. It's an issue that is usually not considered until it's too late.

Over the past 22 years, the U.S. has suffered 52 major weather-related disasters—including hurricanes, tornadoes, tropical storms, floods, fires, droughts, and freezes—incurring total normalized losses of more than \$380 billion. According to a cost of corrosion study published by the Federal Highway Administration (FHWA) in 2002, the direct cost of corrosion in the United States is 3.1% of the U.S. Gross Domestic Product per year, or more than \$450 billion annually by today's estimates.

Specifically, the 2002 FHWA report stated that the total annual direct cost of corrosion for drinking water and sewer systems is \$36 billion, roughly \$50 billion in 2013 dollars. These estimates include the costs of replacing aging infrastructure, lost water from unaccounted-for leaks, corrosion inhibitors, internal mortar linings, external coatings, and cathodic protection. Because of corrosion in water infrastructure, the U.S. loses approximately 11% through leaks each year. Unlike other natural disasters, corrosion can be controlled, and it is estimated that one third of the annual cost is preventable with the application of existing corrosion control technologies. Such existing corrosion control technologies include organic and metallic protective coatings; corrosion-resistant alloys, plastics, and polymers; corrosion inhibitors; and cathodic protection—a technique that creates an electrochemical cell in which the surface to be protected is the cathode and corrosion reactions are mitigated.

In the both of the examples listed above, corrosion was the direct cause for water pipe failure. In the case of Prince George's County, one of the reasons local utilities were able to mitigate damage and prevent a pipe blowout, which has roughly the same force as a small bomb, was because a corrosion-detection plan was in place. The Washington Suburban Sanitation Commission had installed an acoustic cable designed to detect the sounds of the concrete pipe's reinforcing steel wire as it begins to snap from corrosion, signaling that the pipe is weakening in that spot.

Unfortunately, with respect to the pipe failure in Bethesda, MD, a corrosion plan was not put in place. It's since been reported that the contractor who installed the pipe installed it directly against a rock, which led to cracks and corrosion. Additionally, the contractor failed to place a bed of gravel along the pipe, which would have delayed the corrosion process. As Washington Suburban Sanitation Commission Chief Engineer Gary Gumm noted in an interview, these actions "started a process of corrosion that ultimately brought about the failure of the pipe."

It's clear that unmitigated corrosion can cause significant damage to public safety, the environment, and the U.S. economy. By implementing a corrosion-plan before beginning construction on infrastructure projects, we improve public safety, save billions of dollars in damage, and protect the environment from the harmful effects of corrosion. Corrosion-control measures can extend the life of aging infrastructure and new construction, and we believe that all federally funded projects should have a corrosion control plan and require the use of qualified professionals to ensure corrosion control technology is properly installed and maintained. These measures will result in a longer, safer useful life of an asset.

As the world's leading resource for information, education and expertise in corrosion control, NACE International is a technical society composed of more than 32,000 individual members with expertise in corrosion science and engineering. Our members work together on more than 350 technical committees to produce trusted industry standards. The organization provides the most specified technical training and certification programs, conferences, reports, and publications dedicated to the control and prevention of corrosion.

Our association includes members from a wide array of industries such as: industrial and potable water, aerospace, military, chemicals and allied products, infrastructure, transportation, pipelines, waste management and more. Our members include students, engineers, inspectors and technicians, scientists, business owners and CEOs, researchers, and educators. These members are drawn together to learn and develop ways to mitigate the causes of corrosion. The mission of the organization is to protect people, assets, and the environment from corrosion.

On behalf of NACE International, I look forward to working with the Subcommittee, the overall Committee, and the Senate as policy makers and staff move forward on efforts to rebuild America's infrastructure. NACE International welcomes the opportunity to be a resource and to provide insight and expertise to ensure the safety and productivity of our nation's infrastructure.

STATEMENT OF THADDEUS BETTNER, PE, GENERAL MANAGER, GLENN-COLUSA
IRRIGATION DISTRICT

Chairman Schatz and Members of the Subcommittee, I am Thaddeus Bettner, the General Manager of the Glenn-Colusa Irrigation District (GCID), the largest irrigation district in the Sacramento Valley and the third largest irrigation district in the State of California. I appreciate the opportunity to provide GCID's perspective on the issue of how the federal government can help address the challenge aging and inadequate water infrastructure in the United States.

GCID covers approximately 175,000 acres in Glenn and Colusa Counties, and is located about 80 miles north of Sacramento. Our district contains a diverse working

landscape including a variety of crops such as rice, tomatoes, almonds, walnuts, orchards, vine seeds, cotton, alfalfa, and irrigated pasture. Just as important, we convey water to three Federal wildlife refuges totaling more than 20,000 acres, and also deliver water to more than 50,000 acres of seasonally flooded wetlands. GCID is a Sacramento River Settlement Contractor and diverts water directly from the Sacramento River through the largest flat plate fish screen in the world. GCID's Settlement Contract was first entered into in 1964 and it resolved disputes with the United States related to the seniority of GCID's rights over those of the United States and, in fact, allowed the US Bureau of Reclamation (Reclamation) to obtain water rights from the State Water Resources Control Board for the Central Valley Project. GCID's water rights originated with a filing in 1883 for 500,000 miner's inches under 4 inches of pressure, one of the earliest and largest water rights on the Sacramento River. Other Sacramento River Settlement contracts were also entered into among water right holders on the Sacramento River and Reclamation.

Notwithstanding the seniority of our water rights on the Sacramento River, the greatest water infrastructure challenge we face is in securing new storage. The pressures on our water infrastructure continue to grow each year from population growth and new demands for water for the environment. In this context, I want to focus on three issues: (1) why we need additional storage in the Sacramento Valley; (2) our experience working to advance Sites Reservoir, an up to 1.8 million acre-foot capacity offstream north-of-the-Delta reservoir; and, (3) going forward, how the federal government can help advance new storage projects.

THE IMPORTANCE OF STORAGE

New storage is vitally important to GCID and all of Northern California because the federal Central Valley Project (CVP), which our water diversions are intertwined with, and the State Water Project have both lost water supply yield and operational flexibility. That yield and flexibility has eroded over time due to increased contractual obligations and increased water demands to meet the needs of endangered species and the state and federal refuge system.

We do not need much in the way of additional water supplies in the Sacramento Valley, but without new storage, the pressure on our existing water supplies will continue to grow. The State's population continues to increase and the reallocation of water to environmental uses is expanding. This reality continues to play itself out, especially given that no new investments in the development of additional water supply or storage have occurred. For water users north of the Delta, in the area of origin, the ever-increasing demand for water, coupled with no new storage, represents a threat to the vitality of irrigated agriculture in the Sacramento Valley, our local environment including the protection of the Pacific Flyway, and our groundwater system which sustains our rivers, creeks and streams. A strong agricultural sector and healthy environment depend heavily upon a certainty of water supply. Disrupt that certainty, allow the strain on existing water supplies to persist, and investments in agriculture will not be as readily forthcoming. That lack of investment translates into a dim future for agriculture and continued instability in water supplies, which will threaten the economic health of the state as a whole.

THE SITES EXPERIENCE

The North-of-the-Delta Offstream Storage (NODOS) investigation is a feasibility study being carried out by the California Department of Water Resources (DWR) and Reclamation, in partnership with local interests. The study emanates out of the CALFED Bay-Delta Program's Programmatic Environmental Impact Statement/Report Record of Decision. One of the alternatives under consideration includes three configurations of a dam and reservoir located about 10 miles west of the town of Maxwell, California, and otherwise referred to as Sites Reservoir.

Since Fiscal Year 2002, Reclamation has spent approximately \$12.7 million on the Sites feasibility study alone and DWR has spent many millions more. Unfortunately, despite this effort and the many promised benefits that would result from the Sites project, we still find ourselves in a place where it is difficult to clearly articulate the benefits of the project, the costs, and how the project will be funded. The funding to date has allowed the agencies to complete a number of important reports, such as a project scoping report produced in 2002, an Initial Alternatives Information Report completed in 2006 and a Plan Formulation Report finalized in 2008. The agencies were originally scheduled to release a draft Environmental Impact Statement/Environmental Impact Report (EIR/EIS) under the National Environmental Policy Act (NEPA) and the California Environmental Quality Act (CEQA) and a draft Feasibility Report in the summer of last year. However, that target date was not met and the current schedule remains uncertain. The greatest obstacle to

completing this work remains the convoluted planning process and political will to make key decisions, at both the federal and state levels.

While part of the delay is certainly due to the complexities associated with multiple state and federal agencies being involved in the project, other delays are attributable to shifting environmental requirements. For example, delays in completing the Sites project environmental review process are attributable in part to changes in operational conditions described in the Central Valley Project Operations Criteria and Plans (OCAP) Biological Opinions (BOs) in 2004/2005 and then again based upon a Biological Opinion from U.S. Fish and Wildlife Service regarding the Delta Smelt issued in 2008. In both instances, DWR and Reclamation had to go back and remodel the project, based on the revised BOs. As Reclamation's Mid-Pacific Regional Office noted in a letter to "Interested Parties" in May 2009, "Changes are continuing so rapidly that our studies and reports are not keeping pace."

This new information did not, in fact, change the fundamentals of the project. The fundamentals of the project remained sound, but the process stalled further increasing costs and further delaying the availability of the many benefits a Sites Reservoir will provide.

Growing concerns about the delays and costs associated with the Sites project as well as the need for a local voice, led to the formation, in August of 2010, of the Sites Project Joint Powers Authority (Sites JPA). The Sites JPA, which includes Glenn County, Colusa County, Reclamation District 108, Glenn-Colusa Irrigation District, the Tehama-Colusa Canal Authority, Maxwell Irrigation District and Yolo County Flood Control and Water Conservation District, was formed with the stated purpose of establishing a public entity to design, acquire, manage and operate Sites Reservoir and related facilities to improve the operation of the state's water system. The Project would also provide improvements in ecosystem and water quality conditions in the Sacramento River system and in the Bay-Delta, as well as provide flood control and other benefits to a large area of the State of California. The formation of local JPA's was included as a key provision in the 2009 California Water Package Water Bond legislation for the purposes of pursuing storage projects that could be eligible for up to 50% of project funding for public benefits.

As the Sites JPA began working with Reclamation and DWR, the JPA took a common sense approach. The JPA worked with Reclamation and DWR to put together what we refer to as Foundational Formulation Principles. In other words, first identifying the needs of the water operations system and then designing the project that would meet those needs. We conceived a project that would be integrated with the system we already have, but one that would also operate effectively regardless of future operational changes, such as conveyance to south-of-Delta exporters. The JPA wanted to maximize the benefits associated with our existing infrastructure, and provide as much benefit as possible to both the existing state and federal water projects at the lowest feasible cost.

We approached the Sites project with the goal of making the best possible use of limited resources, and in the end, we believe we are on a path that will lead to a project that is both affordable and will provide significant benefits. It maximizes ecosystem benefits consistent with the State water bond, which states that at least 50 percent of the public benefit objectives must be ecosystem improvements. Other benefits include water supply reliability, water quality improvements, flexible hydropower generation, recreation and flood damage reduction. In short, we approached the Sites project with the goal of generating water for the environment while improving statewide water reliability and regional sustainability in Northern California, and we believe we have achieved that goal.

One of the greatest environmental benefits of the project is a greatly expanded cold water pool that would be created in upstream reservoirs. Flow modifications to manage river temperatures, habitat conditions and flow stability would be greatly enhanced with a constructed Sites Reservoir.

A 1.8 million acre foot capacity Sites Reservoir, for example, would generate an average annual yield of 400,000 to 640,000-acre feet, in dry and critical years, and in addition would provide nearly 900,000 acre feet of additional storage in Shasta, Oroville, Folsom and Trinity Lakes during the operationally important months of May through September through the system integration and operation.

Our experience with the Sites project has revealed at least three bureaucratic and regulatory challenges. First, the environmental review process that Reclamation is forced to deal with through existing federal law does not support the common sense approach that the JPA has attempted to pursue on the Sites project. Under NEPA, a great deal of time and money is expended on studies and analysis of multiple inferior alternatives to the original purpose and need statement, only to use the EIS process to eliminate these lesser alternatives and arrive back at the project that you

originally proposed as the solution with the greatest benefit for the dollars expended.

In the case of the Sites project, Reclamation and DWR initially investigated and considered 52 alternative reservoir sites before identifying Sites Reservoir as the preferred location for an offstream, north-of-Delta storage reservoir. That iterative screening process was completed in 2008, yet some have recently suggested that even that process was carried out too quickly and perhaps the agencies should have taken even more time to examine still other sites before narrowing the list to three separate storage configurations at the Sites location. Ironically, the three configurations being evaluated today in the EIR/EIS are very similar to the project originally envisioned in the 1960's. Still, Reclamation is unwilling to focus on any alternative for the "fear of being predecisional" prior to completion of the EIR/EIS, which only continues to delay and increase the cost of the environmental review process.

Second, although the Sites project would provide significant benefits in any operational environment, the environmental review process does not accommodate the real-world requirement that any new water supply project be flexible in, and responsive to, a constantly evolving regulatory environment. As noted above, any changes to the operating criteria for the federal and state water projects resulted in a requirement to develop new models to reflect those changes, when, in fact, the Sites project benefits remained constant regardless of the new demands for environmental water.

Finally, under NEPA, the costs of alternatives are not considered until after the environmental review documents are completed. In our view that is just not a practical way to develop a project. In the case of water supply, you can end up with a project that no one can afford, sacrificing any opportunity for even incremental storage benefits. The process must consider project costs, both the total costs and how the project is going to be paid for, earlier in the process.

RECOMMENDATIONS FOR ADVANCING NEW WATER STORAGE PROJECTS

Reduce Regulatory and Bureaucratic Barriers

In his 2011 State of the Union Address, and again in August 2011, President Obama called for further steps to enhance the efficient and effective permitting and environmental review of infrastructure development "through such strategies as integrating planning and environmental reviews; coordinating multi-agency or multi-governmental reviews and approvals to run concurrently; setting clear schedules for completing steps in the environmental review and permitting process; and utilizing information technologies to inform the public about the progress of environmental reviews as well as the progress of Federal permitting and review processes."

All of these are worthy goals, but in water resources development, at least in California, there is little evidence that these goals are actively being implemented and turned into new practices.

Our experience with the Sites project suggests the following steps to reduce regulator and bureaucratic barriers are worthy of consideration:

1. **Statutory Directives.**—Adopt statutory directives for all relevant departments and agencies to work with the states and local water supply agencies to make it a priority to improve the efficiency of the regulatory and permitting processes associated with water supply projects. Attitudes are important in the agencies, and even without mandatory deadlines, statutory directives would encourage the agencies to make it a priority to streamline the environmental review process.

2. **Statutory Deadlines.**—Establish statutory deadlines where appropriate for the completion of the environmental review process. For example, federal agencies should expeditiously review and approve administrative drafts that then can be publicly released as a draft Environmental Impact Statement (EIS). Once a draft EIS is released, the agencies should be required to establish a timeframe within which the EIS and even a Record of Decision will be finalized.

3. **Greater Coordination.**—Require all federal agencies with a role in preparing and reviewing NEPA documents for water storage or water resources projects to coordinate their reviews concurrent with one another. Earlier and better coordination is essential to resolving conflicting standards and avoiding unnecessary project delays.

4. **Alternatives Analysis.**—Agencies with a role in the environmental review process for new water supply projects should be required to develop a simpler approach to alternatives analysis. Streamlining this process can save money and time without sacrificing the legitimate need to thoroughly explore project alternatives or project sites that will cause the least negative environmental impact.

5. Costs.—NEPA should permit project costs to be considered in an open fashion, before the environmental review process is complete. Currently, Reclamation relies upon Feasibility Studies to examine the costs and allocation of benefits, however, that effort is done internally by Reclamation and potential beneficiaries and locals have no ability to participate in this process. We need to make certain that the projects that make it through the environmental review process have beneficiaries, public and private, that can afford to pay for them, especially in light of the Federal government fiscal climate

6. Federal Role.—Lead federal agencies should determine their role in a project as soon as practicable. In water storage projects, as with other major infrastructure projects, there is growing interest in public-private partnerships and non-federal water supply development, in general, that may rely upon a combination of public dollars, private equity, government-backed financing and the like. If Reclamation is a customer for the benefits of a project rather than the developer of the project that should also create an opportunity to further streamline the regulatory and environmental review processes.

7. Budgeting.—Regulatory and environmental streamlining means that more funding resources may be needed upfront to enable agencies to accelerate the review process and establish realistic schedules. Our experience with Sites suggests that Reclamation's relatively modest budget requests over the years for the Sites study process, at a minimum, did not permit the study to proceed on an optimum schedule. This does not mean the agencies need to spend more overall, however. Limited funds should be prioritized to support completing the study and review process in a timely fashion.

Innovative Financing—Water Infrastructure Finance and Innovation Act (WIFIA)

Finally, Congress should explore methods of highly leveraging limited federal funding in order to increase its impact and, in effect, do more with less. Although federal funding for water infrastructure projects is already leveraged in the form of local matching requirements for federal grants, this leverage can be increased by developing innovative, market-based financing tools that provide significant financial savings for localities while shifting the bulk of financial risk from the taxpayer to the private sector.

Specifically, Congress should authorize Reclamation to provide access to long-term, low interest credit assistance modeled after the highly successful Transportation Infrastructure Finance and Innovation Act (TIFIA) program, which has been operated by the Department of Transportation (DOT) since 1998. A WIFIA program set up under Reclamation could help finance large-scale and costly infrastructure projects by leveraging each dollar of federal funding into \$10 of credit assistance and \$30 of infrastructure investments. The \$122 million authorized for TIFIA, the level authorized in the last transportation reauthorization bill, has allowed the program to provide \$1.22 billion in credit assistance and help finance \$3.66 billion in transportation infrastructure improvements annually.

Like TIFIA, WIFIA should be structured to provide eligible applicants with access to long-term, up to 40-year, financing at low interest rates. Currently, the TIFIA interest rate is 3.71 percent for a 35-year repayment period (the program provides for a five-year window after substantial completion of a project where no repayment is required). On large projects, like the Sites project, which is currently estimated to cost as much as \$4 billion, every saved tenth of an interest point would translate to millions of dollars in local savings.

Under TIFIA, projects are selected by DOT for funding based upon the extent to which they generate economic benefits, leverage private capital, and promote innovative technologies, among other objectives. Projects do not need to be congressionally authorized to be eligible for TIFIA financing. I encourage you to set up a similar process of determining eligibility under a Reclamation WIFIA program as well.

WIFIA, like TIFIA, should also offer three separate forms of financing. The program should offer direct loans that offer flexible repayment terms to cover construction and capital costs of a project. WIFIA should also be constructed to allow Reclamation to provide loan guarantees to enable institutional investors, such as pension funds, to make loans to the project sponsor. Finally, like TIFIA, WIFIA should be authorized to allow Reclamation to offer lines of credit to projects to represent contingent sources of financing, in the form of direct federal loans, to supplement project revenues and make it easier for the project to attract financing from the private sector.

Again, WIFIA would greatly benefit a wide variety of water supply projects, like Sites, and I encourage the Committee to give careful consideration to establishing such a program under Reclamation.

Thank you for the opportunity to submit this testimony, and I greatly appreciate the Subcommittee highlighting the impediments to addressing the aging and inadequate water infrastructure nationwide.

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